Irena Iskra-Golec · Janet Barnes-Farrell
Philip Bohle *Editors*

Social and Family Issues in Shift Work and Non Standard Working Hours

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Preface

There has been surprisingly little research on the effects of shift work and 'non-standard' working hours on family and social life. This is so despite a substantial growth in the proportion of the workforce employed on non-standard work schedules in many countries over the past few decades. These work schedules often require workers to work and sleep at different times of the day to the rest of the society, often with negative effects on social and family life. Night work also disturbs daily biological rhythms, which diminishes health and well-being and may, in turn, impair performance of family and social roles.

As editors, we have worked to bring together a collection of contributions from eminent scholars from different countries to showcase their research on a variety of topics that relate to these issues. We believe that the resulting collection represents the state of the art in research on family and social consequences of shift work and non-standard working hours. We hope that it will draw much-needed attention to the subject and provide an evidence base to inspire preventive activities.

In combination, the nine chapters in this book examine an extensive range of family and social effects of different forms of shift work and non-standard hours. The terminology associated with these effects reflects the diversity of approaches that researchers have taken to thinking about and studying these problems. For example, Jansen and Kant (in Chap. "Reciprocal Relations Between Working Time Arrangements and Work-Family Conflict Over Time") use several terms drawn from the relevant literature to refer to specific effects, such as work-family conflict, work-life balance or work-home interference and attribute-specific meanings to each. Several chapters (Camerino; Grzywacz; Iskra-Golec; Radošević-Vidaček, Košćec and Bakotić; Ribeiro, Rotenberg and Fischer) focus their attention specifically on relationships between work and the family domain. This relationship is often described broadly, using terms such as work-family conflict, work-family balance or work-family interface. Elsewhere, however, unidirectional effects are examined, for example family-work conflict and work-family conflict or work-home interference. As implied by the terminology, in many cases the focus is on difficult or detrimental relationships between work and non-work domains, with reference to such processes

as conflict, interference, imbalance and negative spillover. However, attention is also given to positive impacts of one domain on another, represented by such terms as work-family enrichment, work-family facilitation, family-work facilitation and positive spillover between work and home). In addition to examination of the relationships between the work and family spheres, other chapters (Arlinghaus and Nachreiner; Bohle; Costa) consider effects that reach beyond the family into the broader social sphere, referring to work-life conflict or work-life balance. These differences in terminology denote the diversity of the domestic and social effects arising from shift work and non-standard working hours and reflect the specific terminology used by researchers to differentiate these effects.

The book begins with two chapters that provide an overview of the impact of shift work and non-standard working hours on family, health and well-being. Chapter "Shift Work and Its Implications for Everyday Work and Family Life: A Foundation and Summary" (Grzywacz) presents an overview of research and theory on the link between work and family. Chapter "Introduction to Problems of Shift Work" (Costa) examines the health, well-being and work performance challenges created by shift work and strategies to minimize these negative effects.

The next three chapters concentrate on the social consequences of specific features of working time organization. Chapter "Unusual and Unsocial? Effects of Shift Work and Other Unusual Working Times on Social Participation" (Arlinghaus and Nachreiner) describes and quantifies the separate negative effects of shift work and work at unusual times (evenings, Saturdays and Sundays) on self-reports of employee work–life balance and social participation. The data are drawn from several large-scale European Working Conditions Surveys and smaller data sets from Germany. Chapter "Reciprocal Relations Between Working Time Arrangements and Work-family Conflict Over Time" (Jansen and Kant) examines longitudinal evidence on the effects of work–family conflict on adjustments in work schedules and working hours over time. Chapter "Work-life Conflict in 'Flexible Work': Precariousness, Variable Hours and Related Forms of Work Organization" (Bohle) examines the impact of two forms of 'flexible work' (precarious work and flexible working hours), irregular hours and related work organization variables on work–life conflict.

The following two chapters investigate the consequences of shift work and non-standard work hours for workers and their families. Chapter "Parents Working Non-standard Schedules and Schools Operating in Two Shifts: Effects on Sleep and Daytime Functioning of Adolescents" (Radošević-Vidaček, Košćec and Bakotić) concentrates on the sleep and daytime functioning of adolescent family members, based on the work carried out in Croatia, where a form of shift work is also characteristic of school schedules. Chapter "Irregular Work Shifts and Family Issues—The Case of Flight Attendants" (Ribeiro, Rotenberg and Fischer) draws on quantitative data regarding the work conditions of employees in the airline industry and qualitative data collected from professional flight attendants in Brazil to describe the psychosocial and family consequences of irregular shift working hours for members of a profession for which irregular work schedules are a characteristic work condition.

Finally, chapters "Gender Differences in Safety, Health and Work/Family Interference—Promoting Equity" and "Individual Differences in Circadian Rhythm Parameters and Work-family Spillover in Shift Workers" explore the moderating role of individual differences on the work–family relationship. Chapter "Gender Differences in Safety, Health and Work/Family Interference—Promoting Equity" (Camerino) presents a gender perspective on the problems of work–family relationship, safety and health at work, paying particular attention to sociopolitical conditions and social policies that support or hinder gender equity. Chapter "Individual Differences in Circadian Rhythm Parameters and Work-family Spillover in Shift Workers" (Iskra-Golec) investigates the moderating role of chronotype and circadian type characteristics on work–family conflict and work–family facilitation among male shift workers.

Collectively, the chapters presented in this volume bring a truly international perspective to current thinking about many ways that shift work and non-standard working hours affect the family lives of workers and the broader social spheres that we all inhabit. We are extremely grateful to each of the invited authors for their excellent contributions, enthusiasm, cooperation and understanding.

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Part I
Introduction: Problems in the Relationship Between Work and Family, Shift Work, and Non-standard Working Hours

Shift Work and Its Implications for Everyday Work and Family Life: A Foundation and Summary

Joseph G. Grzywacz

Abstract The expanding use of shift work throughout the global economy is raising a variety of new questions, including those explored in the current volume. Is shift work an environmental demand that makes "balancing" work and family more difficult, or is it a viable tool for alleviating inherent conflicts between work and family life? A casual perusal of the scholarly and popular literature will result in evidence supporting both positions, suggesting there is neither a simple nor a straightforward conclusion. In fact, the many dimensions and contours of "shift work" demand careful consideration before even attempting to answer the basic question, "is shift work a friend or foe of working adults' ability to meet their responsibilities in the domains of work and family?". The overall goal of this chapter is to create a conceptual foundation for the content of this volume. To achieve this goal the chapter begins by outlining the meaning of "shift work" and alternative perspectives on combining work and family to help readers see that the concepts are both complex, making their linkages and potential interconnections exceedingly complicated. Next is a critical review of published research linking shift work with individuals' ability to integrate work and family lives to help readers interpret the scientific literature. Finally, the chapter concludes with an agenda of high priority future research topics requiring attention to enable appropriate individual and collective responses to expanded reliance on shift work in the 21st century economy.

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1 Conceptual Foundations

1.1 "Shift Work"

Shift work is a challenging idea to conceptualize, as is partially illustrated by the way it is defined by different geopolitical bodies. As Costa (this volume) reports, "shift work means, in general, any form of organization of work that is different from the normal 'daily work' in which the operating time of a company is extended beyond the typical work day to cover the entire 24 h period through alteration of different groups of workers" (p. XX). This definition follows from the International Labor Organization [ILO] (2004), which defines shift work as "any method of organizing work whereby workers succeed each other at the same work stations according to a certain pattern, including a rotating pattern, and which may be continuous or discontinuous, entailing the need for workers to work at different times over a given period of days or weeks". The Australian Fair Work Act of 2009 defines shift work as "work carried out with consecutive shifts of employees throughout the 24 h of each of at least six consecutive days without interruption except for breakdowns or meal breaks or due to unavoidable causes beyond the control of the employer". The United States Centers for Disease Control and Prevention defines shift work as "working outside the normal daylight hours. That is, outside the hours of around 7 am–6 pm, the time period in which many people in our society work a 7- to 8-h shift" (Rosa and Colligan 1997).

The diverging emphases of these definitions begin to offer insight into one of the complexities of understanding shift work; that is, the origins of the phenomenon. In the case of the European Union, the ILO, and the Australian Fair Work Commission, the origins of shift work lies in the work itself or the way the work is organized (Sauter et al. 1990). This is evidenced explicitly in the European Union's and the ILO's definition in the phrase "any method of organizing work…", and it is evidenced implicitly by the Australian Fair Work Commission's intimation that that someone or something set up the "work carried out with consecutive shifts…". From the perspective of these organizations, shift work is part of the work: although an individual may "choose" a job that has shift work, shift work is not a personal choice, but rather something that is imposed upon workers. By contrast, the origins of shift work from the U.S. perspective is much more ambiguous because the definition focuses on when work is performed. In doing so, the origin of shift work is unclear because it could result from personal volition (e.g., a mother who works nights so she can be with her children during the day), an entrepreneurial attempt of one business to get competitive advantage over another, a mandate of the industry (e.g., hospitals need to provide 24/7 care), or some combination.

Studying shift work is made even more complicated by the fact that it takes on its primary meaning based on a configuration of several criterion or dimensions. As outlined by Costa (this volume) and elsewhere (Karlson et al. 2009; Totterdell 2005), the potential influence of shift work depends on the configuration of shift length and shift cycle, the direction of shift rotation, the speed of shift change, and

the positioning of days off. Each of these criteria is illustrated in the "standard" work schedule; that is, an 8-h period beginning around 8 am and ending around 5 pm spanning Monday through Friday (i.e., shift duration and cycle, and positioning of days off) that does not change (i.e., no shift rotation, consequently no variability in speed of shift change). Deviations from this "standard" along any dimension has been labeled "nonstandard", "atypical", and "unsocial".

1.2 The Work-Family Interface

Conceptual understanding and subsequent scientific scrutiny of the work-family interface has evolved over the past 40 years. Historically, the ideal notion of the work-family interface paralleled the ideal notion of health; that is, just as health is typically conceived in terms of the absence of illness, a "good" work-family arrangement was studied in terms of the absence of work-family conflict. Work-family conflict is classically defined as "a form of inter-role conflict in which the role pressures from the work and family domains are mutually incompatible so that participation in one role [home] is made more difficult by participation in another role [work]" (Greenhaus and Beutell 1985, p. 77). Work-family conflict is inherently non-directional (Greenhaus and Beutell 1985, proposition 5a, p. 84); however, once a decision is made to resolve the work-family conflict (either passive or deliberate), work-family conflict results in work-to-family interference (WFI) or family-to-work interference (FWI). WFI and FWI are conceived as independent but reciprocally related constructs (Frone et al. 1997), and several meta-analyses indicate small to medium correlations between measures of WFI and FWI (Byron 2005; Mesmer-Magnus and Viswesvaran 2005).

The second generation of work-family research challenged the assumption that work and family were greedy institutions vying for an individual's limited time and energy, and it began considering the extent to which there was synergy between work and family (Grzywacz and Butler 2008). Greenhaus and Powell (2006) ultimately formalized the concept of work-family enrichment, defining it as "the extent to which experiences in one role (work or family) improves the quality of life in the other role" (p. 72). As implied by the definition, work-family enrichment is presumed to be bidirectional, meaning that work can "enrich" family life, and family can "enrich" work life. A body of research has accumulated suggesting that work-family enrichment (under various conceptual labels) is distinct from work-family conflict and work-family interference. The content and structure of work-family enrichment scales differ from those measuring work-family interference (Carlson et al. 2000, 2006), estimated correlations between work-family interference and work-family enrichment are typically small (Grzywacz and Marks 2000), and they have distinct correlates (Grzywacz and Butler 2005).

Attention has turned to studying work-family balance recently, but there is not an agreed upon conceptualization. Early in this phase of the thinking, Frone (2003) conceived work-family balance in terms of low work-family conflict and high

work-family enrichment. Others have suggested that work-family balance is achieving satisfaction with both work and family life (Greenhaus and Allen 2011), or being able to meet role responsibilities in both the work and family domains (Grzywacz and Carlson 2007). There are other views on what work-family balance is, but the fundamental point is that there is no agreed upon definition of the construct, and Jeffrey Greenhaus suggested during a 2014 panel presentation that identifying the meaning of "work-family balance" is a key step to moving the literature forward.

In short, the conceptual and operational meaning of what it means to have a "good" work and family arrangement is entirely unclear. There is a body of work-family research that studies work-family conflict (presumably the inverse of a good work and family arrangement) and subsequent experiences of work-to-family and family-to-work interference. Similarly, although there is no precedent to suggest that the presence of work-family enrichment, either work-to-family or family-to-work enrichment, is isomorphic with work-family balance, some do argue that high levels of work-family enrichment is a necessary albeit insufficient element of work-family balance (Frone 2003; Grzywacz and Carlson 2007). Finally, researchers are beginning to conceptualize work-family balance and develop corresponding theory and instruments, but more work is needed in this area.

1.3 Implications of Conceptual Complexity and Ambiguity

The conceptual complexities of "shift work" and the evolving meaning of a "good" or synergistic work and family arrangement raise several implications for research that require attention before reviewing results from empirical studies. One key issue is the absence of clarity in the meaning and subsequent operationalization of "shift work". This issue was poignantly illustrated in Dunifon et al. (2013) analysis of alternative strategies for measuring "nonstandard" work schedules. They argued and found that conventions used in U.S. survey research restricting respondents to select the most typical work schedule (restricting participants to one primary "shift") seriously underestimated the proportion of workers with a nonstandard schedule. Dunifon and colleagues' further contended that prevalence underestimation likely leads to misclassification and ultimately biased estimates of association. Consistent with the notion that shift work, in itself, has little meaning, they concluded that effective measurement must capture "…the complexity and multiplicity of schedule types" (p. 531).

Further exaggerating measurement ambiguity are complexities surrounding the origins of the work schedule, or why an individual works one shift or schedule, multiple shifts, or various shift configurations. There are at least three factors contributing to workers' self-reported information about the temporal structure underlying their work schedule. The first factor contributing to work schedules is the requirements of the occupation. The consequences of shift work in the context of petroleum extraction may be entirely different from the consequences of

hospital-based shift work or emergency-response shift work, even if all aspects of the shift work (i.e., shift length and shift cycle, the direction of shift rotation, the speed of shift change, and the positioning of days off) are identical. The requirements of these diverse occupations create a distinctive context of physical, psychological and social demands that may condition the consequences of identical shift work configurations. The second factor shaping workers' work schedules is employer demands or requirements. Whether it is a short-staffed hospital requiring all nurses to take on extra shifts, mandated 70 h workweeks for all personnel in an accounting firm during tax season, or a "lean" pharmaceutical company wherein employees regularly take work home at night—workers can find themselves with little discretion over when work is performed, regardless of whether it is a formalized "shift" or schedule. Similarly, it is difficult to find a university professor who does not work days (i.e., teaching classes) as well as nights and weekends (e.g., grading papers, writing research reports). Transcending both occupational and employer requirement considerations are the myriad of self- and social-selection processes into different occupations and employers. The final consideration is individual choice or volition. A platform worker who takes on extra shifts, a social worker who takes advantage of informal "flextime" to bank hours for maternity leave, or an aspiring public defender burning the "midnight oil" to secure the top job can place themselves in different formal or informal shift cycles that likely changes the meaning of the phenomenon.

Individually and collectively, the conceptual and measurement issues surrounding shift work raise meaningful questions. Is there evidence of criterion validity and measurement equivalence for items used to operationalize shift work? Apart from Dunifon et al. (2013), no studies could be located demonstrating criterion validity, or that systematically compared alternative measurement strategies in diverse populations. In light of Dunifon's and colleagues' findings, prevalence estimates of the number of shift workers in various shift configurations are likely to be inaccurate. They argued that measurement variability can result in a 100 % underestimate of actual exposure, although they could not differentiate between individuals who had different shifts imposed on them by their employment, as opposed to individuals who reported working at different times and different days out of personal choice. Of course, this reality is only concerning if personal choice over work shift and schedule is meaningful, which some contend (Duncan and Pettigrew 2012; Garies et al. 2003; Olsen and Dahl 2010). The basic question of measurement validity raises subsequent questions about data comparability, or comparability of results from different studies using alternative measurement strategies. Likewise, if different measurement strategies produce different classifications (Dunifon et al. 2013), what are the biases inherent within alternative measurement approaches, and what do those biases mean in terms of parameter estimates of association?

Variability in the meaning of a "good" work and family arrangement also produces meaningful issues that require attention before reviewing existing research. Consider, for example, the simplest and most common notion of a good work-family arrangement; that is, the absence of work-family conflict. A reader is

still left to question, "what type of work-family conflict?" recognizing that Greenhaus and Beutell (1985) argued that work-family conflict can be time-, strain- and behavior-based. Further, if accepted as a non-directional phenomenon (Greenhaus and Beutell 1985, proposition 5a, p. 84), it is reasonable to question whether some types of work-family conflict are possible in the context of shift work. If an individual is working at night while family members are sleeping, is it possible for a time-based role pressure from the family to emerge? Alternatively, can behavior-based conflict or the idea that behaviors appropriate in the home but not in the workplace occur in shift work performed by nurses or others in the caring profession? Of course, the answer to each of these questions, in theory, is "yes," because a child can awaken in the middle of the night desperately wanting mommy or daddy, or a care-worker may find cause to behave punitively toward a client or patient. However, the extent to which these more exceptional cases can be tapped by existing instruments is another question.

There has been little explicit theorizing about how or why shift work might influence or otherwise shape experiences at the work-family interface. There are at least four distinct, albeit interrelated, frameworks for positing a linkage between shift work and the quality or degree to which work and family fit together (Table 1). The biobehavioral framework focuses primarily on the physiological consequences of shift work. The fundamental argument underlying this framework is that shift work promotes circadian disruption, leaving workers physiologically ill equipped to meet their family responsibilities. Specifically, behavioral manifestations of circadian disruption (e.g., having difficulty falling asleep at night, excessive daytime

Table 1 Alternative frameworks for considering the impact of shift work on work-family balance

Framework	Illustration
Biobehavioral framework	A 42 year-old male shift worker goes to the doctor complaining of excessive daytime sleepiness that causes him to fall asleep during family meals or spends a large proportion of family vacations "getting caught up on sleep"
Social-cognitive framework	A 28-year old auditor spends 60 % of her time on the road, knowing that the days (and nights) on the road will help create a fast-track to the "partner" spot. Although she wants to have a family someday, she decides to delay having a baby for another 5 or 6 years thinking that, once she has achieved partner, she will have the finances and flexibility to be a better mother
Social disruption framework	A new mother and father decide to "tag-team" parent, wherein mom works days while dad works nights. The arrangement saves on child care costs, and it allows both to be directly involved raising their young child. However, like "ships passing the night" there is very little opportunity for their marriage
Socialization framework	A young father takes on an oil platform job to make some good money for his growing family. Like many offshore platforms, his job requires 14 days of work followed by 21 days off. At first, everything seems fine but after a few years his wife and child seem "distant" from him. In talking with coworkers, he hears that this "distance" is common, and his coworkers encourage him to "get used to it". He embraces this "reality" starts putting less effort into his children and his marriage

sleepiness, or early morning awakenings: see Gamaldo et al. 2014) impede quality interactions with children, compromise emotional closeness with a spouse or partner, or impair family leisure, thereby leading to poor work-family balance. The second framework, the social-cognitive framework, focuses on the psychological consequences of shift work. The central argument underlying this framework is that personal experiences associated with shift work, such as inattentiveness, distractedness, irritability or social detachment leave workers psychologically ill equipped to meet their family responsibilities. Regardless of its physiological underpinnings, excessive sleepiness is widely believed to impair judgment and delay reaction time resulting in motor vehicle accidents and disasters like the Exxon Valdez spill Alaska Oil Spill Commission (1990). In daily work and family life, impaired judgement in terms child supervision, responding harshly to a family member's request and unrealistic expectations for children's behavior can impede work-family balance.

The last two frameworks are more socio-structural in orientation. The social disruption framework focuses primarily on the temporal structure underlying everyday life. The central argument of the social disruption framework is that shift work leaves workers socially ill equipped to meet family responsibilities because they are often physically absent (Nippert-Eng 1996). A district sales manager who spends four nights a week on the road may often miss children's soccer games, cannot help children with homework or a partner with household chores, and may not be able to participate in family celebrations like anniversaries or birthdays. Similarly, a nurse working a fixed evening schedule cannot create bedtime routines with children, because the individual work schedule conflicts with common bedtimes for children. Thus, dis-synchrony in the temporal structures demanded by the job and those of the family and society is believed to impair work-family balance (Morehead 2001). Finally, the socialization framework focuses primarily on changes to the worker that may accompany shift work. Just as Kohn and Schooler (1978) argued that individuals in "white collar" jobs are socialized differently from those in "blue collar" jobs, the central argument of the socialization framework is that shift work changes the "hearts and minds" of the shift worker. Shift workers may resign themselves to the belief that they cannot be a "good parent", or that the demands of the job will keep them from ever having a "good marriage" which may subsequently lead to social withdrawal or other behaviors that may convert the belief into a reality and result in poor work-family balance.

Each of the four frameworks have specific mandates or priorities for designing research focused on shift work and experiences at the work-family interface, and interpreting the results of that research. Measurement precision surrounding work shift or schedule varies greatly across the alternative frameworks. Whereas the physiological focus of the biobehavioral framework necessitates nuanced measurement of refined aspects of the temporal placement of work in the light-dark cycle, the other frameworks may be able to accommodate more crude assessments of shift work. Sample designs frequently differ across the alternative frameworks. Because shift work as it is conceptualized outside of the U.S. is relatively uncommon in the general workforce, research informed by the biobehavioral and

work socialization frameworks tend to use non nonprobability sampling techniques (cf. Camerino et al. 2010; Jansen et al. 2010) which raises questions about the external validity and generalizability of study results. By contrast, research informed by a social-cognitive or social disruption frameworks often use a more robust sample design to maximize external validity (e.g., Beutell 2010; Jansen et al. 2003). Moreover, they frequently lack refined assessments of the various elements of work scheduling needing to operationalize "shift work", and rarely do they capture the mechanisms that may explain differences in work-family balance across alternative work schedules, shifts or shift rotations.

The origin of action is distinct in each framework. Whereas the origin of action in the biobehavioral framework is circadian rhythm disruption, the primary origin of action in the social-cognitive framework is the psychological (i.e., cognitive and affective) sequelae of shift work which are presumed to be independent (at least partially) from circadian rhythm disruption. The origin of action underlying the social disruption framework is the mismatch between the temporal structure underlying paid employment vis-à-vis the broader social clock that places rest periods on Saturday and Sunday, commercial production and institutional education from Monday through Friday between roughly 8 am and 5 pm, and social consumption and leisure in the evening hours and weekends. Finally, the origin of action underlying the socialization framework is the culture, the set of shared beliefs held by workers within a given industry, or employer with a common temporal structure underlying work.

Following the distinct origin of action are categorical differences in the putative mechanisms or explanations for supposed linkages between shift work and experiences at the work-family interface. The physiological imperative underlying the biobehavioral framework argues that basic hormonal, physiological or neurochemical changes that accompany circadian disruption will explain differences in work-family experiences across work schedules or shifts. However, research informed by the biobehavioral framework often gives little attention to the personal characteristics (e.g., personality), psychological resources (e.g., sense of coherence, organizational commitment) and the coping strategies (e.g., identify salience) used by workers and their families to compensate or accommodate an individual's work shift or schedule that may also buffer the physiological consequences of circadian disruption. By contrast, attributes like those generally overlooked by the biobehavioral framework are the main focus of research informed by the social cognitive framework. Although research informed by a social cognitive framework may consider the psychosocial consequences of shift work [e.g., perceived schedule fit, ratio of perceived benefits to costs (Garies et al. 2003)], it typically does not consider the social distribution of distinct job types and schedules, or the interpersonal processes used by workers and their family members and coworkers in navigating daily work and family life (Clark 2000). By contrast, the social disruption and socialization frameworks emphasize social and interpersonal processes (e.g., marital disagreement, family division of household labor, parent-child leisure time) in building a rationale for linking shift work with work-family balance. Although they undoubtedly underlie psychological and social processes underlying

the social-cognitive and social disruption frameworks, rarely are the physiological or neurochemical processes central to the biobehavioral framework invoked in considering the effects of shift work on work-family balance.

2 The Evidence Base

The evidence base linking shift work to work-family balance is best described as "developing;" there is a critical mass of studies accumulating with increasing levels of conceptual and methodological rigor. Among the earliest studies, Staines and Pleck (1984) used an American conceptualization of shift work (i.e., working outside the normal daylight hours: Rosa and Colligan 1997) and nationally representative cross-sectional data to demonstrate higher levels of work-family conflict among shift workers relative to workers with a Monday thru Friday daytime schedule. This basic finding has been replicated and refined. Jansen et al. (2003) were among the first to document in a longitudinal design that shift work predicted elevated experiences of work-family conflict; however, shift work was again operationalized from a U.S. perspective (i.e., as anything other than a fixed-day schedule from Monday thru Friday). Buetell (2010) used data from the National Study of the Changing Workforce to demonstrate that workers with a fixed daytime schedule had lower work-family conflict than any other work schedule, but there were no differences among workers with different work schedule configurations like "rotating shifts" or "split shifts". However, self-reported synergy between work and family was highest among workers with fixed day work schedules and that among those with a non-fixed day schedule, individuals whose schedule or shift varied had lower self-reported synergy than did workers with rotating schedules. Olsen and Dahl (2010) noted that workers with an irregular work schedule (a concept operationalized in a manner akin to the American definition of shift work Rosa and Colligan 1997) had lower levels of self-reported work-family balance, particularly when workers with these schedules had little flexibility or say over choosing this schedule. Collectively, this developing body of research, which is largely informed by the social disruption framework, suggests that achieving a well-fitting work and family arrangement may be more difficult for individuals who do not have a fixed Monday thru Friday daytime schedule. Further, consistent with the social-cognitive framework, the challenges of achieving an effective work-family arrangement may be particularly strong when the non-day schedule or shift has little regularity or the worker has little say over the timing of their work.

The notion that the quality of the work-family interface is shaped more by the regularity of when work is performed than the timing of when work is performed is highlighted in a cluster of studies undertaken primarily with European nurses and other health care professionals. Using a randomly selected sample of Italian nurses, Camerino et al. (2010) reported that nurses whose shift rotation included nights and those with irregular daytime shifts had the highest levels of work-family conflict. In similar fashion, Mauno et al. (2015) reported that nurses with faster shift rotations

(i.e., staying in the same 8-h shift for fewer consecutive days) reported more work-family conflict than their counterparts with slower shift rotation, suggesting that giving individuals (and their families) the opportunity to "settle into" a shift may be useful. In an evaluation of a natural experiment with health care workers, the frequency of work-family conflict declined followed an institutional move from a more rapid to a slower non-night shift rotation schedule (Karlson et al. 2009). Collectively this developing body of work informed by the social disruption framework suggests that shift rotations that allow workers (and their families) to plan and prepare, and potentially create daily routines or different routines for work and non-work days may be useful for achieving work-family balance.

There is also some evidence supportive of the biobehavioral framework. Using prospective data from the Maastricht Cohort study, van Amelsvoort et al. (2004) found variability in experiences of work-family conflict by shift rotation. Male workers with a forward shift rotation wherein a worker rotates from nights to days to evenings reported less work-family conflict than individuals with a backward rotation from nights to evenings to days. Informed by the chronobiology literature documenting greater circadian disruption from backward vis-à-vis forward rotation, the researchers posited that less opportunity to recover from the forward shift cycle produced more work-family conflict. However, the greater risk of work-family conflict among backward rotating shift workers persisted after adjustment for sleep quality, which may suggest that the shorter opportunity to create new daily routines, not physical recovery per se, may be the source of elevated work-family conflict. Separate analyses of the Maastricht Cohort study suggest that individuals who experience work-family conflict are more likely to transfer out of shift work (van Amelsvoort et al. 2004), or to transfer from shift work into a fixed daytime schedule (Jansen et al. 2010). Evidence from the Australian Time Use Survey indicated that weekend workers spend less time in both self-care and family care on weekend days than weekday workers, but reported comparable time in these activities as weekday workers on week days (Craig and Brown 2014).

There is also evidence indicating that shift work may not impede adults' ability to integrate their work and family lives successfully. Evidence from two panels of the Canadian General Social Survey suggests that non-fixed daytime work schedules became less common between 1998 and 2005 for both women and men, and that the ability to "balance" work and family did not differ by work schedule for women in either panel (Duncan and Pettigrew 2012). However, in both 1998 and 2005 men who worked something other than a fixed daytime schedule were less likely than their counterparts who worked a fixed day schedule to experience work-family balance. Similarly, in a cross-sectional study of European nurses Estryn-Béhar et al. (2012) reported that night shift nurses working either 10 or 12-h shifts were disproportionately represented in the high work-family conflict group, but these differences did not persist in multivariate analyses.

Collectively, the evidence favors a linkage that workers with a non-day work schedule and those working alternative shifts have greater difficulty combining their work and family lives than fixed day-schedule workers. Although there is some evidence for a biobehavioral explanation, the most compelling evidence supports

the social disruption framework. Dis-synchrony between the worker's schedule and the broader temporal structure may stand in the way of family and social activities, and features of the work schedule may impede the creation of successful routines for navigating daily work and family life in such a way that allows successful performance of all work- and family-related roles.

3 A High-Priority Research Agenda

Research studying work and family experiences among individuals performing shift work and other work schedules that diverge from a fixed-day, Monday thru Friday norm has progressed. Nevertheless, more research is needed. A key issue for future researchers is careful use of the term "shift work," using it only when describing a specific organization of work such as those articulated by the International Labor Organization or the Australian Fair Work Commission. The U.S. Centers for Disease Control's definition of shift work is more appropriately labeled a "non-standard" (vis-à-vis a normative fixed day, Monday thru Friday) schedule. A parallel priority is the need for consistent and purposeful attentiveness to the key elements for characterizing alternative forms of shift work; that is, the configuration of shift length and shift cycle, the direction of shift rotation, the speed of shift change, and the positioning of days off (Karlson et al. 2009; Totterdell 2005). Each of these features requires attention in future research, particularly the clear reporting of which elements were measured and how they were combined to create distinct forms of shift work. Most of the studies of "shift work" in this review provided insufficient information to enable replication of measurement, which is an essential element of science that is taking on increased scrutiny (Open Science Collaboration 2015).

American studies that use refined measures of shift work are needed. Although the literature is generally under-developed, Europe and other locations in the western world are further along in capturing the potential work and family implications of shift work thanks to thoughtfully designed studies like the Maastricht Cohort Study. The National Study of the Changing Workforce, fielded every five years by the Work and Family Institute is perhaps best equipped to monitor trends in shift work and the work and family-related consequences of shift work for individual workers. Minimally the National Study of the Changing Workforce could add probes to any participant responding "rotating shifts" to capture additional features such as the length of the shift cycle and the direction of rotation. Given the relatively low base prevalence of shift work in the U.S. (McMenamin 2007), only about 5 % of survey respondents would be required to answer the additional probes. However, in light of evidence that rotation direction and length may meaningfully shape work-family experiences (Karlson et al. 2009; van Amelsvoort et al. 2004), it seems the added costs for capturing these clarifying data are appropriate. Similar modifications to other national surveillance systems around the world would be useful for generating the worldwide burden of shift work.

Nearly 25 years ago Moen and Wethington (1992) argued that workers and their families developed adaptive strategies for accommodating the demands of family members' employment responsibilities: research that identifies, characterizes and evaluates alternative family adaptive strategies under different shift work configurations is needed. Evidence suggests that family members of individuals whose job requires frequent traveler take on different patterns of behavior before, during and after the job-related travel (Swenson et al. 2015). Likewise, in light of evidence indicating few differences in work-family experiences between shift workers and those with typical schedules (Duncan and Pettigrew 2012; Estryn-Béhar et al. 2012), it seems clear that some families effectively minimize the dis-synchrony between the worker's schedule and the broader temporal structure, or they can support effective recovery of the worker to minimize impairment. A true understanding of the putative effects of shift work on daily work and family life demands recognition that families have elegant systems for protecting the family unit and its members (Broderick 1993).

Research studying both positive and negative experiences at the work-family interface is needed. After nearly twenty years of research it is becoming increasingly clear that combining work and family, in general, can produce positive experiences as well as potential conflicts. Beutell's (2010) analysis demonstrated no differences in experiences of work-family conflict among workers with "rotating shifts," "irregular," or "other shifts", but that self-reported synergy between work and family was better for workers with rotating shifts relative to those in irregular schedules. These findings suggest the possibility that workers can generate strategies to minimize conflicts between work and family when working something other than a fixed daytime schedule, but the absence of regularity may impede the creation of positive of synergistic experiences between work and family.

The last and final high priority research need is careful attentiveness to potential endogeneity and other selection problems. Evidence clearly indicates that experiencing difficulties combining work and family increase the likelihood of exiting shift work for fixed-day schedule work (Jansen et al. 2010; van Amelsvoort et al. 2004). Men, those with less education, and people of color are disproportionately represented in shift work and jobs requiring something other than a fixed non-day schedule (McMenamin 2007). These and other realities highlight vexing challenges to study design and implementation. For example, results indicating that shift work may be more challenging to men's work-family balance than women's (Duncan and Pettigrew 2012) may be an artifact of sample design—specifically underrepresentation of women in shift work in a national probability sample—rather than a substantive finding (Grzywacz et al. 2013). Researchers collecting primary data should be attentive to basic issues of gender composition and implement sampling and recruitment strategies to minimize artifacts results from self-selection, and researchers using existing data are encouraged to use analytic techniques such as fixed-effects regression models (Heckman and Vytlacil 2007) or propensity score matching methods (D'Agostino 1998) to minimize potential selection effects.

4 Conclusion

The continued world press toward a 24/7 economy and potential increases in the need for workers to engage in shift work and work schedules outside the fixed-day, Monday thru Friday schedule, requires giving attention to the implications of these work arrangements work workers everyday work and family lives. The existing body of evidence suggests that shift work and nonstandard work schedules impair a worker's ability to integrate their daily work and family lives successfully. However, interpreting this evidence is difficult because of ambiguity in conceptualizing and operationalizing "shift work", and equal ambiguity in terms of identifying and using relevant concepts capturing the work-family interface. Overall, the evidence is "developing." Research is needed that uses consistent measurement strategies, acknowledges that workers and their families are active agents in responding to employment-related demands, that considers both positive and negative work-family experiences, and remains attentive to selection problems in study design and data analysis. Addressing these critical gaps will bring the evidence-base to a level of maturity to ensure workers in these work arrangements can meet all their work and family role requirements.

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References

Alaska Oil Spill Commission. (1990). Spill. The wreck of the Exxon Valdez: Implications for the safe transportation of oil. Retrieved September 7, 2015, from http://www.arlis.org/docs/vol1/B/33339870.pdf

Beutell, N. J. (2010). Work schedule, work schedule control and satisfaction in relation to work-family conflict, work-family synergy, and domain satisfaction. *Career Development International*, *15*(4–5), 501–518. doi:10.1108/13620431011075358

Broderick, C. B. (1993). *Understanding Family Process: Basics of Family Systems Theory*. SAGE.

Byron, K. (2005). A meta-analytic review of work-family conflict and its antecedents. *Journal of Vocational Behavior*, *67*(2), 169–198. doi:10.1016/j.jvb.2004.08.009

Camerino, D., Sandri, M., Sartori, S., Conway, P. M., Campanini, P., & Costa, G. (2010). Shiftwork, work-family conflict among Italian nurses, and prevention efficacy. *Chronobiology International, 27*(5), 1105–1123.

Carlson, D. S., Kacmar, K. M., & Williams, L. J. (2000). Construction and Initial Validation of a Multidimensional Measure of Work-Family Conflict. *Journal of Vocational Behavior, 56*(2), 249–276.

Carlson, D. S., Kacmar, K. M., Wayne, J. H., & Grzywacz, J. G. (2006). Measuring the positive side of the work-family interface: Development and validation of a work-family enrichment scale. *Journal of Vocational Behavior, 68*(1), 131–164.

Clark, S. C. (2000). Work/family border theory: A new theory of work/family balance. *Human Relations*, *53*(6), 747–770. doi:10.1177/0018726700536001

Craig, L., & Brown, J. E. (2014). Weekend work and leisure time with family and friends: Who misses out? *Journal of Marriage and Family, 76*(4), 710–727.

D'Agostino, R. B. (1998). Propensity score methods for bias reduction in the comparison of a treatment to a non-randomized control group. *Statistics in Medicine, 17*(19), 2265–2281.

Duncan, K. A., & Pettigrew, R. N. (2012). The effect of work arrangements on perception of work-family balance. *Community, Work and Family, 15*(4), 403–423.

Dunifon, R., Kalil, A., Crosby, D. A., Su, J. H., & DeLeire, T. (2013). Measuring maternal nonstandard work in survey data. *Journal of Marriage and Family, 75*(3), 523–532.

Estryn-Béhar, M., Van der Heijden, B. I. J. M., & Group, N. S. (2012). Effects of extended work shifts on employee fatigue, health, satisfaction, work/family balance, and patient safety. *Work (Reading, Mass.), 41*(1), 4283–4290.

Frone, M. R. (2003). Work-family balance. In J. C. Quick & L. E. Tetrick (Eds.), *Handbook of occupational health psychology* (pp. 143–162). Washington, DC, US: American Psychological Association.

Frone, M. R., Yardley, J. K., & Markel, K. S. (1997). Developing and testing an integrative model of the work-family interface. *Journal of Vocational Behavior, 50*(2), 145–167.

Gamaldo, C. E., Chung, Y., Kang, Y. M., & Salas, R. M. E. (2014). Tick-tock-tick-tock: The impact of circadian rhythm disorders on cardiovascular health and wellness. *Journal of the American Society of Hypertension*, *8*(12), 921–929. doi:10.1016/j.jash.2014.08.011

Garies, K. C., Barnett, R. C., & Brennan, R. T. (2003). Individual and crossover effects of work schedule fit: A within-couple analysis. *Journal of Marriage and Family*, *65*(4), 1041–1054. doi:10.1111/j.1741-3737.2003.01041.x

Greenhaus, J. H., & Allen, T. D. (2011). Work–family balance: A review and extension of the literature. In J. C. Quick & L. E. Tetrick (Eds.), *Handbook of occupational health psychology* (2nd ed., pp. 165–183). Washington, DC, US: American Psychological Association.

Greenhaus, J. H., & Beutell, N. J. (1985). Sources of conflict between work and family roles. *Academy of Management. The Academy of Management Review, 10*(1), 76.

Greenhaus, J. H., & Powell, G. N. (2006). When work and family are allies: A theory of work-family enrichment. *Academy of Management. The Academy of Management Review, 31* (1), 72–92.

Grzywacz, J. G., & Butler, A. B. (2005). The impact of job characteristics on work-to-family facilitation: Testing a theory and distinguishing a construct. *Journal of Occupational Health Psychology*, *10*(2), 97–109. doi:10.1037/1076-8998.10.2.97

Grzywacz, J. G., & Carlson, D. S. (2007). Conceptualizing work-family balance: Implications for practice and research. *Advances in Developing Human Resources*, *9*(4), 455–471. doi:10.1177/1523422307305487

Grzywacz, J.G., & Butler, A. B. (2008). Work-family conflict. In J. Barling & C. L. Cooper & (Eds), *Handbook of Organizational Behavior (Vol. 1): Micro-Approaches* (pp. 451–468). Thousand Oaks, CA: Sage.

Grzywacz, J. G., & Marks, N. F. (2000). Reconceptualizing the work-family interface: An ecological perspective on the correlates of positive and negative spillover between work and family. *Journal of Occupational Health Psychology, 5*(1), 111–126.

Grzywacz, J. G., Carlson, D. S., & Reboussin, B. A. (2013). A primer on sampling. (pp. 110–132). Psychology Press (New York, NY, US).

Heckman, J. J., & Vytlacil, E. J. (2007). Econometric evaluation of social programs, part I: Causal models, structural models and econometric policy evaluation. *Handbook of Econometrics, 6b* (2), 4779–4874. doi:10.1016/S1573-4412(07)06070-9

International Labor Organization. (2004). Shiftwork. Conditions of work and employment program. Retrieved September 7, 2015 from http://www.ilo.org/wcmsp5/groups/public/—ed_protect/—protrav/—travail/documents/publication/wcms_170713.pdf

Jansen, N. W. H., Kant, I., Kristensen, T. S., & Nijhuis, F. J. N. (2003). Antecedents and consequences of work-family conflict: A prospective cohort study. *Journal of Occupational and Environmental Medicine, 45*(5), 479–491.

Jansen, N. W. H., Mohren, D. C. L., van Amelsvoort, L. G. P. M., Janssen, N., & Kant, IJ. (2010). Changes in working time arrangements over time as a consequence of work-family conflict. *Chronobiology International, 27*(5), 1045–1061.

Karlson, B., Eek, F., Ørbæk, P., & Österberg, K. (2009). Effects on sleep-related problems and self-reported health after a change of shift schedule. *Journal of Occupational Health Psychology*, *14*(2), 97–109. doi:10.1037/a0014116

Kohn, M., & Schooler, C. (1978). Reciprocal effects of substantive complexity of work and intellectual flexibility—longitudinal assessment. *American Journal of Sociology*, *84*(1), 24–52. doi:10.1086/226739

Mauno, S., Ruokolainen, M., & Kinnunen, U. (2015). Work–family conflict and enrichment from the perspective of psychosocial resources: Comparing Finnish healthcare workers by working schedules. *Applied Ergonomics, 48*, 86–94.

McMenamin, T. M. (2007). A time to work: Recent trends in shift work and flexible schedules. *Monthly Labor Review, 130*(12), 3–15.

Mesmer-Magnus, J. R., & Viswesvaran, C. (2005). Convergence between measures of work-to-family and family-to-work conflict: A meta-analytic examination. *Journal of Vocational Behavior, 67*(2), 215–232.

Moen, P., & Wethington, E. (1992). The concept of family adaptive strategies. *Annual Review of Sociology, 18*, 233–251.

Morehead, A. (2001). Synchronizing time for work and family: Preliminary insights from qualitative research with mothers. *Journal of Sociology*, *37*(4), 355–369. doi:10.1177/144078301128756391

Nippert-Eng, C. E. (1996). *Home and Work: Negotiating Boundaries through Everyday Life*. University of Chicago Press.

Olsen, K. M., & Dahl, S.-Å. (2010). Working time: implications for sickness absence and the work–family balance. *International Journal of Social Welfare, 19*(1), 45–53.

Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science*, *349*(6251), aac4716–aac4716. doi:10.1126/science.aac4716

Rosa, R. R. & Colligan, J. M. (1997). Plain language about shiftwork (97–145). *CDC—NIOSH publications and products*. Retrieved September 7, 2015, from http://www.cdc.gov/niosh/docs/97-145/

Sauter, S. L., Murphy, L. R., & Hurrell, J. J. (1990). Prevention of work-related psychological disorders: A national strategy proposed by the National Institute for Occupational Safety and Health (NIOSH). *American Psychologist*, *45*(10), 1146–1158. doi:10.1037/0003-066X.45.10.1146

Staines, G. L., & Pleck, J. H. (1984). Nonstandard work schedules and family life. *Journal of Applied Psychology, 69*(3), 515.

Swenson, A. R., Zvonkovic, A. M., Rojas-Mcwhinney, J., & Gerst, K. N. (2015). A couple analysis of relationship perception among couples who face work demands. *Personal Relationships*, *22*(1), 153–171. doi:10.1111/pere.12069

Totterdell, P. (2005). Work schedules. In J. Barling, E. K. Kelloway, & M. R. Frone (Eds.), *Handbook of Work Stress* (pp. 35-62). Thousand Oaks, CA: Sage.

van Amelsvoort, L. G. P. M., Jansen, N. W. H., Swaen, G. M. H., van den Brandt, P. A., & Kant, I. (2004). Direction of shift rotation among three-shift workers in relation to psychological health and work-family conflict. *Scandinavian Journal of Work, Environment and Health, 30*(2), 149–156.

Introduction to Problems of Shift Work

Giovanni Costa

Abstract This chapter gives an overview of the health problems associated with shift work, and the main organizational guidelines on how to protect workers' health and well-being. Working time organization is becoming a key factor on account of new technologies, market globalization, economic competition, and extension of social services to general population, involving more and more people in continuous assistance and control of the work processes over the 24 h. The strong increase of epidemiological studies on this issue demonstrates the seriousness of this risk factor for human health and well-being, at both social and psychophysical levels, starting from disruption of biological circadian rhythms and the sleep/wake cycle, ending in several psychosomatic troubles and disorders, probably including cancer, and passing through impairment of performance efficiency and family and social life. Appropriate interventions on the organization of shift schedules according to ergonomic criteria, on the one hand, and a careful health surveillance and social support to shift workers, on the other hand, are important preventive and corrective measures able to allow people to keep working without significant health and social impairment.

1 Introduction

"Shift work" means, in general, any form of organization of work, different from the normal "daily work", in which the operating time of a company is extended beyond the usual 8–9 h (typically between 07–08 a.m. and 05–06 p.m.), to cover the entire 24 h, through the alternation of different groups of workers.

According to the most recent EU Directive (2003/88/EC of 4 November 2003), "concerning certain aspects of the organization of working time":

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- "Shift work" means any method of organizing work in shifts whereby workers succeed each other at the same work stations according to a certain pattern, including a rotating pattern, and which may be continuous or discontinuous, entailing the need for workers to work at different times over a given period of days or weeks;
- "Shift worker" means any worker whose work schedule is part of shift work;
- "Night time" is a period of not less than seven hours including the period between midnight and five in the morning;
- "Night worker": (a) any worker who, during night time, works at least three hours of his daily working time as a normal course; (b) any worker who works a certain proportion of his annual working time, as defined at the choice of the Member State concerned.

There are thousands of diverse shift systems adopted worldwide, which may have different impacts on workers' health, depending on factors such as:

- the duration of the duty period: predominantly from 6 to 8–9 h, but it can last up to 12 or be reduced to 4 h (in case of part-time work);
- the interruption or not on week-end or Sunday (semi-continuous or continuous systems);
- the presence and frequency of work in the "night time" (see above);
- the number of shifts/workers that take place throughout the day: mainly 2 (Morning and Afternoon) or 3 shifts (including the Night) of 7–9 h, or 4 shifts of six hours (Morning, Afternoon, Evening, Night, in the so-called "6 × 6" shift system);
- the start and end times of each shift: i.e. 06-14-22, 07-13-23, 07-14-21, 06-12-18-24;
- the direction of rotation: clockwise or phase-delayed (Morning-Afternoon-Night), counter-clockwise or phase-advanced (Afternoon-Morning-Night);
- the speed of rotation among the shifts: fast (every 1–3 days), intermediate (every 4–6 days), slow (7 or more days), null (in case of fixed shifts);
- the regularity/irregularity and length (i.e. from 5 days up to 6 months or more) of the entire shift cycle.

Although Bernardino Ramazzini (1633–1714), in his book "De Morbis Artificum Diatriba" (1713), pointed out the harmfulness of shift work, in particular night work, as far as concerns the bakers, who "work at night, so when the others sleep they stay awake, while trying to sleep during the day like animals who escape the light: hence, in the same town, there are men living an antithetic life in comparison with the others", medical and social interest in the problem started last century, between the two World Wars, and has increased over the latest 50 years.

In the modern "24-hour Society" we are both consumers and producers at the same time by requiring, at any time of the day and the night, the availability of goods and services, on the one hand, and by making it possible, on the other hand (Kreitzman 1999). Shift work, night work, irregular and flexible working hours, together with new technologies, are the milestone of this transition to the 24-h

society, of which shift workers are builders and victims at the same time. The most recent statistics say that the majority of the working population is engaged in irregular or "non-standard" working hours, including shift and night work, week-end work, split shifts, on-call work, compressed week, telework, part-time work, variable/flexible working time, prolonged duty periods.

The classical working day, 7–8 a.m. to 5–6 p.m., Monday to Friday, is nowadays a condition affecting a minority of workers (27 % of employed and 8 % of self-employed people in Europe (Costa et al. 2004), and working time arrangement has become a key issue of work organization and a basic condition linking human capacities with production means. It is associated with the increasing economic competition among companies and countries, due to the globalization of labour markets, the development of new technologies and productive strategies, as well as the extension of basic services to the general population, requiring continuous human assistance and control over the 24 h.

Therefore, the borders between working and social times are no longer fixed and rigidly determined by the normal diurnal working day. Not only are waking hours extended to evening and night hours, and also to weekend days, but hours of duty have become more variable (e.g. part-time, 6-h and 12-h shifts, irregular shift schedules, split shifts).

Now, thanks to new technologies, not only the link between work place and working times has been broken (e.g. telework), but also the value of working time changes according to the different economic/productive/social effects it can have at different hours/periods of the worker's life. Moreover, the more the modern economy transfers its interest from tangible to intangible goods, the more time becomes the main criterion of evaluation and profit ("time is money").

According to the World Health Organization definition, "health is a state of complete physical, emotional, and social well-being, not merely the absence of disease or infirmity". Shift work and related problems fit well with this definition, as it interferes with all those dimensions, namely:

(a) it perturbs the physiological homeostasis, due to disturbance of the circadian rhythms of the psychophysiological functions, starting from the sleep/wake cycle;
(b) it decreases work ability, due to fluctuations in work performance and efficiency over the 24-hour span, with consequent errors, accidents and injuries;
(c) it hampers human relations at both family and social level, with consequent negative influences on marital relations, care of children and social contacts;
(d) it deteriorates health and well-being both in the short-term, through disturbances of mood, sleeping and eating habits and related complaints, and in the long run, through more severe troubles and illnesses, dealing prevalently with the gastrointestinal, neuropsychological, metabolic, cardiovascular and reproductive functions and, probably, cancer.

All that leads to increased morbidity and absenteeism, with consequent high economic and social costs for the individual, the enterprise, and the whole society.

2 Biological Functions and Sleep/Wake Cycle

At the biological level, the perturbation of the sleep/wake cycle, connected with the modified activity/rest pattern, is a significant stress for the endogenous regulation of the "circadian" (about 24 h) rhythms of biological functions, which are driven by the body clock, located in the suprachiasmatic nuclei of the encephalon, and synchronised by environmental cues, the light/dark cycle in particular, through non-vision-related photic stimuli from retinal ganglion cells with high sensitivity to light (Reppert and Weaver 2002; Roenneberg et al. 2007).

Staying awake at night and trying to sleep during the day is not a physiological condition for diurnal creatures as we humans are. Workers are subjected to a continuous stress to adjust as quickly as possible to variable duty periods, which, in most cases, is only partial and invariably frustrated by continuous changeovers.

The misalignment of circadian rhythms of body functions is responsible for the so-called "jet lag" (or more properly "shift lag" in this case) syndrome, characterized by feelings of fatigue, sleepiness, insomnia, digestive troubles, irritability, poorer mental agility and reduced performance efficiency. It recovers in a few days depending on the length and duration of the phase shift imposed, and on personal characteristics (e.g. age) and coping strategies.

It is quite obvious that the perturbation of the sleep/wake cycle has its main effect on sleep, which suffers both in quantity and quality according to the timing of shifts and rest periods, the environmental conditions, and the worker's characteristics and behaviours. After a night shift, workers usually go to bed as soon as they get home, that is one or two hours after the end of the shift, depending on the commuting time and family commitments (see later for women). This means that they have to sleep during the normal rising phase of biological rhythms which sustains wakefulness. This makes it difficult to fall asleep and sleep longer, also because the environmental conditions are not the most appropriate, in particular as concerns disturbing noises and lighting, being linked to the diurnal activities of the general population. Also in early morning shifts, sleep can be notably reduced and disturbed, mainly in the REM phase, due to the truncation of the last part of the sleep, where it is prevalent (Åkerstedt et al. 2010; Rosa 1993).

Therefore, sleep deteriorates both in quantity and quality, and the severity may vary according to timing of shifts (on night and early morning shifts in particular), position and duration of rest periods and associated environmental conditions (exposure to light and noise in particular), workers' characteristics and life styles.

In fact, it has to be taken into account that the type of shift rotation can significantly affect resting and rising times as well as sleep duration. For example, in case of the classical semi-continuous shift system at forward, weekly rotation "5/2" (5 morning shifts, 2 rest-days, 5 afternoon shifts, 2 rest-days, 5 nights 2 rest-days), the interval between two night shifts is always 16 h, and there are 48 or 56 h between the last night shifts and the following morning or afternoon shift period. On the other hand, in case of a fast, backward-rotating shift system (1 afternoon shift, 1 morning shift, 1 night shift, 2 rest days), having the morning shift

immediately after the afternoon shift and the night shift in the same day ("quick return"), the rest intervals between the shifts last only 8 h, and the night shift starts in the same day as the morning shift, thus combining the truncation of the sleep preceding the morning shift with its curtailment before the night shifts. Moreover, in case of continuous shift schedules, it was found that sleepiness decreases passing from a backward- to a forward-rotating shift system, as there are longer rest intervals among shifts (Vittasalo et al. 2008).

As a matter of fact, about 10 % of night and rotating shift workers, aged between 18 and 65, have been estimated to have a clinical "shift-work sleep disorder" according to the International Classification of Sleep Disorders (Drake et al. 2004).

More recently other large epidemiological studies reported far higher numbers of shift workers screened positive for excessive wake time sleepiness and insomnia related to work schedule, such as 53.9 % of 4957 sworn police officers in North America (Rajaratnam et al. 2011), 32.1 % night workers versus 10.1 % day workers in 1163 Australian employees (Di Milia et al. 2013), and 35.7 % among 1533 Norwegian nurses (Waage et al. 2014).

3 Performance Efficiency, Errors and Accidents

The combination of circadian disruption and sleep deprivation can be responsible for high levels of sleepiness and fatigue during the work periods, with consequent higher proneness to performance impairment, inducing or favoring errors and accidents, both at the work site and during commuting from home to work and vice versa.

Hence, both homeostatic (time elapsed since prior sleep termination) and circadian (sleep/wake cycle) components interact in determining the extent of the reduction in alertness and psycho-physical performance over the waking day, and even more so at night.

Sleepiness, sleep disturbances, chronic fatigue and oscillatory fluctuations of alertness and vigilance are key factors in causing human errors, and consequent work accidents and injuries, by interacting with organisational factors, such as environmental conditions, job content, workload, and time pressure.

Some studies that estimated the relative risk of incidents in the morning, afternoon and night shifts of 8-hour shift systems, in comparable working conditions, showed an increased risk of 18 % in the afternoon shift, and of 30 % in the night shift, as compared to the morning shift. Moreover, other studies reported that the risk increases over successive shifts, being about 6 % higher in the second night, 17 % higher in the third night, and 36 % higher in the fourth consecutive night (Folkard and Tucker 2003).

Also the length of hours on duty is a key factor for fatigue-related accidents. An aggregated analysis of several studies carried out in English industries (Folkard 1996) showed an almost exponential increase of accidents after the eighth hour of

work; this has been also evidenced in Sweden (Åkerstedt 1995), examining the national database of work accidents, and in Germany through the insurance registries on industrial accidents (Haenecke et al. 1998). According to these studies it is possible to estimate a double risk of accident when working in a 12-h shift as compared with a 8-h shift. Also a recent survey of more than 75,000 US workers over a 4-year period (Lombardi et al. 2010) confirmed a higher risk of injury strictly related to a progressive increase of working hours and reduction of sleep duration.

4 Health Disorders

Shift workers frequently complain of irritability, nervousness and anxiety, in relation to more stressful working conditions and greater difficulties in family and social life. In association with persistent disruption of circadian rhythms and sleep deficit, they may lead to chronic fatigue, mood disorders, neuroticism, as well as to chronic anxiety and/or depression, favoring absenteeism and often requiring the administration of psychotropic drugs (sedatives and hypnotics) (Colquhoun et al. 1996; Nakata et al. 2004).

Digestive troubles are the most frequently complained of by shift workers (20–75 vs. 10–25 % of day workers), being connected with phase displacements between mealtimes and normal circadian phases of gastrointestinal functions, as well as to changes in food quality and composition (i.e. more pre-packed food and 'pep' and soft drinks) (Lennernas et al. 1994; Knutsson and Boggild 2010).

Several epidemiological studies have recently reported a higher prevalence of nutritional and metabolic disturbances in shift workers, such as metabolic syndrome and diabetes, emphasizing their role in the pathogenesis of coronary heart disease (Karlsson et al. 2003; Biggi et al. 2008; De Bacquer et al. 2009; Suwazono et al. 2009; Lowden et al. 2010; Van Drongelen et al. 2011; Tucker et al. 2012; Wang et al. 2014; Gan et al. 2015).

According to some authors, shift workers have a 40 % excess risk for ischemic heart disease as compared to day workers. It has been suggested that these associations are due to the combination of the stress connected with perturbed cardiac autonomic control, sleep deprivation, work/family conflicts, and life style changes (e.g. diet and smoking) (Bøggild and Knutsson 2000; Puttonen et al. 2010; Esquirol et al. 2011).

A higher incidence of altered menstrual cycle, pre-menstrual syndrome and menstrual pains has been reported in many groups of women shift workers, such as nurses, air crews, and blue collar workers in industry. Some studies also reported a higher incidence of miscarriage and impaired fetal development, including pre-term birth and low birth weight (Nurminen 1998; Mozurkewich et al. 2000; Zhu et al. 2003).

In 2007, the International Agency on Research on Cancer (IARC) classified "shiftwork that involves circadian disruption" as "probably carcinogenic to

humans", on the basis of "limited evidence in humans for the carcinogenicity of shift-work that involves night work", and "sufficient evidence in experimental animals for the carcinogenicity of light during the daily dark period (biological night)". The mechanisms by which circadian disruption may favor the induction and/or promotion of malignant tumors are complex and multi-factorial. The multi-level endocrine changes, caused by circadian disruption with melatonin suppression by exposure to light at night, lead to the oncogenic targeting of the endocrine responsive breast in women and possibly prostate in men. Repeated phase shifting with internal desynchronization may lead to defects in circadian cell cycle regulation, thus favoring uncontrolled growth. Moreover, sleep deprivation leads to suppression of immune surveillance which may permit the establishment and/or growth of malignant clones (Straif et al. 2007; Costa et al. 2010; Ijaz et al. 2013).

5 Family and Social Problems

People engaged in irregular or "atypical" working hours, such as shift and night workers, are frequently out of phase with the society, as most family and social activities are arranged according to the day-oriented rhythms of the general population. Work, leisure and sleep times usually assume different "values" according to social timetables: the late afternoon and evening hours, as well as week-ends are the most desirable for social contacts and leisure activities.

Shift workers experience directly the conflicts between their time budgets and the complex synchronization of the social activities, both in primary individual duties (e.g. work hours, commuting times, school timetables, etc.) and leisure and social services. Therefore, shift workers have more difficulties in combining their "productive" and "consuming" times, particularly when their leisure activities involve the integration of many people into organized groups, such as sports teams, civic groups, and political and cultural organizations requiring constant and regular contacts. Thus shift work can lead to some degree of social isolation or marginalisation (Colligan and Rosa 1990; Loudoun and Bohle 1997).

Shift work may also interfere with the already complex co-ordination of individual times of family members, particularly since family life can vary greatly according to different phases of the family cycle (e.g. marital status, number and age of children, presence of old people, illnesses), distribution of work among its members (official job, housework, moonlighting) and the availability of community services (i.e. shop hours and transports).

Stress, "time pressure" and related complaints are a constant condition for those who have high family burdens or complementary duties (Beerman and Nachreiner 1995; Gadbois 1981). These problems are further complicated when both partners are shift workers, and have negative effects on marital relationships, parental roles and children's education.

As concerns women in particular, although no relevant differences between sexes in terms of chronobiological adjustments to temporal changes are detectable, some studies pointed out that women shift workers have lower fertility and higher abortion rates than their day worker colleagues not only because of the interference on the hormonal rhythms, but also for a personal choice of avoiding or limiting pregnancies or new babies, due to the more complex and difficult organization of their life caused by the conflicts between irregular work schedules and home commitments.

Such social problems are often more frequent than those related to the biological problems, and they are also the main cause of mal-adaptation to shift work and may have a clear influence on the development of psychosomatic disorders (Pisarski et al. 2008).

On the other hand, shift workers may also be forced to learn how to use daytime periods more positively; this gives more flexibility to those who enjoy solitary activities (hobbies) or in the case of women who give a higher priority to family and domestic duties than to personal leisure. As a consequence, it is found that shift work can be fully accepted by some shift workers as it provides them more opportunities to use daytime hours to comply with private needs (e.g. access to public offices, banks, the doctor's), or simply to enjoy longer intervals of free time between the shift cycles. For these reasons some shift systems based on a backward fast rotation, having "quick returns" (double shift in one day) and long off-duty periods, are often preferred by some groups of shift workers despite their clear negative effects upon circadian rhythms and sleep (Loudoun 2008).

6 Tolerance to Shift Work and Health Surveillance

There is a high inter-individual variability in tolerance to shift work, which can be due to the interaction among individual characteristics, working and social conditions.

Among the former, some authors suggested morningness/eveningness, neuroticism, rigidity/flexibility of sleeping habits, hardiness, neuroticism, and stability of circadian rhythms (Costa 2003; Van Dongen 2006; Reinberg and Ashkenazi 2008; Saksvik-Lehouillier et al. 2012). Subjects having the characteristics of "morningness" generally face more difficulties in short-term adjustment to night work compared to the "evening" types. Moreover, people who present high levels of neuroticism, or the characteristics of rigidity of sleeping habits and lower ability to overcome drowsiness, have more difficulties in their adaptation to irregular work schedules. On the other hand, good physical health and a strong commitment to shift work could favour a better tolerance (Härmä 1996).

The critical age for increasing intolerance to shift and night work seems to be about 45-50 years of age, due to chronobiological factors, psycho-physical aspects and to social conditions. Ageing is associated with a more difficult adjustment of circadian rhythms to night work, to increased sleep disturbances, and to reduced

tolerance for longer work hours, such as in the case of 12-h shifts. The difficulty in achieving adequate circadian adjustment is due to several factors including (a) a weakening of the circadian system resulting from molecular and functional changes in the suprachiasmatic nuclei that makes the organism more prone to internal desynchronisation; (b) an earlier phasing of circadian rhythms; (c) a slower circadian adjustment over successive night shifts; (d) a reduced sleep duration with a consequent increased sleepiness during waking hours. There is evidence to suggest that the alertness and performance efficiency of older workers suffers more from the homeostatic sleep process (that is, the duration of the previous waking period) than the circadian process, compared with younger workers. Moreover, health deterioration with increasing age may be more pronounced in shift workers than in day workers due to chronic fatigue and problems with sleep (Härmä 1996; Costa and Sartori 2007; Costa and Di Milia 2008).

As already mentioned, women's tolerance is often more related to family and social determinants: women shift workers in fact (in particular those with small children) have more difficulties in combining their irregular working schedules with their additional domestic duties, and thus suffer more from sleep problems and chronic fatigue. Therefore, consequent actions have not only to guarantee a higher protection for women shift workers by proper legislation (i.e. exemption from night work when pregnant), but also to support them by means of suitable social services (i.e. kindergartens, school and shop timetables) and working time arrangements (i.e. flexible working hours).

Moreover, atypical and irregular working hours may also be differently associated with diverse types of employment and work sectors. Workload and work content may notably differ between temporary and permanent workers even within the same work activity, particularly with regards to job demand, job control and autonomy, and work-life conflicts. All this has a significant impact on work satisfaction, psychological well-being and work-family balance.

Furthermore, poor social and living conditions can aggravate the impact of shift and night work on health, as reported from many surveys carried out in developing countries (Ong and Kogi 1990; Fischer 2001; Fletcher 2010). Labour-market globalisation carries not only a positive interracial mixing and a wider distribution of goods and services all over the world, but also causes an increasing flow of poor people from developing to developed countries, that is very often associated with racial and social discrimination. Immigrant people are those who have to face more unfavourable working conditions, including bad shift systems, in the industrialised countries. Consequently the actions that have to be undertaken from this perspective deal not only with the psycho-physical domain, but mainly with the social one, in terms of political and economic strategies as well as ethical choices.

On the other hand, there are many pathological conditions, either directly associated with shift and night work, as above mentioned, or independent from it, that may be a potential contraindication for irregular working hours. They must be carefully evaluated both in terms of severity and possibility of appropriate therapy, in the process of assessment of fitness to work, with or without limitations and/or prescriptions, on a temporary or permanent basis (Koller 1996; Costa 1998).

This is the case, in particular, of persistent sleep disorders (i.e. chronic insomnia, obstructive sleep apnea syndrome, parasomnias), severe gastrointestinal disorders (i.e. peptic ulcer, chronic hepatitis or pancreatitis, Crohn's disease), cardiovascular diseases (i.e. ischemic heart disease and severe hypertension), neuro-psychic syndromes (i.e. chronic anxiety and/or depression, seasonal affective disorders, epilepsy), metabolic (i.e. diabetes) and hormonal disorders (i.e. thyroid and suprarenal pathologies), chronic renal impairment, and cancer.

Several etiological and/or contributing risk factors may include genetic inheritance, psychological characteristics, life-styles, socio-economic conditions, and other concurrent or pre-existent health disorders. Consequently, intolerance to shift and night work is the result of the interaction among several risk factors dealing with different domains, which can have different weight and relevance among shift workers both in terms of severity and timing of manifestation during their working life.

These factors can have different effects (e.g. physical health, mental health, social relations) according to the circumstances and ways of interaction (e.g. addition, enhancement, compensation), and the consequent result depends not only on the specific load of each factor, but mainly on how much and how long they interact and interfere with each other in relation to the peculiar conditions of each individual or group of shift workers. They may also have significant implications for productivity, company strategies and social organisation, which in turn influence individual health and well-being.

All that explains the high inter- and intra-individual variability, both in terms of short-term adaptation and long-term tolerance, as concerns the level of imbalance of well-being and the type and severity of health troubles and disorders.

7 Preventive Measures

Some international directives have emphasized the necessity of a careful organisation of shift and night work to protect the workers' health, namely the ILO Convention no. 171 and Recommendation concerning Night Work (1990) and the European Parliament Directives 1993/104/EC and 2003/88/EC concerning "certain aspects of the organisation of working time".

There are thousands of different shift schedules which may have a quite different impact on worker's health, safety and social life, in particular with reference to amount of night work, timing and duration of shifts, length of shift cycle, speed and rotation of shifts, position and length of rest days.

Hence, particular attention has to be given to the organisation of the shift schedules, to take into account not only economic reasons, but also give priority to the workers' needs, in particular as concerns the physiology of the human body, psychological and social problems, and possible negative effects on health and well-being. The main guidelines for designing shift systems according to ergonomic criteria are (Knauth 1996, 1998, 2007; Gartner et al. 2004):

- Quickly rotating shift systems are better than slowly rotating ones, since they interfere less with circadian rhythms and minimise the extent of any cumulative sleep deficit.
- Clockwise rotation (morning/afternoon/night) is preferable to counter-clockwise (afternoon/morning/night) since it parallels the endogenous circadian rhythms (which show a periodicity slightly longer than 24 h in "free-running" experiments), avoids quick changeovers (e.g. morning and night shift on the same day) and allows longer rest periods for the immediate recovery from fatigue and sleep deficit.
- Early starts of the morning shift should be avoided in order to reduce the truncation of sleep (REM phase in particular) and consequent fatigue and risk of errors.
- Prolonged work shifts (9–12 h) should only be contemplated when the workload is suitable, there are adequate pauses, and the shift system is designed to minimise the accumulation of fatigue and the exposure to toxic substances.
- Shift systems should be as regular as possible and guarantee as many free weekends as possible, to allow people to plan and enjoy their leisure and social time more conveniently.
- Permanent night work can be acceptable only for particular working situations, which require a complete adjustment to night work in order to guarantee the highest levels of safety.
- Flexible working time arrangements should be promoted in order to meet workers' needs and preferences.

However, it is worth stressing that there is no "best" shift system to be recommended in general, but each shift work schedule should be planned and adapted according to the different job activities and demands, as well as to the specific characteristics, social habits and cultural background of the workers involved. This implies a careful strategy for the arrangement of the shift schedules, that requires the participation of the workers in the analysis, design, implementation and assessing of the shift system chosen. This is of paramount importance, not only for taking into account the suggestions of those who have direct experience of the problem, but also for promoting the right motivation for accepting the changes and, consequently, improving their psycho-physical tolerance.

8 Compensative Measures

Interventions aimed at counteracting the inconveniences caused by shift and night work can be distinguished in "counter-weights" and "counter-values". The first ones are only aimed at compensating for the troubles caused by shift work (i.e. monetary compensation, improved general working conditions), whereas the second ones are aimed at reducing or eliminating the possible negative effects, through reduction of working hours, restriction of night shifts, more compensatory rest days

or extra time off, additional pauses for meals and naps, sleep and canteen facilities, social support (e.g. day-nursery, transports, extended school and shop hours), financial support for better housing, medical surveillance, physical and psychological training, transfer to day work after a certain number of years, early retirement.

Proper education and counseling is another key issue on this respect. Both managers and persons in charge of working time organization, as well as workers involved, must be adequately informed of the possible negative effects of shift work. The former have to understand which may be the negative consequences of shift work on worker's health and performance, hence also on productivity, absenteeism and company costs, in order to plan the best possible countermeasures in terms of work organization and worker management. The latter have to understand which troubles and disorders are more related to shift and night work, and what are the best coping strategies to prevent or limit them, in particular with reference to sleep habits, diet, physical fitness and leisure times. It has been evidenced that good social support from co-workers and supervisors at work, as well as from family members, is able to significantly improve adaptation and tolerance (Kogi 1996, 2001; Knauth and Hornberger 2003; Knauth et al. 2006; Pallesen et al. 2010).

The search for innovative working time arrangements and the adoption of flexible working systems, taking into account not only production demands but also individual needs and preferences, must have a positive effect on shift workers' tolerance. They support an increased compatibility of the employee's professional and private life through changes and adjustment of working times (work shift duration, amount of night work, time autonomy), that may be articulated on several temporal scales (daily, weekly, monthly, annual, working life) according to different requirements workers may have. Flexible working hours can also mean that more vulnerable groups (i.e. women, aging workers) can find a way to cope with shift work without worsening their health, losing jobs or professional opportunities, and deteriorating family and social life.

The increasing interest in "temporal flexibility" is due to policies related to working time duration and employment, on the one hand, and to a progressive transfer of attention from the quantitative to the qualitative aspects of work and social activities, on the other hand.

Work-life balance is a concept with increasing importance in ergonomics, which has to take into account both diversities among groups and individuals (e.g. older workers, women, family responsibilities, income levels, expertise) and their social interactions (e.g. consumer's role, participation in social groups, leisure activities).

However, there are large differences in conceptualisation and approaches to flexible working hours; in particular there are different points of view between employers and employees. For the former ("company-based flexibility"), they are tools for a prompt adjustment of production and service systems to market demands and technological innovations (e.g. shift and night work, split shifts, week-end work, seasonal work); for the latter ("individual-oriented flexibility"), they are important tools able to improve and harmonize working and social life by

increasing employment, autonomy and time sovereignty (e.g. part-time work, shortened work week, self-determined start and end times, bank of hours).

It can be argued that, in general, the higher the individual-based "flexibility" the better health and work satisfaction, whereas company-based "flexibility" might have more negative interference. However, due to their different possible combinations, the expected effects on health and working conditions cannot be assessed a priori, but they have to be carefully analysed, taking also into account several intervening personal and social factors. Moreover, the result of their interactions may depend (and largely differ) on such individual factors as the time of occurrence in the worker's life, their duration, etc.

In a study concerning the dataset of the 3rd EU Survey on working conditions (Costa et al. 2004, 2006), lack of individually-oriented flexibility of working hours has been shown to be associated with job dissatisfaction, feeling of not being able to do the same job at the age of 60, lower health and safety, as well as with unfavourable adjustment to family and social commitments. On the other hand, lower company-based flexibility proved to be favourably associated to family and social commitments, and health and well-being. In particular, individually-oriented flexibility resulted as the first most important factor to influence work satisfaction; the second one to affect family and social commitments, overall fatigue, and the ability to do the same job at the age of 60; the third one to influence some health outcomes, such as heart disease, stomach ache, and anxiety. It is also worth noting that the "feeling of not being able to do the same job when at 60 years old" was mainly associated to poor participation in work organisation and lack of individually-oriented flexibility of working hours.

Also Janssen and Nachreiner (2004) found that a high variability in both duration and position of working hours is associated with impairment in health and well-being, particularly if it is company-controlled, while it is less pronounced if it is self-controlled.

It has also to be taken into account that the company's demand for higher "variability" is primarily related to short-term adaptation to economic and productive pressures, whereas the individual's demand for higher "flexibility" is more related to mid/long-term planning and harmonisation of working and non-working life.

9 Conclusions

The interferences between irregular working hours, particularly shift work and night work, on health and well-being are complex and multifaceted in their origins and temporal manifestations, dealing with several aspects of personal characteristics, working and social conditions.

Both occupational and non-occupational stressors, as well as cognitive and behavioural coping efforts and strategies, interact and testify to the complexity of

the problem and the difficulty in combining factors pertaining to different dimensions, namely:

(a) external risk factors: i.e. work load and environment, family and social conditions;
(b) individual aspects: i.e. age, gender, personality, attitudes, coping strategies;
(c) outcomes and targets: i.e. circadian adjustment, sleep troubles, performance efficiency, mental health, physical health, family life, social integration, work satisfaction, work ability;
(d) interactions among factors and effects, for example dose/response (circadian rhythms, hormonal strain, sleep), dose/effect (health troubles, family life), up/down regulation (association, enhancement, compensation), mediators/modulators, short/long-term action;
(e) importance, priority and feasibility for the individual, companies, communities, and the whole society;
(f) preventive and corrective actions: i.e. legislation, work organisation, working time arrangements, social support, group/individual education;
(g) domains describing human life, such as: physiology, psychology, sociology, ergonomics, economics, politics, and ethics.

Consequently, the more holistic the approach is, the more possibilities exist for fully understanding the problem and, consequently, for adopting the best actions and countermeasures. Conversely, the more specific the appraisal is, the more detailed and deep the analysis can be, but the higher the risk is of "losing the picture" and consequently not being able to define the most congruent actions, with a more balanced integration between individual aspects and community policies. Although more difficult, this is the only way that has a chance of avoiding some uncritical evaluations of (mal)adaptation, (in)tolerance and (un)fitness to shift and night work based on particular or limited aspects (i.e. some individual characteristics and/or behaviours) not sufficiently supported by scientific data and longitudinal studies. This can lead to a risky and even dangerous (i.e. for employment) attitude for selection of shift workers, without taking into consideration the whole context in terms of (shift) work organisation and social conditions, which in many cases are the most relevant intervening factors, and towards which more profitable (both for subjects and companies, as well for society) interventions should be addressed.

References

Åkerstedt, T. (1995). Work injuries and time of day—National data. *Shiftwork International Newsletter, 12*, 2.

Åkerstedt, T., Keklund, G., & Selén, J. (2010). Early morning work—Prevalence and relation to sleep/wake problems: A national representative survey. *Chronobiology International, 27*, 975–986.

Beerman, B., & Nachreiner, F. (1995). Working shifts—different effects for women and men? *Work & Stress, 9*, 289–297.

Biggi, N., Consonni, D., Galluzzo, V., et al. (2008). Metabolic syndrome in permanent night workers. *Chronobiology International, 25*, 443–454.

Bøggild, H., & Knutsson, A. (2000). Shiftwork and cardiovascular disease: Review of disease mechanisms. *Reviews on Environmental Health, 15*, 359–372.

Colligan, M. J., & Rosa, R. R. (1990). Shiftwork effects on social and family life. *Occupational Medicine: State of art review, 5*, 315–322.

Colquhoun, W. P., Costa, G., Folkard, S. et al. (1996). *Shiftwork: Problems and solutions*. Arbeitswissenschaft in der betrieblichen Praxis No. 7, Peter Lang, Frankfurt aM.

Costa, G. (1998). Guidelines for the medical surveillance of shiftworkers. *Scandinavian Journal of Work, Environment & Health, 24*(Suppl 3), 151–155.

Costa, G. (2003). Factors influencing health of workers and tolerance to shift work. *Theoretical Issues of Ergonomics Science, 4*, 263–288.

Costa, G., & Di Milia, L. (2008). Ageing and shiftwork: A complex problem to face. *Chronobiology International, 25*, 165–181.

Costa, G., & Sartori, S. (2007). Ageing, working hours and work ability. *Ergonomics, 50*, 1–17.

Costa, G., Åkerstedt, T., Nachreiner, F., et al. (2004). Flexible working hours, health, and well-being in Europe: Some considerations from a SALTSA project. *Chronobiology International, 21*, 831–844.

Costa, G., Sartori, S., & Åkerstedt, T. (2006). Influence of flexibility and variability of working hours on health and well-being. *Chronobiology International, 23*, 1–13.

Costa, G., Haus, E., & Stevens, R. (2010). Shiftwork and cancer: Considerations on rationale, mechanisms, and epidemiology. *Scandinavian Journal of Work, Environment & Health, 36*, 163–179.

De Bacquer, D., Van Risseghem, M., Clays, E., et al. (2009). Rotating shift work and the metabolic syndrome: A prospective study. *International Journal of Epidemiology, 38*, 848–854.

Di Milia, L., Waage, S., Pallesen, S., & Bjorvatn, B. (2013). Shift Work Disorder in a Random Population Sample – Prevalence and Comorbidities. *PLoS ONE, 8*(1), e55306.

Drake, C. L., Roehrs, T., Richardson, G., et al. (2004). Shift work sleep disorder: Prevalence and consequences beyond that of symptomatic day workers. *Sleep, 27*, 1453–1462.

Esquirol, Y., Perret, B., Ruidavets, J. B., et al. (2011). Shift work and cardiovascular risk factors: New knowledge from the past decade. *Archives of Cardiovascular Disease, 104*, 636–668.

Fischer, F. M. (2001). Shiftworkers in developing countries: Health and well-being and support measures. *Journal of Human Ergology, 30*, 155–160.

Fletcher, A. (2010). Staying safe in the jungles of Borneo: Five studies of fatigue and cultural issues in remote mining projects. *Industrial Health, 48*, 406–415.

Folkard, S. (1996). Effects on performance efficiency. In W. P. Colquhoun, G. Costa, S. Folkard, & P. Knauth (Eds.), *Shiftwork: Problems and solutions* (p. 65). Frankfurt aM: Peter Lang.

Folkard, S., & Tucker, P. (2003). Shiftwork, safety and productivity. *Occupational Medicine, 53*, 95–101.

Gadbois, C. (1981). Women and night shift: Interdependence of sleep and off-job activities. In A. Reinberg, N. Vieux, & P. Andlauer (Eds.), *Night and shift work: Biological and social aspects* (p. 223). Oxford: Pergamon Press.

Gan, Y., Yang, C., Tong, X., et al. (2015). Shift work and diabetes mellitus: A meta-analysis of observational studies. *Occupational and Environmental Medicine, 72*, 72–78.

Gartner, J., Popkin, S., Leitner, W., et al. (2004). Analyzing irregular working hours: Lessons learned in the development of RAS 1.0—The representation and analysis software. *Chronobiology International, 21*, 1025–1035.

Haenecke, K., Tiedemann, S., Nachreiner, F., et al. (1998). Accident risk as a function of hours at work and time of day as determined from accident data and exposure models for the German working population. *Scandinavian Journal of Work, Environment & Health, 24*(Supplement 3), 43–48.

Härmä, M. (1996). Ageing, physical fitness and shiftwork tolerance. *Applied Ergonomics, 27*, 25–29.

Ijaz, S., Verbeek, J., Seidler, A., et al. (2013). Night-shift work and breast cancer: A systematic review and meta-analysis. *Scandinavian Journal of Work, Environment & Health, 39*, 431–447.

Janssen, D., Nachreiner, F. (2004). Health and psychosocial effects of flexible working hours. *Revista de Saùde Pùblica* 38(Supl), 11–18.

Karlsson, B., Knutsson, A., Lindahl, B., et al. (2003). Metabolic disturbances in male workers with rotating three-shift work. Results of the WOLF study. *International Archives of Occupational and Environmental Health, 76*, 424–430.

Knauth, P. (1996). Designing better shift systems. *Applied Ergonomics, 27*, 39–44.

Knauth, P. (1998). Innovative worktime arrangements. *Scandinavian Journal of Work, Environment & Health, 24*(Suppl 3), 13–17.

Knauth, P. (2007). Extended work periods. *Industrial Health, 45*, 125–136.

Knauth, P., & Hornberger, S. (2003). Preventive and compensatory measures for shift workers. *Occupational Medicine, 53*, 109–116.

Knauth, P., Jung, D., Bopp, W., et al. (2006). Compensation for unfavorable characteristics of irregular individual shift rotas. *Chronobiology International, 23*, 1277–1284.

Knutsson, A., & Boggild, H. (2010). Gastrointestinal disorders among shift workers. *Scandinavian Journal of Work, Environment & Health, 36*, 85–95.

Kogi, K. (1996). Improving shift workers' health and tolerance to shiftwork: Recent advances. *Applied Ergonomics, 27*, 5–8.

Kogi, K. (2001). Healthy shiftwork, healthy shiftworkers. *Journal of Human Ergology, 30*, 3–8.

Koller, M. (1996). Occupational health services for shift and night work. *Applied Ergonomics, 27*, 31–37.

Kreitzman, L. (1999). *The 24 hour society*. London: Profile Books.

Lennernas, M., Hambraeus, L., & Åkerstedt, T. (1994). Nutrient intake in day and shift workers. *Work & Stress, 8*, 332–342.

Lombardi, D. A., Folkard, S., Willetts, J. L., et al. (2010). Daily sleep, weekly working hours, and risk of work-related injury: US national health interview survey (2004–2008). *Chronobiology International, 27*, 1013–1030.

Loudoun, R. (2008). Balancing shiftwork and life outside work: Do 12-h shifts make a difference? *Applied Ergonomics, 39*, 572–579.

Loudoun, R., & Bohle, P. (1997). Work/non-work conflict and health in shiftwork: Relationships with family status and social support. *International Journal of Occupational and Environmental Health, 3*, S71–S77.

Lowden, A., Moreno, C., Holmback, U., et al. (2010). Eating and shift work – effects on habits, metabolism, and performance. *Scandinavian Journal of Work, Environment & Health, 36*, 150–162.

Mozurkewich, E. L., Luke, B., Avni, M., et al. (2000). Working conditions and adverse pregnancy outcome: A meta-analysis. *Obstetrics and Gynecology, 95*, 623–635.

Nakata, A., Haratani, T., Takahashi, M., et al. (2004). Association of sickness absence with poor sleep and depressive symptoms in shift workers. *Chronobiology International, 21*, 899–912.

Nurminen, T. (1998). Shift work and reproductive health. *Scandinavian Journal of Work, Environment & Health, 24*(Supplement 3), 28–34.

Ong, C. N., & Kogi, K. (1990). Shiftwork in developing countries: Current issues and trends. *Occupational Medicine, 5*, 417–428.

Pallesen, S., Bjorvatn, B., Mageroy, N., et al. (2010). Measures to counteract the negative effects of night work. *Scandinavian Journal of Work, Environment & Health, 36*, 109–120.

Pisarski, A., Lawrence, S. A., Bohle, P., et al. (2008). Organizational influences on the work life conflicts and health of shiftworkers. *Applied Ergonomics, 39*, 580–588.

Puttonen, S., Härmä, M., & Hublin, C. (2010). Shift work and cardiovascular disease – Pathways from circadian stress to morbidity. *Scandinavian Journal of Work, Environment & Health, 36*, 96–108.

Rajaratnam, S. M. W., Barger, L. K., Lockley, S. W., et al. (2011). Sleep disorders, health, and safety in police officers. *JAMA, 306*(23), 2567–2578.

Reinberg, A., & Ashkenazi, I. (2008). Internal desynchronization of circadian rhythms and tolerance to shiftwork. *Chronobiology International, 25*, 625–643.

Reppert, S. M., & Weaver, D. R. (2002). Coordination of circadian timing in mammals. *Nature, 418*(6901), 935–941.

Roenneberg, T., Kumar, C. J., & Merrow, M. (2007). The human circadian clock entrains to sun time. *Current Biology, 17*, R44–R45.

Rosa, R. (1993). Napping at home and alertness on the job in rotating shift workers. *Sleep, 16*, 727–735.

Saksvik-Lehouillier, I., Bjorvatn, B., Hetland, H., et al. (2012). Personality factors predicting changes in shift work tolerance: A longitudinal study among nurses working rotating shifts. *Work & Stress, 26*, 143–160.

Straif, K., Baan, R., Grosse, Y., et al. (2007). Carcinogenicity of shift-work, painting, and fire-fighting. *Lancet Oncology, 8*, 1065–1066.

Suwazono, Y., Dochi, M., Oishi, M., et al. (2009). Shiftwork and impaired glucose metabolism: A 14-year cohort study on 7104 male workers. *Chronobiology International, 26*, 926–941.

Tucker, P., Marquié, J. C., Folkard, S., et al. (2012). Shiftwork and Metabolic Dysfunction. *Chronobiology International, 29*, 549–555.

Van Dongen, H. P. A. (2006). Shift work and inter-individual differences in sleep and sleepiness. *Chronobiology International, 23*, 1139–1148.

Van Drongelen, A., Boot, C. R. L., Merkus, S. L., et al. (2011). The effects of shift work on body weight change—A systematic review of longitudinal studies. *Scandinavian Journal of Work, Environment & Health, 37*, 263–275.

Vittasalo, K., Kuosma, E., Laitinen, J., et al. (2008). Effects of shift rotation and the flexibility of a shift system on daytime alertness and cardiovascular risk factors. *Scandinavian Journal of Work, Environment & Health, 34*, 198–205.

Waage, S., Pallesen, S., Moen, B. E., et al. (2014). Predictors of shift work disorder among nurses: A longitudinal study. *Sleep Medicine, 15*, 1449–1455.

Wang, F., Zhang, L., Zhang, Y., et al. (2014). Meta-analysis on night shift work and risk of metabolic syndrome. *Obesity Reviews* 06/2014. doi:10.1111/obr.12194

Zhu, J. L., Hjollund, N. H., Boggild, H., et al. (2003). Shift work and subfecundity: A causal link or an artefact? *Occup Environment, 60*, e12.

Part II
Social Consequences of Specific Features of Working Time Organization

Unusual and Unsocial? Effects of Shift Work and Other Unusual Working Times on Social Participation

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Abstract Unusual working hours, such as shift work and work on evenings or weekends, are highly prevalent in the 24/7 economy. Adverse psychosocial effects of shift work are well-known and include poor work-life balance, decreased opportunities for social participation, family problems and negative effects on partners and children. This chapter describes the social impact of different components of working times—separating the effects of shift work and work on evenings, Saturdays, and Sundays. An overview of several studies shows that each of these categories of working hours has a separate negative effect on self-reports of employee work-life balance and social participation. Worker control over working times may buffer the negative effects of unusual work hours to a certain degree, but it does not and cannot balance them out completely. An approach is demonstrated to quantify the individual effects by calculating the time off required to achieve comparable social participation as under "usual" working times.

1 Social Effects of Shift Work and Unusual Working Times

Shift work usually comprises work beyond the "usual" Monday to Friday 9–5 working week, including night work and "non-standard" or "unusual" working times, such as work on evenings and weekends. But these types of unusual working times also exist outside and independent of traditional shift work, partly due to long and irregular work hours common in several service sectors and industries. The growth in flexible production requirements and extended service hours are especially linked to unusual, non-standard working hours, in addition to the more

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"traditional" shift work occupations such as in health care, production and manufacturing, and transportation.

Furthermore, advances in information and communication technologies, such as mobile computers and smartphones, have made it possible to work nearly anywhere and anytime, at least in certain occupations. This has led to an increase of work at home and constant availability for contacts outside of "normal", "regular" or "agreed" working hours. This so-called "supplemental work" leads to extended work hours and is, by definition, linked to a higher frequency of work at unusual times (Arlinghaus and Nachreiner 2014).

Working in the evenings and on weekends is becoming more and more common. For example in 2013 in the EU, 43.8 % of all employed persons have worked on Saturdays at least sometimes, 25.5 % have worked on Sundays, and 36.1 % have worked on evenings (Eurostat 2015a, b, c). However, despite all attempts to promote a 24/7 economy, the social rhythm of (at least western) societies—resulting from the rhythms of "normal" work hours and sleep—have remained largely unchanged (we do not have any data on other societies, but we suppose structurally similar, but not necessarily identical, effects for all societies). The utility and thus the value of free time is estimated to be higher on evenings than during the day and highest on weekends, resulting in a stable and largely unchanged pattern over the last decades (Baer et al. 1981, 1985; Hinnenberg et al. 2009; Wedderburn 1981). Figure 1 shows an example of the trends of such evaluations across a work day, a Sunday and the stability across roughly 25 years.

These results reflect the persistence of the social rhythm in our societies [evening and weekend societies (Neuloh 1964)] and the circumstance that a large part of the social environment is available for social activities on evenings, Saturdays and especially on Sundays. At the same time, the weekend is traditionally the time for family activities. Opportunities for social interaction and family activities are therefore considerably higher on weekends than on 'normal' working days. Thus, this social rhythm serves as a normative time structure for social behavior in western societies.

Working at socially valuable times, for example, when working time is temporally located in the most valuable times of the day and the week for social activities, leads to a loss of time for social participation and interaction and, if

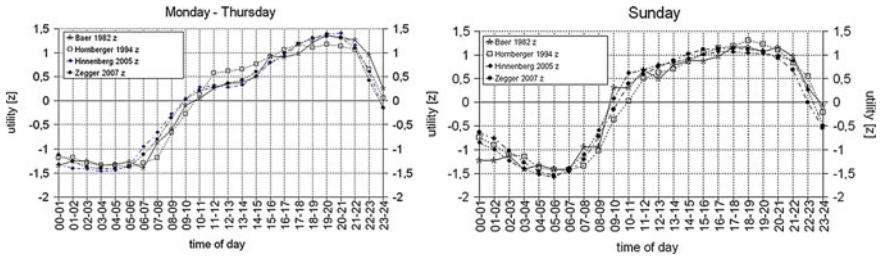

Fig. 1 Utility of free time as a function of the day and the time of the day in four studies from 1982 to 2007

compensated with additional time off at the wrong times, eventually to free time when no one is available for social interaction. It should thus lead to a desynchronization between one's personal work and social activity rhythms and the social rhythm of the society around us. Such work hours are considered unsocial. This desynchronization of personal and social behavioral structures—based on specific characteristics of the work schedules—or their interference, has been found to be associated with impairments to health (Giebel et al. 2008) and social life (Wirtz et al. 2008), and this association has been well established in the literature on night and shift work (Arendt 2010; Colquhoun et al. 1996; Tucker and Folkard 2012; see also Costa in this book). Due to the interference of these rhythms, that is the interference of work life with private life, social activities, and family responsibilities, work on evenings and weekends directly impacts work- non-work domain balance and social participation (e.g. Bittman 2005; Brown et al. 2010; Lyonette and Clark 2009; Tucker et al. 2010, 2013; Wirtz et al. 2011). A poor balance between work- and non-work domains can in turn increase the risk of negative health outcomes (Driesen et al. 2010; Frone 2000; Grant-Vallone and Donaldson 2001; Hammer et al. 2004; Jansen et al. 2010; Lyonette and Clark 2009; Wirtz and Nachreiner 2010). Weekend work has also been directly related to health impairments (Jamal 2004; Kümmerling and Lehndorff 2007; Lyonette and Clark 2009; Wirtz and Nachreiner 2010) and occupational accidents (Brogmus 2007; Wirtz et al. 2011). A possible explanatory mechanism might be that weekends offer not only opportunities for social activities but also for socially accepted inactivity, e.g. restful recovery from work-related fatigue (Tucker et al. 2010; Wirtz et al. 2011). Insufficient recovery (e.g. on workdays and, thus, due to counter normative (in) activity), on the other hand, is a risk factor for health impairments (Geurts and Sonnentag 2006) and occupational accidents (Williamson et al. 2011). Support for this recovery hypothesis can be found in a study by Basner et al. (2007), who showed that sleep duration for those in the work force was substantially increased on Sundays as compared to other days of the week.

Shift work and all other types of unsocial working times also directly impact the time available for family activities and childcare. Again, evening and weekend shifts particularly interfere with family responsibilities, especially if family members work and live according to a "normal" day oriented schedule. Additionally, shift workers who work (at least partially) at night need to sleep during the day, which requires behavioral adaptation of the whole family, that is, being quiet during the day, not disturb the sleeping family member, etc. While some types of shifts allow spending more time with children than typical day work (e.g., morning shifts usually end earlier than normal day work, e.g. around 14:00 h), afternoon and night shifts usually pose difficulties regarding the organization of family meals and taking care of children after kindergarten or school. In contrast, free time in the morning before afternoon shifts can effectively be used for parent-child interaction with non-kindergarten or non-school going children, i.e. those with no fixed time schedule (Lenzing and Nachreiner 2000; Volger et al. 1988).

The impact of shift work on families and children has been investigated in several studies. The results suggest that children of shift workers differ from children of day workers in several aspects: Children of shift workers seem to suffer from more behavioral and emotional problems (Barton et al. 1998; Han 2008), they are more likely to achieve a lower education and performance at school (Diekmann et al. 1981; Jugel et al. 1978; Maasen 1978), tend to prefer solitary hobbies over playing with friends, participate less in temporally structured activities, (Lenzing and Nachreiner 2000), and are in general less satisfied with their parents' working hours (Janssen and Nachreiner 2001) than children whose parents work day shifts. On the other hand, families with at least one shift working parent also seem to develop strategies to cope with the non-standard work schedules of the shift worker (see also Neuloh 1964). Results from Lenzing and Nachreiner (2000) suggest that the (shift working) father is more likely to be included in domestic responsibilities and childcare, spends more time with the children (see also La Valle et al. 2002), especially when children do not yet have a time schedule of their own, and that parents of families with one shift worker tend to be dual-earner couples.

The findings on effects of shift work on families and children, however, usually differ depending on the family situation and type of job of each parent (Grzech-Sukalo and Nachreiner 1997), typically with the worst outcomes for families in which both parents work in some kind of shift work (Diekmann et al. 1981; Han 2008). Diekmann et al. (1981) have shown that this also applies in the case of scholastic achievement of school children. They examined a sub-sample of 318 German police officers with children from a larger survey on social effects of shift work, and used the data from this survey to measure the police officers' educational level via type of job within the police force (lower, medium or higher service, indicating a lower, medium or higher educational level; at that time the position in the police hierarchy was contingent upon the level of general education), shift work (day work vs. three-shift work), job status of the partner (working or not, and if working whether in shift work or day work), and school level of their children (higher vs. lower secondary education). With this information, they calculated the probability of a higher or lower scholastic achievement of the children depending on job type, shift work, and partner's work situation. The results showed, as before with Maasen (1978), a clear disadvantage of children with shift working fathers for attending higher levels of secondary education. In contrast to Maasen (1978), who interpreted the disadvantage as a result of intellectual biological inheritance (since shift workers in general were hypothesized as being less well educated or intelligent) Diekmann et al. (1981) rejected this interpretation on the basis of their results and were able to demonstrate that it was the shift work that was responsible for the effect. Controlling for the level of the fathers' education, children of shift working fathers showed a decreased performance in terms of attending higher secondary education in comparison to those of day working fathers across all three levels of educational (and socio-economic) status. In all three levels of educational background (and the resulting job and socio-economic status

resulting from that) the difference between shift and day working fathers was clearly evident. This effect was most pronounced if not only the father but both parents worked shifts. While educational level of fathers also showed a significant impact on the scholastic achievement of their children, as could be expected, controlling for it still led to an independent effect of shift work.

While Maasen (1978) and Diekmann et al. (1981) dealt with the effects of shift work on scholastic career development, Jugel et al. (1978) in the former GDR presented some results suggesting that also the performance of children from shift working parents at school, as measured by the grades achieved, was inferior to that of non-shift working parents. Since these results were not in accordance with the intention within the GDR to increase the proportion of shift workers, this problem seems to have not been pursued further. At least no further results have been published on this topic.

The reasons for this disadvantage for children produced by or associated with shift work are not at all clear. As Volger et al. (1988) showed, it cannot simply be the (mostly, but not always) reduced common free time of family members of shift workers as opposed to day workers, since this explained only a small proportion of the variance. According to the results presented above on social rhythms in the utility of time, an analysis using weighted common free times could yield a more positive association. But the main question would seem to be how much of the common free time is used for interaction with children—and especially how this time is used. It could easily be argued that a shift worker after a series of 12 h night shifts might interact differently with his/her children than a day worker on a 9–5 job. However, these topics need further research.

Shift work must thus be regarded as having a substantial and far reaching social impact not only on the shift workers themselves but also on their family members, and under a certain perspective on the society as a whole. Bearing in mind that shift workers' children obviously attain lower levels of education means that this is not only a loss for the individual but also for a society with regard to the qualification potential of its work force. Both seem unacceptable and require urgently preventive action. An interesting question would also be whether these or comparable results would apply for other kinds of unusual work hours. Considering that these also (can) lead to an interference with social rhythms the hypothesis and the theoretical conclusions would seem to be: yes.

The reasons for working shifts or unusual hours may be different for men and women: While fathers tend to work these kinds of working hours due to financial reasons or career prospects, the reason for mothers seems to be to reconcile work and family responsibilities, depending—among others—on childcare availability and costs (La Valle et al. 2002). Additionally, the effects of shift work and unusual working times on families and children may be quite different depending on the reasons for these kind of work hours, i.e., if the parents work atypical hours voluntarily or not, and on the degree of autonomy over the work schedule to fit working hours with personal needs, interests and requirements (see also in Sect. 3).

2 Social Impact of Different Components of Working Times

The social consequences of shift work depend to a large degree on the actual shift schedule, since it is not shift work (in all its different kinds and variations) per se which impacts social and family life, but certain components of it—or its consequences. As described above, the degree to which the work schedule interferes with the social rhythm plays a major role in the development of social impairments.

Shift schedules that have a slow rotation (e.g., five to seven shifts of the same type in one block) typically show a high interference with social activities due to the large amount of adjacent days being not available for social interaction, as in the case of a week of night and especially afternoon shifts. Several controlled intervention studies showed that reduced hours with rapidly rotating shifts have positive effects on work-life balance indicators (Härmä et al. 2006; Hornberger and Knauth 1993; Knauth and Kieswetter 1987; Smith et al. 1998), although there is sometimes a confounding between the change in the shift system and reduced hours which does not allow for a clear assignment of the effects. Bonitz et al. (1987), Grzech-Sukalo et al. (1990) and Hedden et al. (1989; 1990) were able to show that it is the frequent (even if short) resynchronization with the social rhythm instead of a longer but less frequent resynchronization period that is important for reducing adverse effects on family and social life, and this can usually be better achieved with fast rotating systems.

The direction of rotation also plays an important part for social well-being, besides the biological impact (see Costa in this book). A study by Van Amelsvoort et al. (2004) found for example that several health-related outcomes and work–home conflict among three-shift workers were associated with backward rotation.

The available evidence, thus, shows a rather consistent trend with workers in fast forward rotated systems reporting less impairment than those in slowly forward and fast backward rotated systems. The socially most detrimental systems seem to be those with a slow backward rotation. Results on the effects of different forms of shift schedules (under otherwise comparable conditions, in order to control for confounding) seem to argue for fast and forward rotating systems (Horn et al. [in preparation], see also Janssen and Nachreiner 2001). However, most of the studies reported have some severe limitations, since the results are often based on workers from different populations working under different conditions in different companies and within different social environments—besides working under different shift systems. This could mean that some of the reported effects and their inconsistencies are not caused by the shift system but by confounding conditions, e.g. worker populations, social environments, types of job, work load, etc.

Besides the desynchronizing elements of shift work or shift rotation, certain components of work hours (which are usually associated with shift work) determine the degree of social interference, i.e., work on evenings, Saturdays and Sundays ("unusual working times"). Thus, it seems important to separate the effects of shift work (as a generic entity) from those of such unusual working times (which are also

a constituent part of shift work) when examining social effects. Recent studies by the authors and colleagues showed that, independent of shift work, work on evenings, Saturdays, and Sundays—separately and in combination—increased the risk of impairments to work-life balance, health, and occupational safety in different samples of the European Union and Germany (Arlinghaus and Nachreiner 2012; Greubel et al. [submitted]; Wirtz et al. 2008, Wirtz 2010; Wirtz et al. 2011).

In a study by Wirtz et al. (2008), working hours were self-recorded over four weeks in a German sample (n = 428, excluding individuals who were working in regular shift work). In addition, the online-survey measured several outcomes such as different health complaints and indicators for social problems, such as compatibility between work and private interests, having enough time for a hobby, arguments with the partner, etc. The resulting patterns of work and work-free time were then examined in order to determine their variability (or irregularity) and to quantify the resulting degree of social interference using spectral analysis. Spectral analysis can be used to determine rhythms (or more precisely the periodic components) in time dependent signals, in this case the dichotomous pattern of work and non-work times over four weeks. The results of spectral analyses of such signals indicate whether the time signal has any periodic components (i.e., in this case a 24 h (daily) and a 168 h (weekly) rhythmic component) and the strength of the rhythmic components found in the signal. That means, very regular work schedules will have strong 24 h and 168 h rhythms, while variable or irregular work schedules will not have any or only weak periodic components or rhythms. Daily and weekly rhythms can also be detected in the social rhythm described above in Fig. 1. In a second step bivariate spectral analyses then allow to determine the strength of the association of a periodic component in both time series and the phase difference between the daily and weekly rhythms inherent in each time signal (work/non-work and the social rhythm), where a low phase difference indicates a high overlap between work and socially valuable times of the day and week, i.e., a high interference between work and the social rhythm. The findings of this study indicate that those work schedules with a low phase difference, i.e., those which included a high amount of regular evening and weekend work and therefore regularly interfered with the social rhythm, were associated with several self-reported social impairments, such as more frequent arguments with the partner, the partner suffering from one's working hours, and the work schedule being difficult to combine with private interest ("hobbies"). For a detailed description of the method and the findings see Wirtz et al. (2008) or Giebel et al. (2008), who adopted this approach to unusual work hours and health complaints and found comparable results.

A recent cross-validation study by these authors (Greubel et al. submitted; see also Greubel et al. 2013) used the fourth and fifth European Working Conditions Surveys from 2005 (Parent-Thirion et al. 2007) and 2010 (Parent-Thirion et al. 2012) to investigate the risk of reporting a poor work-life balance associated with regular work on evenings and weekends. The European Working Condition Surveys are large-scale population based surveys which contain representative samples from each member state of the European Union plus several candidate

countries and associated states (overall 31 countries in 2005 and 34 countries in 2010, resulting in sample sizes of n = 23,934 from EU 2005 and n = 35,187 from EU 2010). The surveys contain a large number of questions regarding working conditions (physical and mental work load, autonomy over working conditions), working hours (weekly working hours, shift work (yes or no), work on evenings/ Saturdays/ Sundays, and variable working times), control over working conditions, health outcomes, work-life balance and social activities, demographic characteristics etc. Logistic regression analyses were carried out to estimate the risk of reporting a poor work-life balance in association with regular work on evenings, Saturdays, and Sundays in employed workers. A high number of covariates were included to control for the diversity of working conditions, since work at unusual times is more frequent in certain occupations and, of course, with shift work. Therefore, actual work load indicators were built from several variables on physical (e.g., heavy lifting, standing) and mental (e.g., learning new things, complex tasks) work load and autonomy (e.g., choosing the method of work, speed of work). In addition, several working time-related characteristics were included, such as the amount of weekly work hours, variable work hours, and self-reported shift work (classified as "yes" or "no", since the surveys do not allow for a distinction between different kinds of shift work, which would be desirable. But in any case this allows controlling for the existence of any regular work at unusual hours due to shift work.).

The results show an increased risk due to unusual working hours, controlling for a number of covariates, including shift work, weekly working hours, work load, and demographic factors. As demonstrated in Fig. 2, the adjusted Odds Ratios (OR) show an increase in the reports of poor work-life balance of more than 50 % in association with work on evenings and Saturdays, and a small increase (15 %) in one of the samples for Sunday work for those employed workers with regular work at unusual times as compared to those without these unusual working hours.

In conclusion, based on the findings described above, social effects of work schedules seem to depend on factors such as rotational speed and direction of shift

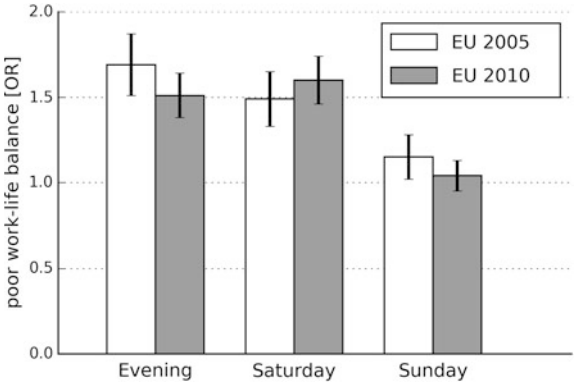

Fig. 2 Adjusted Odds Ratios and 95 % Confidence Intervals of poor work-life balance associated with regular work on evenings and weekends in two different samples of the European Union (reference groups: no work at these times)

schedules, and the actual frequency of work on evenings and weekends. The highest social impairment is found for slowly rotated systems and backward rotation. Regular work on evenings and weekends is associated with problems of work-life balance and family-related outcomes, with the degree of social interference being directly related to the—rather substantial—amount of social impairment.

3 The Role of Worker Control

Working hours can be set by the employer or company without any possibilities for individual adaptation (employer-determined work hours), or may allow individual adaptation to personal preferences to certain degrees (self-determined work hours). The amount of control, or autonomy, over work hours can be limited such as switching shifts or choosing from different work schedules, up to entirely self-determined work hours as, for example, trust-based work hours or agreement on objectives or results. The opportunity to adapt work hours to personal preferences is generally seen as a resource which can help to improve general work-domain balance (Nijp et al. 2012, 2015) and buffer other, potentially negative, effects of shift work and unusual work hours (Costa et al. 2004, 2006; Garde et al. 2012; Wirtz et al. 2011). In general, these studies suggest that worker control of work hours, usually (with the exception of Garde et al. 2012) assessed via one or more questions on whether the workers perceive more or less influence on setting their actual work hours (covering a range from no influence at all over possible shift changes to completely self-determined work hours, which, however, is absolutely rare in Europe and confounded with the type of job) that worker control or autonomy over work hours is associated with reduced reporting of impairing effects from unusual work hours. The results thus suggest a moderating effect of working time autonomy, since even higher degrees of worker control over work hours cannot and do not entirely balance out the impairing effects of unusual working times (Arlinghaus and Nachreiner 2014; Costa et al. 2004; Wirtz et al. 2011). This might be due to the resulting desynchronization when working unusual hours, even when they are self-determined. After all, even entirely self-determined working hours still interfere with the social rhythm if they are located in the evenings and weekends. An important question in this relation is whether self-determined work schedules or work hours are in fact superior to or less impairing than company determined work hours from an ergonomics point of view, or whether the reported difference is, at least in part, due to attributional processes and effects of cognitive consistency: Having set one's own work hours oneself is cognitively inconsistent with reporting impairing effects due to these work hours. As a consequence less impairment should be expected to be reported by those controlling their own work hours as compared to company controlled unusual work hours. To some degree, the findings reported from an intervention study by Garde et al. (2012) point in this direction, since an increase in actual work hour control (self-rostering) led to overall benefits for health and recovery, but actual changes in work hours did not explain

this association. In the intervention group with the strongest health effect, no significant change in work hours was found. This lends support to the hypothesis that cognitive processes influence the reporting of health outcomes in studies of self-controlled work hours. However, the authors also argue that their measurement of work hours was not effective enough, since, for example, the actual days worked (Monday, Wednesday …) were not measured.

It is unfortunate that many studies advocating the positive effects of worker control over their work hours have failed to assess the resulting factual work hours and whether such self-controlled work hours in fact lead to better work schedules which could then be responsible for or at least associated with the reported reduced impairments. As long as research on this topic is confined to the analysis of associations between cognitive elements within respondents (e.g. Nijp et al. 2015) and without specifying and testing the hypothesized effect mechanisms, the cognitive consistency hypothesis cannot be ruled out—with the danger of developing erroneous preventive action. More research, especially including a comparison of the actual working times, and not only their subjective representation and evaluation, is definitely needed.

4 An Approach to Quantify the Social Impact of Unusual Working Hours

The evidence showing detrimental social effects of work on evenings and weekends is quite consistent and leads to the question of how workers should be adequately prevented from or at least be compensated for working these unusual and unsocial work hours, if they are necessary or unavoidable. Since the evidence of detrimental effects of working unusual hours to social participation (besides its effects to safety and health) is so consistent, this implies that work at unusual times should be reduced as far as possible in order to avoid any detrimental or impairing effects. If this is not possible, the question is how to avoid or at least to reduce these effects, e.g. by providing an adequate compensation, for example in the design of working hours for these workers in general.

In many countries, a financial compensation is the most common procedure with certain legally or collectively agreed amounts of money being paid for certain types of work (i.e., evenings, nights, weekends or holidays) irrespective of the effects produced. However, from an ergonomics viewpoint, a compensation, and especially a financial compensation, is not the adequate approach to deal with social impairments (Thierry and Jansen 1981), since only a problem oriented compensation with additional free time at socially valuable hours may avoid, reduce or make up for lost socially valuable time and allow for maintaining a certain degree of synchronization or achieving a re-synchronization with the social rhythm of our society. In order to compensate for social impairments by unusual work hours, compensation with *additional time at socially valuable hours*, i.e., weekends and

evenings, would be necessary, since only in this case a true compensation of lost socially valuable time could take place. On the other hand, receiving a work-free Wednesday as a compensation for working on Saturday would not be an adequate compensation, since "Wednesday is not Saturday", as one of Sergean's (1971) shift workers pointed out. In practice, compensation with additional free time is rarely done, mostly since this would increase labor costs and workers depend, or are made dependent, on the extra money they are paid for working unsocial work hours. However, in the last couple of years, there seems to be a tendency of increasing openness towards compensation with free time, especially within younger workers (Hesse 2014), which should be encouraged further since this is the only mechanism that offers a chance for a problem oriented solution.

The question, however, is how to determine an adequate amount of additional free time needed to avoid detrimental effects or to compensate for unavoidable work on evenings and weekends. One approach could be to estimate the social impact of work at unusual times by comparing, for example, work-life balance indicators of individuals who work such unusual times with those who do not. In a second step, it could then be determined, at how many hours per week both groups show a similar level of work-life balance, to (at least theoretically) calculate the additional time off needed for workers with unusual working times to achieve a similar level of work-life balance as those with regular normal work hours. This is demonstrated in Fig. 3, which shows the results of a study by Wirtz (2010) on the impact of long work hours and work on Saturdays on self-reported work-life balance in two samples of the European Working Conditions Surveys from 2000 and 2005. In this population-based analysis (which did not account for any covariates and is therefore considered as a theoretical example), the group of employees with regular Saturday work reported a "good" work-life balance when working 35–39 h per week. Individuals without Saturday work, on the other hand, reported a similar (decreased) level of work-life balance when working 50–54 h per week, i.e., about 15 h more. Thus, individuals working on Saturday would theoretically need 15 h of additional free-time (or a reduction in weekly working hours of roughly 15 h) in order to

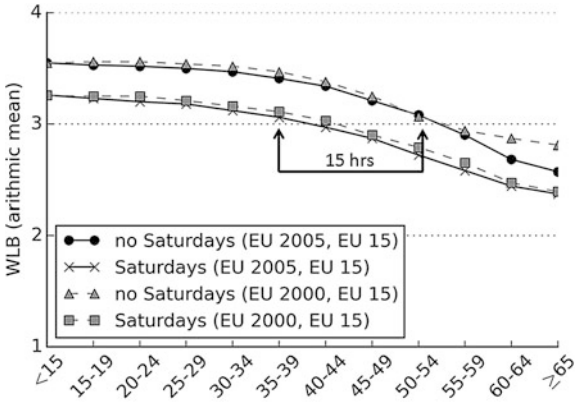

Fig. 3 Work-life balance (WLB) in association with regular work on Saturdays and weekly work hours in two European samples. Adapted from Wirtz (2010). WLB ranging from 1 = not at all well to 4 = very well

achieve the same level of work-life balance as employees without Saturday work. Similar results have been found for work on evenings and Sundays (Wirtz 2010).

Nachreiner and Arlinghaus (2013) took this approach one step further by estimating a model to calculate compensation time while controlling for potential confounding effects (e.g., shift work, weekly working hours, work load, socio-demographic characteristics). Although they used health outcomes and not social effects in their study, they estimated that in order to achieve a similar health status as employees without unusual working times, individuals with work on evenings or weekends might need a reduction between 2 and 8.5 work hours per week—and thus additional free time, preferably at times with a high social utility (or utility for recuperation)—as compensation for these unusual working times. The health outcomes used in this study were several self-reported work-related health impairments, including a wide range of problems such as muscular pain, sleep problems, heart disease, gastro-intestinal impairments and psychological problems. The authors used an indicator "work-related health impairments" which was classified into "yes", if the participants reported at least one work-related health problem, and "no", if they were free from health impairments. Thus, rather than using single health problems, which could balance out when calculating a mean, a rather broad indicator of work-related impairments was calculated—in accordance with the ergonomics concept to achieve an absence of work related impairments. Since social effects of unusual working times have been found to be typically much stronger than effects on health and safety (Wirtz et al. 2011; Greubel et al. submitted), an estimation of the amount of time needed to compensate for these effects would very likely result in a higher number of additional time off, both for recuperation and social participation. This could make a lot of the requests for work at unusual times less attractive from an economic point of view. However, additional research is definitely needed to investigate these issues further, especially incorporating a weighted model of times and not only using an hour by hour compensation, as is usual in working time banks or accounts up to date.

5 Summary and Discussion

5.1 How "Unusual" Are Unusual Work Hours?

Unusual and unsocial working times are quite common, and in fact far from unusual in today's working population; "unusual hours" thus today only refers to their relation with ergonomic standard working times, not to their prevalence. It can thus be questioned whether the term "unusual work hours" is still the right term to designate or characterize these work hours. In our opinion, at least, the term should be kept in order to designate that these working times deviate from a normative concept of "normal" or "usual" work hours, or an ergonomics reference standard of (hopefully) not impairing work hours, which is what we should try to achieve.

This seems to us more important than a reference to the frequency or prevalence of such work hours. We would also refrain from calling these hours "unsocial hours" since the hours under discussion are not unsocial. Quite the opposite is true: these are socially valuable times. However, it is the request for work and working at these times (without adequate prevention and/or compensation) which is unsocial.

Due to their interference with the social rhythm of our society as a societal norm working at these times can pose severe risks for social participation, create problems in aligning work and non-work domains, and reduce time available for social participation and family activities. Shift work as well as other kinds of unusual work hours, thus, not only affects the shift worker but also their families, children, and, under a long-term perspective, the society as a whole. As we have shown in this chapter, "social effects" can be manifold, including effects on work-life balance, activities with partners, families and friends, hobbies, impact on partners and children, and many more. Thus, the specific effects of certain components of "unusual" working times can be different depending on the temporal conditions and the outcomes under study.

Especially work on evenings and weekends interferes with the socially most usable and valuable times of the week and must be considered as a substantial risk factor in the development of impairments to safety, health and well-being in the workforce. Additionally, shift schedules with a slow rotation lead to a high number of afternoon shifts in a row and are therefore less preferable with a view to social interaction than schedules with a fast rotation (with only two or three afternoon shifts in one week) which provide at least a certain amount of socially usable/valuable time each week and avoid long periods of "socially dead times".

5.2 *Preventive Work Schedule Design to Minimize Risks to Health and Well-Being*

As we have shown, the social rhythm of our society has not substantially changed in spite of all endeavors to establish a 24/7 society. Therefore, this rhythm needs to be respected, not neglected. As Baaijens (2005) has demonstrated, the preferred times for work of the majority of workers are still the times of the old "usual" work hours, and thus for a normatively regulated, reliable time for work and non-work. Thus keeping to these hours—as far as possible—should not only reduce the risk of detrimental effects but also align with the preferences of the working population.

Worker control over working hours seems to reduce social impairments, most probably by allowing individuals to adapt working times to personal needs and preferences, although not much convincing *factual* evidence for improved self-determined schedules has yet been presented. However, the number of workers with self-determined working times is rather low and restricted to certain kinds of occupational activities. But even entirely self-determined unusual hours are likely and have been shown to interfere with the social rhythm of our western societies if

they regularly involve evening and weekend work. Thus, worker control is or might be a valuable resource but cannot entirely balance out the negative effects of shift work and unusual working hours due to their desynchronizing effects. Workers who have control over their work hours should thus be informed about these effects in order to enable them to design their work schedules accordingly. It would be interesting to see whether this leads to superior schedules and as a consequence to reduced impairments.

The question might arise whether social, health and safety impairments follow the same or different patterns with regard to work hours, and if not, how to compromise (or not) for the best results. As far as we can see at the moment and based on the available evidence, the results across outcome domains (e.g., sleep, social well-being) are overall in good agreement with each other (cf. e.g. Giebel et al. 2008 and Wirtz et al. 2008). One exception is that some studies indicate that sleep might be partially improved by scheduling shifts according to individual differences (e.g., chronotype, see Vetter et al. 2015), which however might lead so socially unfavorable schedules (e.g., a high number of afternoon and evening shifts) and difficulties in staffing each shift while achieving a fair distribution of unfavorable shifts for everyone. Another argument against these kinds of individual, biologically oriented schedules is that the competition between sleep and leisure time will in many cases favor social or leisure activity over sleep (Basner and Dinges 2009). Decades of research have shown, that working hours that are associated with increased impairments in one domain are usually also related to increased impairments in the other domains. This consistency is encouraging with regard to the design of (un)usual work hours: keep the desynchronization produced by or associated with a work schedule at the minimum possible and allow for (short but frequent) resynchronization where shift work or unusual hours are necessary. This should have positive implications for safety, health and social participation. However, this might not be easy in every specific case and depends both on company requirements and employees' preferences and needs.

5.3 *Separating the Effects of Unusual Work Hours and Shift Work*

What we further need with a view to necessary research in this area are studies which disentangle the separate effects of unusual times and shift work, especially with regard to the components of such systems leading to impairments, i.e. longitudinal or retrospective longitudinal studies that allow for at least some causal interpretation. What we further need is a more factual database (instead of relying on self-reports in survey data), e.g., diary or time budget studies or register data in order to compare day workers, shift workers and former shift workers with and without weekend work and controlling at the same time for possible confounders (e.g., in production: continuous vs. discontinuous shift work in the same branches

and with comparable jobs); intervention studies where the amounts of unusual hours are reduced as well as intervention studies where monetary compensation for unusual working times is compared with temporal compensation. Outcomes should be of a wide range of social effects, from perceptions and satisfaction to factual information about social impairments of workers, their partners, their children and their social relations. As an example it would be desirable to measure the actual time spent at (un)usual work hours and the actual time spent at certain activities (partners, children, hobbies, …) to measure the social impact and to relate it to the structural components of the work schedules. These kinds of studies would help in testing the findings from previous cross-sectional and subjective studies and contribute to a better understanding of the underlying mechanisms between work scheduling, compensation, worker control, and outcomes of occupational safety, health, and social well-being.

6 Conclusions

Since work at unusual times, which are normatively designated for social interaction, is related not only to social impairments but also to health problems and increased safety risks, it might not be profitable for companies to extend work and service hours into evenings and weekends, especially if they are not adequately temporally compensated (i.e., with additional free time at socially valuable times). Job satisfaction might decrease and time lost due to sickness might increase, which could result in profit loss and increasing turnover rates. Conversely, creating ergonomic work schedules, for example with fast forward rotating shift systems, a minimum amount of evening and weekend work and at least some degree of worker control should elevate well-being of the workers involved and make it less challenging for their families to coordinate work and non-work times of all family members.

Finally, from a societal point of view, unusual work hours should not be left completely to the discretion of employers and employees or their representatives, due to the negative effects on individuals and the society as a whole. Instead, some regulating constraints seem necessary to avoid or reduce detrimental effects to the individual workers, the companies, and to the society.

References

Arendt, J. (2010). Shift work: Coping with the biological clock. *Occupational Medicine, 60*, 10–20.

Arlinghaus, A., & Nachreiner, F. (2014). Health effects of supplemental work from home in the European Union. *Chronobiology International, 31*, 1100–1107.

Arlinghaus, A., & Nachreiner, F. (2012). Arbeit zu unüblichen Zeiten - Arbeit mit unüblichem Risiko [Work at unusual times – work at unusual risks]. *Zeitschrift für Arbeitswissenschaft, 66*, 291–305.

Baaijens, C. (2005). Arbeidstijden: tussen wens en werkelijkheid [Between preferred and actual working times]. Ph D dissertation. Utrecht: Utrecht University.

Baer, K., Ernst, G., Nachreiner, F., & Schay, T. (1981). Psychologische Ansätze zur Analyse verschiedener Arbeitszeitsysteme [Psychological approaches to the analysis of various systems of working hours]. *Zeitschrift für Arbeitswissenschaft, 35*, 136–141.

Baer, K., Ernst, G., Nachreiner, F., & Volger, A. (1985). Subjektiv bewertete Nutzbarkeit von Zeit als Hilfsmittel zur Bewertung von Schichtplänen [Subjective scaling of leisure time usefulness as a means to evaluate shift schedules]. *Zeitschrift für Arbeitswissenschaft, 39*, 169–173.

Barton, J., Aldridge, J., & Smith, P. (1998). Emotional impact of shift work on the children of shift workers. *Scandinavian Journal of Work, Environment & Health, 24*(suppl 3), 146–150.

Basner, M., & Dinges, D. F. (2009). Dubious bargain: Trading sleep for Leno and Letterman. *Sleep, 32*, 747–752.

Basner, M., Fomberstein, K. M., Razavi, F. M., Banks, S., William, J. H., Rosa, R. R., et al. (2007). American time use survey: sleep time and its relationship to waking activities. *Sleep, 30*, 1085–1095.

Bittman, M. (2005). Sunday working and family time. *Labour & Industry, 16*, 59–83.

Bonitz, D., Grzech-Sukalo, H., & Nachreiner, F. (1987). Differential psychosocial effects of different shift systems. In: A. Oginsky, J. Pokorski, & J. Rutenfranz (Eds.). *Contemporary advances in shiftwork research. Theoretical and practical aspects in the late eighties* (Proceedings of the 8th International Symposium on Night and Shiftwork, Krakow/Koninki) (pp. 181–189). Krakow: Medical Academy.

Brogmus, G. (2007). Day of the week lost time occupational injury trends in the US by gender and industry and their implications for work scheduling. *Ergonomics, 50*, 446–474. doi:10.1080/00140130601133826

Brown, K., Bradley, L., Lingard, H., Townsend, K., & Ling, S. (2010). Working time arrangements and recreation: making time for weekends when working long hours. Online publication. URL http://www.thefreelibrary.com/Working+time+arrangements+and+recreation%3A+making+time+for+weekends.-a0237838393. Accessed February 19 2015.

Colquhoun, W., Costa, G., Folkard, S., & Knauth, P. (1996). *Shiftwork: Problems and solutions*. Frankfurt: Peter Lang.

Costa, G., Åkerstedt, T., Nachreiner, F., Baltieri, F., Carvalhais, J., Folkard, S., et al. (2004). Flexible working hours, health, and well-being in Europe: Some considerations from a SALTSA project. *Chronobiology International, 21*, 831–844.

Costa, G., Sartori, S., & Åkerstedt, T. (2006). Influence of flexibility and variability of working hours on health and well-being. *Chronobiology International, 23*, 1–13.

Diekmann, A., Ernst, G., & Nachreiner, F. (1981). Auswirkungen der Schichtarbeit des Vaters auf die schulische Entwicklung der Kinder [Effects of the father's shift work on the childrens' development in school]. *Zeitschrift für Arbeitswissenschaft, 3*, 174–178.

Driesen, K., Jansen, N. W. H., Kant, I. J., Mohern, D. C. L., & van Amelsvoort, L. G. P. M. (2010). Depressed mood in the working population: associations with work schedules and working hours. *Chronobiology International, 27*, 1062–1079.

Eurostat. (2015a). Employed persons working on Sundays as a percentage of the total employment, by sex, age and professional status. http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsa_ewpsun&lang=en. Accessed March 23 2015.

Eurostat. (2015b). Employed persons working on Saturdays as a percentage of the total employment, by sex, age and professional status. Internet resource—URL: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsa_ewpsat&lang=en. Accessed March 23 2015.

Eurostat (2015c). Employed persons working in the evenings as a percentage of the total employment, by sex, age and professional status. Internet resource—URL: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsa_ewpeve&lang=en. Accessed March 23 2015.

Frone, M. (2000). Work-family conflict and employee psychiatric disorders: the national comorbidity survey. *Journal of Applied Psychology, 85*, 888–895. doi:10.1037//0021-9010.85.6.888

Garde, A. H., Albertsen, K., Nabe-Nielsen, K., Carneiro, I. G., Skotte, J., Hansen, S. M., et al. (2012). Implementation of self-rostering (the PRIO-project): Effects on working hours, recovery, and health. *Scandinavian Journal of Work, Environment & Health, 38*(4), 314–326. doi:10.5271/sjweh.3306

Geurts, S., & Sonnentag, S. (2006). Recovery as an explanatory mechanism in the relation between acute stress reactions and chronic health impairment. *Scandinavian Journal of Work, Environment & Health, 32*, 482–492. doi:10.5271/sjweh.1053

Giebel, O., Wirtz, A., & Nachreiner, F. (2008). The interference of flexible working times with the circadian temperature rhythm–a predictor of impairment to health and well-being? *Chronobiology International, 25*, 263–270. doi:10.1080/07420520802114029

Grant-Vallone, E., & Donaldson, S. (2001). Consequences of work-family conflict on employee well-being over time. *Work & Stress, 15*, 214–226. doi:10.1080/02678370110066544

Greubel, J., Arlinghaus, A., Nachreiner, F., & Lombardi, D. (2015) Higher risks when working unusual times?—a cross validation of the effects on safety, health, and work-life-balance. *Submitted to Industrial Health (6/2015).*

Greubel, J., Arlinghaus, A., & Nachreiner, F. (2013). Erhöhtes Risiko für Arbeit zu unüblichen Zeiten - eine Kreuzvalidierung [Higher risk of work at unusual times – a cross-validation study]. In: GfA (Hrsg.) *Chancen durch Arbeits-, Produkt- und Systemgestaltung - Zukunftsfähigkeit für Produktions- und Dienstleistungsunternehmen* (pp. 573–576). Dortmund: GfA-Press.

Grzech-Sukalo, H., Hedden, I., & Nachreiner, F. (1990). The relation of periodic components and psychosocial impairment for selected shift rotas. In G. Costa, G. Cesana, K. Kogi, & A. Wedderburn (Eds.), *Shiftwork: health, sleep and performance* (pp. 191–196). Frankfurt am Main: Peter Lang.

Grzech-Sukalo, H. & Nachreiner, F. (1997). Structural properties of shift schedules, employment of partners, and their effects on workers' family and leisure activities. *International Journal of Occupational and Environmental Health 3*(July–September supplement), 67–70.

Hammer, T., Saksvik, P., Nytro, K., Torvatn, H., & Bayazit, M. (2004). Expanding the psychosocial work environment: Workplace norms and work-family conflict as correlates of stress and health. *Journal of Occupational Health Psychology, 9*, 83–97. doi:10.1037/1076-8998.9.1.83

Han, W.-J. (2008). Shift work and child behavioral outcomes. *Work, Employment & Society, 22* (1), 67–87. doi:10.1177/0950017007087417

Härmä, M., Hakola, T., Kandolin, I., Sallinen, M., Vahtera, J., Bonnefond, A., et al. (2006). A controlled intervention study on the effects of a very rapidly forward rotating shift system on sleep-wake-fullness and well-being among young and elderly shift workers. *International Journal of Psychophysiology, 59*, 70–79. doi:10.1016/j.ijpsycho.2005.08.005

Hedden, I., Bonitz, D., Grzech-Sukalo, H., & Nachreiner, F. (1989). Zur Klassifikation und Analyse unterschiedlicher Schichtsysteme und ihrer psychosozialen Effekte. Teil 2: Differentielle Effekte bei Gruppierung nach periodischen Merkmalen – Überprüfung eines alternativen Klassifikationsansatzes [On the classification and analysis of different shift systems and their psycho-social effects. Part 2: Differential effects for grouping in periodic characteristics – a study of an alternative classification approach]. *Zeitschrift für Arbeitswissenschaft, 43*, 73–78.

Hedden, I., Grzech-Sukalo, H., & Nachreiner, F. (1990). Classification of shift rotas on the basis of periodic components. In G. Costa, G. Cesana, K. Kogi, & A. Wedderburn (Eds.), *Shiftwork: Health, Sleep and Performance (Proceedings of the 9th International Symposium on Night and Shiftwork, Verona)* (pp. 197–202). Frankfurt am Main: Lang.

Hesse, G. (2014). Wie die Generation Y die Arbeitswelt verändern wird [How "Generation Y" will change the working world]. The Huffington Post. http://www.huffingtonpost.de/gero-hesse/wie-die-generation-y-die-arbeitswelt-verandern-wird_b_5224965.html. Accessed March 30 2015.

Hinnenberg, S., Zegger, C., Nachreiner, F., & Horn, D. (2009). The utility of time—revisited after 25 years. *Shiftwork International Newsletter, 25*, 52.

Horn, D., Arlinghaus, A., & Nachreiner, F. (in preparation). Psychosocial effects of shift work design—A comparison of different shift systems.

Hornberger, S., & Knauth, P. (1993). Interindividual differences in the subjective valuation of leisure time utility. *Ergonomics, 36*, 255–264. doi:10.1080/00140139308967880

Jamal, M. (2004). Burnout, stress and health of employees on non-standard work schedules: A study of Canadian workers. *Stress and Health, 20*, 113–119. doi:10.1002/smi.1012

Jansen, N. W. H., Mohren, D. C. L., van Amelsvoort, L. G. P. M., Janssen, N., & Kant, I. J. (2010). Changes in working time arrangements over time as a consequence of work-family conflict. *Chronobiology International, 27*, 1045–1061.

Janssen, D. & Nachreiner, F. (2001). Differential psychosocial effects of different shift systems—A comparison of the effects of shiftwork under different systems in the chemical industry. *Shiftwork International Newsletter*, p. 10.

Jugel, M., Spangenberg, B., & Stollberg, R. (1978). Schichtarbeit und Lebensweise. Berlin (Ost).

Knauth, P., & Kieswetter, E. (1987). A change from a weekly to quicker shift rotations: A field study of discontinuous three-shift workers. *Ergonomics, 30*, 1311–1321.

Kümmerling, A., & Lehndorff, S. (2007). *Extended and unusual working hours in European companies*. Luxembourg: European Foundation for the Improvement of Living and Working Conditions.

La Valle, I., Arthur, S., Millward, C., Scott, J., & Clayden, M. (2002). *Happy families? Atypical work and its influence on family life*. Bristol: Policy Press.

Lenzing, K., & Nachreiner, F. (2000). Effects of fathers' shift work on children—results of an interview study with children of school age. In S. Hornberger, et al. (Eds.), *Shiftwork in the 21st century* (pp. 399–404). Frankfurt am Main: Lang.

Lyonette, C., & Clark, M. (2009). *Unsocial hours: Unsocial families? Working time and family wellbeing*. Cambridge: Relationships Foundation.

Maasen, A. (1978). *The family life of shift workers and the school career of their children*. Leuven: Katholieke Universiteit, Hoger Institut for de Arbeid.

Nachreiner, F. & Arlinghaus, A. (2013). Towards a temporal compensation approach for unusual working hours—how much additional time off is needed to balance out negative health effects? *Sleep Science 6*(Suppl 1), s9–s74, 50.

Neuloh, O. (1964). Sozialisation und Schichtarbeit [Socialization and shift work]. *Soziale Welt, 15*, 50–70.

Nijp, H., Beckers, D., Geurts, S., Tucker, P., & Kompier, M. (2012). Systematic review on the association between employee worktime control and work-non-work balance, health and well-being, and job-related outcomes. *Scandinavian Journal of Work, Environment & Health, 38*, 299–313. doi:10.5271/sjweh.3307

Nijp, H., Beckers, D., Kompier, M., van den Bossche, S., & Geurts, S. (2015). Work time control access, need and use in relation to work-home interference, fatigue, and job motivation. *Scandinavian Journal of Work, Environment & Health, 41*, 347–355.

Parent-Thirion, A., Vermylen, G., van Houten, G., Lyly-Yrjänäinen, M., Biletta, I., & Cabrita, J. (2012). *5th European working conditions survey*. Luxembourg: Publication Office of the European Union.

Parent-Thirion, A., Macías, F. E., Hurley, J., & Vermeylen, G. (2007). *4th European working conditions survey*. Luxembourg: Publication Office of the European Union.

Smith, P. A., Wright, B. M., Mackey, R. W., Milsop, H. W., & Yates, S. C. (1998). Change from slowly rotating 8-hour shift to rapidly rotating 8-hour and 12-hour shifts using participative shift roster design. *Scandinavian Journal of Work, Environment & Health, 24*(suppl 3), 55–61.

Sergean, R. (1971). *Managing shiftwork*. London: Gower.

Thierry, H., & Jansen, B. (1981). Potential interventions for compensating shift work inconveniencies. In A. Reinberg, N. Vieux, & P. Andlauer (Eds.), *Night and shift work: Biological and social aspects* (pp. 251–259). Oxford: Pergamon Press.

Tucker, P., Bejerot, E., Kecklund, G., Aronsson, G., & Åkerstedt, T. (2013). *Doctors' work hours in Sweden: Their impact on sleep, health, work-family balance, patient care and thoughts about work*. Stockholm: Stressforskningsinstitutet.

Tucker, P., Brown, M., Dahlgren, A., Davies, G., Ebden, P., Folkard, S., et al. (2010). The impact of junior doctors' worktime arrangements on their fatigue and well-being. *Scandinavian Journal of Work, Environment & Health, 36*, 458–465. doi:10.5271/sjweh.2985

Tucker, P., & Folkard, S. (2012). *Working time, health, and safety: A research synthesis paper*. Geneva: International Labour Office.

Van Amelsvoort, L. G. P. M., Jansen, N. W. H., Swaen, G. M. H., van den Brandt, P. A., & Kant, I. (2004). Direction of rotation among three-shift workers in relation to psychological health and work-family conflict. *Scandinavian Journal of Work, Environment & Health, 30*(2), 149–156. doi:10.5271/sjweh.772

Vetter, C., Fischer, D., Matera, J. L., & Roenneberg, T. (2015). Aligning work and circadian time in shift workers improves sleep and reduces circadian disruption. *Current Biology, 25*, 1–5.

Volger, A., Ernst, G., Nachreiner, F., & Hänecke, K. (1988). Common free time of family members under different shift systems. *Applied Ergonomics, 19*, 213–218.

Wedderburn, A. (1981). Is there a pattern in the value of time off work? In: A. Reinberg, N. Vieux, P. & Andlauer (Eds), *Night and shift work: Biological and social aspects. Advances in the biosciences* (pp. 495–504). Oxford: Pergamon Press.

Williamson, A., Lombardi, D., Folkard, S., Stutts, J., Courtney, T., & Connor, J. (2011). The link between fatigue and safety. *Accident Analysis and Prevention, 34*, 498–515. doi:10.1016/j.aap.2009.11.011

Wirtz, A. (2010). *Lange Arbeitszeiten – Untersuchungen zu den gesundheitlichen und sozialen Auswirkungen langer Arbeitszeiten* [Long work hours – Study of the health and social effects of long work hours]. (Dissertation) Dortmund: Bundesanstalt für Arbeitsschutz und Arbeitsmedizin.

Wirtz, A., Giebel, O., Schomann, C., & Nachreiner, F. (2008). The interference of flexible working times with the utility of time: A predictor of social impairment? *Chronobiology International, 25*, 249–261. doi:10.1080/07420520802114086

Wirtz, A., & Nachreiner, F. (2010). The effect of extended work hours on health and social well-being-a comparative analysis of four independent samples. *Chronobiology International, 27*, 1124–1134. doi:10.3109/07420528.2010.490099

Wirtz, A., Nachreiner, F., & Rolfes, K. (2011). Working on Sundays—effects on safety, health, and work-life balance. *Chronobiology International, 28*, 361–370. doi:10.3109/07420528.2011.565896

Reciprocal Relations Between Working Time Arrangements and Work-Family Conflict Over Time

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Abstract Thus far, many studies on the relationship between working time arrangements and work-family conflict have been cross-sectional in nature, where the direction of influence is difficult to interpret and causal conclusions cannot be drawn. The few existing longitudinal studies on this topic have mainly focused on the normal direction of the causal relationship, that is, on the impact of working time arrangements on work-family conflict over time. To date, however, the reverse relationship, that is, the effects of work-family conflict on adjustments in work schedules and working hours over time, is less clear. Because work-family conflict is highly prevalent in the working population, further insight in this reverse relationship is invaluable to gain insight into secondary selection processes, which may have significant undesirable/unintended implications for labor force participation. Based on data from the ongoing Maastricht Cohort Study, the impact of various characteristics of working time arrangements (e.g., work schedules, working hours, overtime work, and hours control) both in the etiology and consequences of conflict between work and family life over time was investigated in several longitudinal studies, on which will be reported and reflected in this chapter.

1 Work-Family Conflict

1.1 Definition and Prevalence

Considerable changes in labor force demographics and family composition have taken place in the past few decades, making the challenge of adequately balancing

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work and family roles one of today's central concerns for individuals (Valcour 2007). Multiple role pressures experienced by men and women render work-family conflict virtually inevitable (Greenhaus 1988). Work-family conflict is defined as a form of inter-role conflict in which the role pressures from the work and family domains are mutually incompatible in some respect (Greenhaus and Beutell 1985). Research suggests that conflict between work and family is reciprocal in nature, in that work can interfere with family and family can interfere with work (Allen et al. 2000; Frone et al. 1992a). Besides being reciprocal in nature, three major forms of work-family conflict can be distinguished, that is time-based conflict, strain-based conflict, and behavior-based conflict (Greenhaus and Beutell 1985). Reported prevalences of work-family conflict range from about 10 % to about 41 % (e.g., Frone et al. 1992a; Jansen et al. 2004; Kinnunen and Mauno 1998). These large differences in prevalences may amongst others depend on different definitions and operationalizations of work-family conflict, different settings and different gender distributions. Data from the fifth European Working Conditions Survey, in which a specific operationalization for work-family conflict was used, show that in 2010 some 18 % of workers indicate they have problems with their work–life balance (European Foundation for the Improvement of Living and Working Conditions 2012).

1.2 Antecedents of Work-Family Conflict

Many studies and reviews have examined possible antecedents of work-family conflict (e.g., Byron 2005; Eby et al. 2005). Findings from the meta-analytic review by Michel et al. (2011) amongst others indicate that, based on 1080 correlations from 178 samples, work role stressors, work role involvement, work social support, and work characteristics were associated with work-to-family conflict. Family role stressors, family social support, and family characteristics were associated with family-to-work conflict. Results further indicated that internal locus of control and negative affect/neuroticism were associated with both work-to-family conflict and family-to-work conflict. Demographic variables (marital status, parental status, and gender) were found to be significant and meaningful moderators of many work domain/work-to-family conflict and family domain/family-to-work conflict relationships. Findings from this review further suggested that work role stressors and work social support were also associated with family-to-work conflict; and that family role stressors, family role involvement, family social support, and family characteristics were associated with work-to-family conflict (Michel et al. 2011). As such, the two directions of work-family conflict appear to have both common and different antecedents (e.g., Byron 2005; Michel et al. 2011). Whereas there is an extensive literature on antecedents of work-family conflict, it should be noted however, that most studies relied on cross-sectional analyses, thus prohibiting assertions on causality of relations between antecedents and work-family conflict (Casper et al. 2007).

1.3 Consequences of Work-Family Conflict

While conflict between work and family life is undesirable in itself, work-family conflict may also be related to other adverse outcomes. Various studies and reviews have reported on outcomes associated with work-family conflict (e.g., Allen et al. 2000; Amstad et al. 2011; Eby et al. 2005; Jansen et al. 2003a; 2006; Pisarski et al. 2006). Consequences of work-family conflict can roughly be divided into three distinct categories: work-related, family-related, and domain-unspecific outcomes (Amstad et al. 2011; Bellavia and Frone 2005). Without intending to be fully exhaustive, some examples of outcomes within the three categories are mentioned here as an illustration. Examples of work-related outcomes of work-family conflict are lower job satisfaction (e.g., Gao et al. 2013), elevated need for recovery from work (e.g., Jansen et al. 2003a), burnout (e.g., Peeters et al. 2005), sickness absence (e.g., Clays et al. 2009; Jansen et al. 2006; Lidwall et al. 2010), and intentions to turnover (e.g., Fuss et al. 2008; Grandey and Cropanzano 1999; Greenhaus et al. 1997, 2001). Family-related outcomes of work-family conflict amongst others include lower family satisfaction (e.g., Eby et al. 2005) and marital satisfaction (e.g., Voydanoff 2005). Examples of domain-unspecific outcomes comprise life satisfaction (e.g., Perrewé et al. 1999), prolonged fatigue (e.g., Jansen et al. 2003a), and depressive complaints (e.g., Wang et al. 2012). The meta-analysis by Amstad et al. (2011), with mainly cross-sectional primary studies included, reported that both directions of work-family conflict were consistently associated with all three types of outcomes. Both directions of work-family conflict showed stronger relationships to same-domain outcomes than to cross-domain outcomes, indicating that work interference with family was more strongly associated with work-related than with family-related outcomes and that family interference with work was more strongly associated with family-related outcomes than with work-related outcomes. Again, it should be noted that, also with regard to the outcomes of work-family conflict, more studies were based on a cross-sectional than on a longitudinal design.

2 Role of Working Time Arrangements in Work-Family Conflict

A wide range of factors from the work environment have been linked with work-family conflict. A specific and important component of the work domain involves the role of working time arrangements in work-family conflict, since the amount of time demanded by work and the pattern of timing of work within the day and week are among the most obvious ways in which work may affect private life.

2.1 Conservation of Resources Theory

To structure the relationship between working time arrangements and work-family conflict, the Conservation of Resources theory (COR theory) (Hobfoll 1989; Hobfoll and Shirom 2001) constitutes an appropriate theory and framework, already applied to work-family conflict in earlier studies (e.g., Adkins and Premeaux 2012; Dugan et al. 2012; Grandey and Cropanzano 1999; Jansen et al. 2003a; Nohe et al. 2015). The COR theory proposes that individuals strive to obtain, retain, protect, and foster those things they value. These valued entities are termed resources, and include objects, conditions, personal characteristics and energies (Hobfoll 2001; Hobfoll and Shirom 2001). According to COR theory, psychological stress occurs when individuals are threatened with resource loss, lose resources, or fail to gain resources following resource investment (Hobfoll 1989). As more conflict and/or demands are experienced in one domain, fewer resources are available to fulfill one's role in another domain (Grandey and Cropanzano 1999). When the COR theory is applied to the concept of work-family conflict, it proposes that conflict results in stress because resources, of time and energy for example, are lost in the process of juggling both work and family roles (Grandey and Cropanzano 1999). If work-family conflict sustains, that is, when depleted resources are maintained and/or when there is a lack of resource gain, then adverse consequences with regard to for example mental health and sickness absence might develop (e.g., Jansen et al. 2003a, 2006). As applied to the concept of time, COR theory proposes that people feel stress when their time is depleted or threatened with depletion (Dugan et al. 2012). Time has been put forward as a major component of the experience of work-family conflict, since it is a finite resource upon which competing life domains place simultaneous and incompatible demands (Greenhaus and Beutell 1985). For example, frequent overtime work might tap available resources and leave fewer resources available for family demands. Hence, in the case of frequent overtime work, work-family conflict might be considered a reaction to the situation where the resources of the employee are being threatened, depleted or even lost because of the longer time spent at work and the prolonged effort investment. Other aspects of working time arrangements, for example those reflecting control over working hours, may add to employees' resources and constitute resource gains. Consistent with COR theory it would therefore be invaluable to distinguish between relevant characteristics of working time arrangements, that might deplete or add to employees' resources.

2.2 Components of Working Time Arrangements

With regard to working time arrangements, a distinction can be made between work schedules (e.g., shift work vs. day work) on the one hand, and actual working hours (e.g., fulltime vs. part-time) on the other. Work-family conflict among shiftworkers

is thought to arise predominantly because shiftwork involves working and living patterns diverging from community rhythms of social, recreational and domestic activity (Loudoun and Bohle 1997; Walker 1985). With regard to day workers specifically, subgroups of working hours may be defined with increased risks of work-family conflict. One distinction can be made between fulltime and part-time workers. Of course work schedules and working hours are very interrelated with one another, implying that when studying work schedules, the working hours should be taken into account, and vice versa. Moreover, one should consider that working time arrangements mainly concern structural components of work. Both structural and content components, such as job demands, however, are critical to an understanding of the impact of work on employees and their families (Barnett 1998). Job demands often differ between shift workers and day workers (e.g., Bøggild et al. 2001; Jansen et al. 2003b, c) and between fulltime and part-time workers (Barnett and Gareis 2000). Employees with longer working hours may experience more conflict due to higher job demands compared to employees who average lower working hours. Because job demands are in themselves important factors affecting employees' resources, they should be controlled for when studying the effects of working time arrangements on work-family conflict. The same goes for characteristics of the private situation, where for example the degree of responsibility for housekeeping may influence the relation between working time arrangements and work-family conflict. Further, health status could be a potential confounder because, drawing on COR theory, health status will determine part of the energy levels, or resources, employees have left for juggling demands between work and family life (Jansen et al. 2004).

2.2.1 Work Schedules

The term 'shift work' is used to refer in general to a way of organizing daily working hours in which different persons or teams work in succession to cover more than the usual 8 h day, up to and including the whole 24 h (Costa 2003). Definitions for the term 'shift work' are usually very broad. In fact there are thousands of shift systems that may differ widely with respect to their structure (Costa 2003). In some cases shift work overlaps partially with concepts of irregular, unusual, or non-standard working hours. In some cases the term flexible or irregular work is unjustly used as synonymous to shift work. Many types of shift work exist and they can roughly be categorized as permanent versus rotating, continuous versus discontinuous, with or without night work (International Agency for Research on Cancer Working group on the evaluation of carcinogenic risks to humans 2010). Shift systems can also differ widely in relation to other organizational factors (Costa 2003; International Agency for Research on Cancer Working group on the evaluation of carcinogenic risks to humans 2010), such as amongst others, the length of a shift cycle, the duration of shifts, the number of workers/crews who alternate during the working day (e.g., two-shift, three-shift, four-shift, five-shift work schedules), start and finish time of the duty periods, speed

and direction of shift rotation, number and position of rest days between shifts, and the (ir)regularity of shift schedules. All of these factors can be combined in various ways depending on the demands specific to the occupation (International Agency for Research on Cancer Working group on the evaluation of carcinogenic risks to humans 2010).

2.2.2 Working Hours

As with work schedules, also for working hours many definitions and characteristics exist. One commonly used distinction is between fulltime and part-time work. However, the mere distinction between fulltime and part-time work is probably insufficient. Part-time work may encompass working hours close to the fulltime standard and others that are extremely low (Bielenski et al. 2002). One way to account for this heterogeneity is to divide the part-time category into e.g. low and high part-time jobs depending on the hours worked per week. Whereas work schedules are mainly dictated by the company or organization itself, for working hours employees' own preferences and choices play a much more prominent role. As such, also the distinction between voluntary and involuntary fulltime and part-time work is valuable (e.g., Albertsen et al. 2008).

Another component of working hours constitutes overtime work. Overtime work is defined by the European Foundation for the Improvement of Living and Working Conditions (2007) as work performed by an employee in excess of the normal hours of work which has been officially requested and approved by management. It is work that is not part of an employee's regularly scheduled working week for which the employee may be compensated. This definition however may lead to an underestimation of the actual prevalence of overtime, as in many situations, such as unforeseen periods of high workload, much overtime work occurs unexpectedly and unofficially. Apart from high workload situations requiring overtime, employees may work overtime also for financial reasons or for intrinsic motivational reasons or to enhance prospects for advancement (Bakhuys Roozeboom 2009; Caruso 2006).

Flexibility is another component of working hours that may be related to balancing work and family life. Positive flexibility refers to possibilities for employees to use flexible working time for one's own needs, whereas negative flexibility refers to situations where working time flexibility for the employee is actually dictated by one's tasks or supervisor, e.g. unforeseen changes in working time schedules. Thus, to an individual, flexibility can mean both desirable and undesirable working hours. At best, it offers employees possibilities to adjust working hours to suit personal and family needs. At worst, it implies that one has to be flexible to meet the demands of the employer, without having a say oneself (Pärnänen et al. 2007). Apart from flexibility, the predictability of working hours can be of relevance. Predictability refers to scheduled working hours that do not change at short notice and that are predictable for the employee well in advance. In public discussions on working time, inflexible working hours are often seen as a difficult arrangement for

achieving a work-life balance. However, predictable working hours, like flexibility, also have a positive and negative side. When working times are fixed, employees may not have many possibilities of being flexible, e.g., start slightly later, even in the case of small family emergencies. On the other hand, employees can rely on not being forced to stay longer hours at work or having to reorganize childcare arrangements at short notice because of sudden changes in working time schedules (Pärnänen et al. 2007).

2.3 *Literature Findings on Associations between Working Time Arrangements and Work-Family Conflict*

To date, a very large number of studies have explored associations between characteristics of working time arrangements and work-family conflict. In this paragraph only results and conclusions from a few reviews will be highlighted. The meta-analytic review of work-family conflict and its antecedents by Byron (2005) showed that the number of hours spent on work was more positively related to work interference with family than to family interference with work and the number of hours spent on nonwork was more positively related to family interference with work than to work interference with family. Michel et al. (2011) reported in their meta-analytic review on antecedents of work-family conflict that work-time demands were associated with work-to-family conflict. Albertsen et al. (2008) conducted a literature review summarizing the scientific literature about the consequences of long and nonstandard working hours and employee influence over working hours on different measures of work-life balance. Results amongst others indicated that a higher number of working hours and overtime work were associated with less work-life balance in female and gender-mixed groups. For men, however, results were less conclusive. Evidence was reported that different kinds of nonstandard working hours, defined as work outside ordinary daytime 0800–1800, had a negative influence on work-life balance. Employee influence over work schedule was associated with better work-life balance in a range of studies. But, as Albertsen et al. (2008) noted, clear conclusions are difficult to draw due to the methodological problems of some studies. Nijp et al. (2012) conducted a review to assess the empirical evidence between employee work-time control and amongst others work-non-work balance. Moderately strong positive cross-sectional associations were reported between global work-time control and work-non-work balance. Intervention studies included in the review, found that global work-time control was moderately associated with better work-nonwork balance. Limited to moderately strong positive cross-sectional associations were found between multidimensional work-time control and work-nonwork balance. Moderately strong positive associations were reported between flexitime and work-nonwork balance. Nijp et al. concluded that whereas work-time control may be a promising tool for maintaining workers' work-nonwork balance, the current state of evidence allows however only

very limited causal inferences. It is important to note that the findings in primary studies and the reviews described often cannot be readily compared, amongst others due to the varying definitions and operationalizations used for both work-family conflict and characteristics of working time arrangements across studies.

2.4 *Need for Longitudinal Studies on the Role of Working Time Arrangements in the Etiology of Work-Family Conflict*

The vast majority of primary studies included in the reviews described above, consisted of cross-sectional studies, as such precluding the possibility to make causal assertions regarding the nature of the relationships observed (e.g., Allen et al. 2013). Casper et al. (2007) reported in their methodological review of work-family research published in industrial-organizational psychology and organizational behavior journals in the period 1980–2003, that nearly 90 % of the work family research was based on cross-sectional studies. Almost all of the reviews described, call in their suggested directions for future research for more longitudinal studies in the work-family research field. Longitudinal studies can provide insight into the time sequence between working time arrangements and the onset of work-family conflict and allow studying exposure before effect, and as such investigate the normal causal relation. Criteria for causal inference, such as those proposed by Hill (1965), can offer guidance. Among these, the temporality criterion, requiring that exposure must precede disease/outcome, is essential. The extent to which other criteria—such as minimal bias, strength of the association, consistency of findings with those from previous research, consistency of findings within a study, and dose-response relation—are satisfied can vary greatly from study to study (Checkoway et al. 2004). Thus, for example, an observed adverse effect of an occupational exposure that is unlikely to be an artifact of confounding or other biases may indeed be causal, regardless of the magnitude of the effect estimate. A statistically precise dose-response gradient and coherence with other research would add further support for a link. It is important to realize that a single epidemiologic study of occupational exposures, or other factors, can seldom provide a conclusive answer to the question of causation (Checkoway et al. 2004). All in all, causal inferences cannot be proven, but can be made plausible by ruling out alternative explanations (Zapf et al. 1996). Whereas cross-sectional designs are by no means capable of addressing the temporality criterion, longitudinal studies are. However, both cross-sectional and longitudinal studies can be limited when it comes to selection effects and the impact of changes in exposure taking place before or during the time of study.

2.5 Possibility of a Reciprocal Relation?

While many studies on the relationship between working time arrangements and work-family conflict have been cross-sectional in nature, or have mainly focused on the normal causal relationship, that is, the impact of working time arrangements in the onset of work-family conflict over time (e.g., Grice et al. 2008; Jansen et al. 2003a, 2004), the possibility of a potential reciprocal relation has been rather overlooked so far. That is, the reverse relationship, or the effects of work-family conflict on adjustments in working time arrangements, is less clear. Earlier studies showed that work-family conflict is related to intentions to turnover (e.g., Fuss et al. 2008; Grandey and Cropanzano 1999; Greenhaus et al. 1997, 2001), indicating that a common response to high work-family conflict may be a desire to flee the situation. Employees may seek alternative employment with companies that offer arrangements that are (more) supportive of a good work/non-work balance (Allen et al. 2000). On the other hand, it is also likely that employees encountering work-family conflict seek ways to adapt their current job or work situation to better reconcile work and family life. One way to adapt might be by adjusting their working time arrangements, since (a) the amount of time demanded by work and the pattern or timing of work within the day are among the most obvious ways in which work can affect family life, and (b) working time arrangements, in essence, can be subject to change when necessary or requested (Jansen et al. 2010). Although many studies have suggested a reciprocal relation, longitudinal studies addressing this suggested relation are lacking.

2.6 Requirements Data Infrastructure for Studying Reciprocal Relations

To explore the role of working time arrangements in the onset of work-family conflict as well as the notion of reciprocal determinism in the relationships between working time arrangements and work-family conflict adequately, several requirements concerning study design and study population should be fulfilled. First, a large and heterogeneous study population is required, because this allows studying the effects of various characteristics of working time arrangements, and would ensure variation in risk factors and outcomes. Second, a longitudinal design is necessary to gain insight in causal relations. It is likely that different components of working time arrangements show a different time course of cause and effect in relation to work-family conflict. Furthermore, one specific exposure measure may show different time courses of cause and effect as well, depending on the particular outcomes under study. This would require multiple repeated measurements of both exposure and outcome variables over time (Jansen 2003). Moreover, such data infrastructure should also carefully consider the thorough measurement of relevant confounders or mediating factors, which should be taken into account when

studying the relation between working time arrangements and work-family conflict. That is, specific working time arrangements, such as shift work or long working hours, are closely associated with other job characteristics (Albertsen et al. 2008). Long working hours for instance are often associated with high job demands, but at the same time with good possibilities for development, and high influence at work (Härmä 2006). Job demands also often differ between shift workers and day workers (e.g., Bøggild et al. 2001; Jansen et al. 2003b, c). Therefore, multivariable analyses controlling for other possible influential work and family factors are, in most cases, a necessary requirement (e.g., Albertsen et al. 2008). Furthermore, a prospective design enables examination of the impact of changes or transitions in working time arrangements on (changes in) work-family conflict, which is also an important prerequisite for examining causality. Finally, prospective studies also allow investigation of reciprocal relations, e.g., to explore the possibility that those employees struggling to combine work and family life may adjust their work schedules or working hours as a means to reduce work-family conflict (Jansen 2003). The ongoing prospective Maastricht Cohort Study (Kant et al. 2003) constitutes a well-suited data infrastructure to examine such reciprocal relations between working time arrangements and work-family conflict over time.

3 Maastricht Cohort Study

3.1 Background

During the nineties of the twentieth century there was frequent report of fatigue as a common health complaint among employees (Meijman and Schaufeli 1996, Mounstephen and Sharpe 1997). To study the different aspects of fatigue in relation to work, a national concerted research action on Fatigue at Work was set up by the Netherlands Organization for Scientific Research in 1995. As part of this concerted research action, Maastricht University conducted a large-scale prospective cohort study, the so-called Maastricht Cohort Study on 'fatigue at work' (MCS) (Kant et al. 2003). The primary aim of the MCS was to investigate the prevalence and incidence of prolonged fatigue in the work situation, and additionally to study risk factors in both onset and course of prolonged fatigue and the determinants for sickness absence and work disability. By now the MCS has added substantial scientific insight concerning the magnitude, diagnosis, etiology, prognosis, effects and treatment of fatigue among employees. These insights have been implemented in several randomized controlled trials, in order to come up with concrete preventive measures (e.g., Kant et al. 2008; Lexis et al. 2011). To date, many projects and studies, based on the MCS data, have demonstrated clear short-term and mid-term health effects of the psychosocial work environment. Given the high impact of the psychosocial work environment on health complaints, it can be expected however that the psychosocial work environment also plays an important

role in the etiology and course of long-term health outcomes. The extensive follow-up period of the MCS, from 1998 onwards, also facilitates such studies. As such, the MCS becomes exceedingly suitable for answering research questions related to factors affecting sustainable work across the whole work career.

Because of the wide diversity of working time arrangements, their important implications for health and wellbeing, as well as their potential for change, the subject of working time arrangements has received much attention already from the start of the MCS. As such, different projects, based on the MCS data infrastructure, have focused on the (reciprocal) relations between several aspects of working time arrangements, work-family conflict and health outcomes in particular.

3.2 Study Design and Population

In May 1998, a total of 26,978 employees from 45 different companies and organizations received a letter at home, inviting participation, and the self-administered baseline questionnaire. Included were men and women, aged 18–65 years, with a minimum employment of 16 h/week. Temporary workers were excluded from the study because they (may) change jobs frequently and because accurate data on sick leave and work disability would be difficult to obtain. Altogether, 12,161 employees completed and returned the baseline questionnaire (response rate 45 %). Twenty-one questionnaires were excluded from analysis due to technical reasons, resulting in a baseline population of 12,140 (73 % men and 27 % women), including 687 occupations and job titles. Overall, the study population is heterogeneous with respect to demographics, health status, domestic and social factors, and work related factors (Kant et al. 2003; Mohren et al. 2007). Employees received the self-administered questionnaires every four months in the period 1998–2001. Once a year employees received an extensive questionnaire with items on work-related factors, demographics, non-work-related factors and health factors. Twice a year employees received a short questionnaire, capturing mainly (health-related) outcome measures. From 2001 onwards, the participants were followed at irregular time intervals, that is, in 2002, 2008, 2012, and 2014.

3.3 Assessments

A broad range of exposure and outcome variables, amongst others in the domains of the (psychosocial) work environment, mental and physical health, demographic factors and characteristics of the private situation are measured on an individual level by means of self-administered questionnaires. Additional data on sick leave and work disability were gathered by record linkages to company sick leave and work disability registry systems; data on organizational characteristics were obtained by questionnaires and by interviews with a company's personnel manager

(Kant et al. 2003). Further, information about vital status during follow-up is determined through record linkage between the MCS study population and the Dutch Municipal Population Registries. For deceased workers the underlying cause of death can be obtained through record linkage with data on cause-specific mortality from Statistics Netherlands.

3.3.1 Assessment of Working Time Arrangements

The questionnaires of the MCS capture a wide range of items on working time arrangements, where we distinguished between characteristics of work schedules and working hours. As regards work schedules, employees first provided information about their work schedule (day work vs. shift work). As regards shift work types employees could indicate whether they were involved in two-, three-, four-, five- or irregular shift work, or whether they exclusively worked during evenings or nights. As an example, three-shift work, also referred to as 3 × 8 semi-continuous shift work, involves a 24 h production Monday through Friday done by three teams of employees, generally working 8 h shifts (Van Amelsvoort et al. 2006). In three-shift work, teams are switched as a rule every week. Five-shift work involves full continuous shift work, spread over seven days including five alternating teams, generally working 8 h shifts. Employees working irregular shifts are involved in frequently deviating working hours, which can vary substantially every week. As regards working hours, employees were asked for their working hours/week, frequent overtime work, number of overtime hours a week, compensation of overtime, familiarity with work roster one month in advance, the ability to take a day off when wanted, whether employees had changed their working hours during the past year and whether or not this change was at own request. Flexible working hours, defined as flexible start and ending times of the working day, were also inventoried. Finally, commuting time to work was queried.

3.3.2 Assessment of Work-Family Conflict

In the baseline questionnaire of the MCS (May 1998) and in the follow-up waves until May 2000 work-family conflict was assessed with the following yes/no item: 'Are you able to adequately combine work and family life?' The convergent validity of this measure was tested by comparison with a shortened 11-item version of the Survey Work-home Interaction Nijmegen (SWING) (Geurts et al. 2005; Van der Hulst and Geurts 2001; Wagena and Geurts 2000), which was included in the cohort questionnaires as of follow-up wave May 2000. The Cochran-Armitage test for trend revealed that our general one-item measure of work-family conflict showed a significant trend ($p < 0.001$) with all items of the SWING, indicating that our operationalization was sufficiently broad to represent an overall measure of work-family conflict. The SWING is a questionnaire designed to measure directions and domains of work-family conflict. To assess the direction of conflict from work

to family, that is, work-home interference, we used the shortened version (Cronbach's alpha 0.81) of the scale work-home interference from the SWING. An example item is 'How often do your working hours cause difficulties in meeting the demands at home?' All six items were scored on a four-point scale ranging from 'seldom or never' to 'very often'. The total score on the scale work-home interference ranged from 6 to 24. To date there are no existing cutoff points for classifying employees with marked work-home interference as measured with the SWING. Therefore, when applicable, the upper tertile of the scale (total score ≥11) was used to define a contrast between employees with high versus low-medium work-home interference.

With regard to the MCS findings on work-family conflict described in the upcoming paragraphs, the term work-family conflict will be used to indicate general conflict between work and family where the directions of conflict are not separated. The term work-home interference will be used to refer to the direction of interference from work to home.

3.4 The Role of Working Time Arrangements in the Onset of Work-Family Conflict: Findings in the MCS

Several studies of the MCS were designed to expand the understanding of the role of working time arrangements in the onset of work-family conflict. Drawing on COR theory, we hypothesized that demanding characteristics of working time arrangements, such as shift work or overtime work, would be risk factors in the onset of work-family conflict over time, whereas supportive or facilitating elements, such as flexible working hours or the ability to take a day off when wanted, would be protective against work-family conflict.

3.4.1 The Role of Work Schedules

Because shift work involves working and living patterns diverging from community rhythms of social, recreational and domestic activities (Loudoun and Bohle 1997; Walker 1985), conflict between work and family would be more likely to arise among shift workers as compared to day workers. We observed that men involved in shift work (without distinguishing between specific shift types) had a significantly higher risk of developing work-family conflict after one year follow-up as compared to male day workers (RR 1.80, 95 %CI 1.32–2.46), after adjusting for age, presence of a long-term illness and educational level. For women the association between shift work and work-family conflict over one year follow-up just failed to reach statistical significance (RR 2.15, 95 %CI 0.99–4.68) (Jansen et al. 2003a).

In another study from the MCS the focus of outcome was exclusively on the direction of conflict from work to family, that is, work-home interference (Jansen

et al. 2004). First, cross-sectional analyses were conducted to compare work-home interference among shift workers versus day workers. In this particular study the term shift work captured three-shift, four-shift, five-shift and irregular shift work; all including frequent night work. Logistic regression analyses showed that shift work was associated with higher work-home interference in men (OR 2.44, 95 %CI 1.98–3.00) and women (OR 2.14, 95 %CI 1.30–3.51) as compared to day work, adjusted for age, presence of a long-term illness, educational level, psychological job demands, decision latitude, emotional and physical demands, dependent children and housekeeping responsibility. Second, Poisson regression analyses were conducted over eight months of follow-up. Similar findings were found in these analyses (n = 5308) where shift work was associated with somewhat higher work-home interference after eight months follow-up, even when additionally adjusted for baseline work-home interference levels (Jansen et al. 2004). While in these studies a rather broad definition of shift work was used, it should be noted that specific shift work types, or shift schedule characteristics might be particularly associated with difficulties in combining work and family life.

In another MCS study the focus was on the impact of the direction of shift rotation among three-shift workers in relation to work-family conflict (Van Amelsvoort et al. 2004). In this study a subsample of the MCS was selected, including 95 forward rotating three-shift workers and 681 three-shift workers involved in backward rotation. To study the prospective relationship between direction of rotation and work-family conflict data available over 32 months of follow-up were used. The backward rotating three-shift system was associated with a substantially higher risk of work-family conflict during the total observation period. Generally, backward rotating schedules provide employees with a longer span of free time at the end of a complete shift cycle, but allow for less time for rest and sleep between two consecutive blocks of shifts than forward rotation shift schedules do. Nevertheless, a considerable part of the working population continues to work in backward rotating schedules. An important argument often encountered by shift workers is that a backward rotation schedule gives longer coherent periods of time off than a forward rotation schedule, where the free time ‘disappears’ during the regular work day (Kristensen 2000). Therefore, one might perhaps expect employees in a forward rotation schedule to report more work-family conflict. In contrast, however, we found that the forward rotating workers reported less work-family conflict. Apparently, the ‘disappearing’ time between consecutive shifts might be valuable for fine-tuning work and family obligations. This study provides additional evidence that optimization of the shift schedule, in terms of direction of shift rotation, might be valuable to decrease the adverse impact of shift work (Van Amelsvoort et al. 2004).

3.4.2 The Role of Working Hours

To investigate the role of working hours in relation to work-home interference, we included day workers only (Jansen et al. 2004). For men, we distinguished fulltime (≥36 h/week) from part-time work (<36 h/week), whereas in women the numbers

allowed to distinguish fulltime workers from low (≤25 h/week) and high part-time workers (26–35 h/week). In men, fulltime work, as compared with part-time work, was not associated with higher work-home interference. In women, a low part-time job protected against work-home interference, whereas a high part-time job was not associated with lower work-home interference compared with fulltime work. Table 1 shows cross-sectional associations between characteristics of working hours and work-home interference for fulltime and part-time workers separately, and stratified for men and women. In male fulltimers, frequent overtime work, number of overtime hours, and an increase of working hours during the past year were associated with more work-home interference, whereas compensation for overtime work, flexible working hours, familiarity with the work roster in advance and the ability to take a day off were associated with less work-home interference. In general, the associations between working hours characteristics and work-home interference were less strong among male part-timers, probably partly due to the smaller numbers of part-time working men. Cross-sectional associations between characteristics of working hours and work-home interference among women revealed that in both fulltime and low part-time workers, overtime work was associated with more work-home interference. The number of overtime hours was associated with more work-home interference and familiarity with the work roster in advance with less work-home interference for high part-time workers. A decrease in working hours was associated with more work-home interference in fulltime workers. High commuting time to work was associated with more work-home interference for low part-time workers (Jansen et al. 2004).

Poisson regression analysis was conducted to study the prospective relationship between (characteristics of) working hours and the continuous score of work-home interference after eight months of follow-up in day workers (Table 2). Fulltime work was associated with higher work-home interference after eight months of follow-up as compared to part-time work. Additional adjustments for baseline work-home interference levels revealed less strong associations. For fulltime workers specifically, all distinguished characteristics of working hours, except for flexible working hours and an increase in working hours at the worker's own request, were associated with work-home interference. Both an increase and decrease of working hours during the past year were related to higher work-home interference among fulltime workers in these prospective analyses. Possible explanations could be that the employees who changed their working hours had not yet adapted to their new working hours, or that the change in working hours was still not enough to adequately combine work and family life. Furthermore, it may be possible that the private situation has become more demanding for employees who had started working fewer hours during the past year. When we specifically studied whether or not the change in hours was the worker's own choice, it was found that working fewer hours at one's own request during the past year was prospectively related to less work-home interference among fulltime workers. When additional adjustments for baseline work-home interference levels were made, the associations generally were less strong. In part-time workers, frequent overtime work and high commuting time to work at baseline were associated with more work-home

Table 1 Cross-sectional associations between working hours and work-home interference (upper tertile) in fulltime and part-time working men and women in day work (adapted from Jansen et al. (2004))

	Men		Women		
	Fulltime work (≥36 h/week) (n = 3402)	Part-time work (<36 h/week) (n = 204)	Fulltime work (≥36 h/week) (n = 494)	High part-time work (26–35 h/week) (n = 286)	Low part-time work (≤25 h/week) (n = 559)
	OR[a] (95 % CI)	OR[a] (95 % CI)	OR[a] (95 % CI)	OR[a] (95 % CI)	OR[a] (95 % CI)
Frequent overtime work					
Yes	2.99 (2.48–3.60)	2.36 (0.99–5.60)	1.89 (1.12–3.19)	1.72 (0.88–3.35)	1.96 (1.16–3.33)
No	1	1	1	1	1
Hours of overtime work a week					
<5	1	1	1	1	1
≥5	2.17 (1.73–2.71)	0.52 (0.06–4.67)	1.78 (0.88–3.60)	4.30 (1.34–13.84)	2.27 (0.72–7.12)
Compensation for overtime hours					
Time	0.57 (0.38–0.85)	0.46 (0.07–3.12)	0.75 (0.29–1.91)	0.35 (0.10–1.23)	1.28 (0.40–4.13)
Time and/or money	0.70 (0.50–0.97)	0.11 (0.05–2.46)	0.92 (0.31–2.74)	0.33 (0.05–2.04)	0.42 (0.10–1.69)
Money	0.46 (0.27–0.77)	[b]	2.42 (0.44–13.26)	0.40 (0.04–4.56)	1.67 (0.32–8.70)
No	1	1	1	1	1
Flexible working hours					
Yes	0.82 (0.68–0.98)	1.06 (0.67–1.67)	1.40 (0.97–2.03)	0.63 (0.34–1.19)	0.97 (0.64–1.47)
No	1	1	1	1	1
Work roster known 1 month in advance					
Yes	0.62 (0.51–0.76)	0.61 (0.22–1.73)	0.54 (0.26–1.14)	0.43 (0.19–0.99)	0.71 (0.32–1.59)
No	1	1	1	1	1
Able to take a day off when wanted					
Yes	0.45 (0.35–0.58)	0.97 (0.33–2.82)	0.85 (0.47–1.54)	0.51 (0.24–1.08)	0.84 (0.47–1.49)
No	1	1	1	1	1
Decrease in working hours					
Yes	1.12 (0.68–1.83)	0.38 (0.13–1.14)	4.92 (1.40–17.23)	0.99 (0.44–2.25)	0.59 (0.24–1.45)
No	1	1	1	1	1

(continued)

Table 1 (continued)

	Men		Women		
	Fulltime work (≥36 h/week) (n = 3402)	Part-time work (<36 h/week) (n = 204)	Fulltime work (≥36 h/week) (n = 494)	High part-time work (26–35 h/week) (n = 286)	Low part-time work (≤25 h/week) (n = 559)
	OR[a] (95 % CI)	OR[a] (95 % CI)	OR[a] (95 % CI)	OR[a] (95 % CI)	OR[a] (95 % CI)
Increase in working hours					
Yes	2.17 (1.66–2.82)	2.25 (0.40–12.65)	1.52 (0.75–3.06)	1.04 (0.44–2.45)	1.30 (0.61–2.77)
No	1	1	1	1	1
Commuting time to work					
<30 min	1	1	1	1	1
≥30 min	1.00 (0.84–1.19)	1.16 (0.51–2.64)	1.38 (0.83–2.31)	1.23 (0.61–2.46)	2.83 (1.54–5.20)

[a]Adjusted for age, presence of a long-term illness, educational level, psychological job demands, decision latitude, emotional and physical demands, having dependent children and responsibility for housekeeping
[b]Data not available, because the sample size was too small

interference after eight months of follow-up, whereas compensation of overtime, flexible working hours and the ability to take a day off when wanted, were associated with less work-home interference. After additionally adjusting for baseline work-home interference levels, overtime work was still associated with more work-home interference, whereas the ability to take a day off when wanted and increased working hours per week during the past year were associated with less work-home interference (Jansen et al. 2004). As described, overtime work was prospectively related to higher work-home interference. Prolongation of the work day could, in line with the COR theory, deplete time and/or energy resources available for family activities, which was also shown in the cross-sectional analyses, where particularly for women with a low part-time job, overtime work and high commuting time fostered work-home interference. Possibly, these women had already anticipated work-home interference and selected part-time work as an option to reduce it. Due to the prolonged working day, their carefully selected fit between work and family was compromised and work-home interference became more likely to develop. The opportunity to take a day off when wanted, indicating autonomy or control over working hours, could provide employees with better possibilities to combine work and family life and was found to be protective against work-home interference. Flexible working hours were not consistently associated with less work-home interference. In a study by Smith Major et al. (2002), the relation between long work hours and time-based work interference with family was not moderated by schedule flexibility as well. One explanation could be that flexible working hours do not provide a solution for employees with structural time conflicts between work and family, because the actual hours that need to be spend at work still remain similar. Flexible hours may provide a solution when employees encounter occasional time conflict situations however (Jansen et al. 2004).

Table 2 Working hours as risk factors for work-home interference (continuous score) after eight months of follow-up in day workers (adapted from Jansen et al. (2004))

	Day work (n = 4336)					
	Model 1[a]			Model 2[b]		
	β	SE	P value	β	SE	P value
Fulltime versus part-time work	0.059	0.015	<0.0001	0.015	0.011	0.180
	Fulltime work (≥36 h/week) (n = 3422)					
	Model 1[a]			Model 2[b]		
	β	SE	P value	β	SE	P value
Frequent overtime work	0.126	0.011	<0.0001	0.039	0.009	<0.0001
≥5 h of overtime work a week	0.030	0.009	0.001	0.004	0.008	0.641
Overtime hours compensated	−0.064	0.018	<0.0001	−0.017	0.014	0.247
Flexible working hours	−0.001	0.009	0.939	0.006	0.007	0.438
Work roster known 1 month in advance	−0.059	0.013	<0.0001	−0.009	0.010	0.374
Able to take a day off when wanted	−0.068	0.015	<0.0001	−0.012	0.012	0.313
Decrease in working hours	0.067	0.029	0.022	0.046	0.023	0.047
Decrease in working hours at own request	−0.152	0.073	0.038	−0.062	0.063	0.320
Increase in working hours	0.083	0.016	<0.0001	0.018	0.012	0.145
Increase in working hours at own request	−0.012	0.037	0.751	0.013	0.029	0.668
≥30 min commuting time to work	0.033	0.010	0.001	0.011	0.008	0.178
	Part-time work (<36 h/week) (n = 914)					
	Model 1[a]			Model 2[b]		
	β	SE	P value	β	SE	P value
Frequent overtime work	0.140	0.021	<0.0001	0.071	0.017	<0.0001
≥5 h of overtime work a week	0.067	0.041	0.100	0.014	0.034	0.688
Overtime hours compensated	−0.088	0.042	0.035	−0.037	0.035	0.287
Flexible working hours	−0.030	0.015	0.047	−0.020	0.012	0.088
Work roster known 1 month in advance	−0.049	0.027	0.075	0.009	0.022	0.676
Able to take a day off when wanted	−0.095	0.024	<0.0001	−0.040	0.019	0.033
Decrease in working hours	−0.004	0.028	0.889	0.009	0.022	0.676
Decrease in working hours at own request	−0.077	0.105	0.460	−0.160	0.097	0.099
Increase in working hours	−0.001	0.032	0.973	−0.056	0.025	0.027

(continued)

Table 2 (continued)

	Day work (n = 4336)					
Increase in working hours at own request	−0.047	0.073	0.518	0.006	0.065	0.924
≥30 min commuting time to work	0.064	0.023	0.005	0.019	0.018	0.301

[a]Adjusted for gender, age, presence of a long-term illness, educational level, psychological job demands, decision latitude, emotional and physical demands, responsibility for housekeeping and having dependent children

[b]Additionally adjusted for continuous baseline work-home interference levels

From these studies it can be concluded that working time arrangements may have both beneficial and adverse effects on work-family conflict and/or work-home interference under specific conditions. Demanding aspects of working time arrangements, such as for example overtime work and shift work, went together with higher conflict, whereas characteristics of working time arrangements reflecting control and predictability were protective against work-home interference (Jansen et al. 2004).

3.5 Reversed Relation Between Work-Family Conflict and Working Time Arrangements: Findings in the MCS

Apart from studying the normal causal relation regarding the impact of working time arrangements in the etiology of work-family conflict, in the MCS the reverse relation was also investigated, to find out whether employees struggling to combine work and family life have a higher probability of adjusting their working time arrangements over time. When considering adjustments of working time arrangements as a means to solve or mitigate work-family conflict, the distinction between work schedules and working hours is relevant again. A switch from shift work to day work may be more difficult to realize in daily practice, will probably take a longer period of time, and may also have more financial consequences compared to adjustments in the number of working hours/day or week or quitting overtime work. Additionally, when studying the impact of work-family conflict on adjustments in working time arrangements, gender differences should also be taken into account, because of reported differences between men and women in the prevalence, onset, and consequences of work-family conflict (e.g., Frone et al. 1992b; Jansen et al. 2003a), as well as different choices between men and women with respect to working hours and schedules (Bielenski et al. 2002; Corral and Isusi 2005; Leufkens 2009; Siermann 2009). For example, while the proportion of couples with two partners having a paid job increased from 46 % in 1992 to 66 % in 2007 in the Netherlands, it is noteworthy that in 92 % of dual-income couples, the male partner was working fulltime and the female partner part-time (Leufkens 2009). Based on

data of the MCS, we found that high work-home interference among day workers was associated with an increased probability of changing working hours over eight months of follow-up (Jansen et al. 2004). In these analyses, however, no further specification as to the direction of this change in hours could be made. Furthermore, we observed among three-shift workers that work-family conflict was associated with an increased risk of leaving the shift work job over time (Van Amelsvoort et al. 2004). While we had, therefore, already found indications for the existence of a reverse relation between working time arrangements and work-family conflict, insight into the exact time frame when these adaptations occur and what specific components of working time arrangements are being adapted, in particular, were areas that needed further clarification.

3.5.1 Adaptation of Work Schedules

In a separate study of the MCS, multivariable survival analyses using Cox regression analyses were performed to study the effects of work-family conflict on changes in work schedules and working hours (Jansen et al. 2010). For these analyses, the reference group consisted of employees not being a 'case' of work-family conflict at baseline (May 1998). To assess the effect of work-family conflict on changes in work schedules (analyses conducted among males only), we modelled the time from shift work at baseline to a switch to day work over a total period of 32 months follow-up. Table 3 shows that work-family conflict was associated with a significantly increased risk of changing from shift work to day work over 32 months follow-up in male three-shift workers, but that work-family conflict was not significantly associated with a higher risk of changing from shift to day work in five-shift workers and irregular shift workers, after adjusting for age, educational level, and the presence of a long-term illness (Jansen et al. 2010). One explanation for the higher probability of changing from shift to day work especially among three-shift workers, might be that three-shift work in our study is generally characterized by a slower speed of shift rotation, more frequently a backward as

Table 3 Work-family conflict as a predictor of a change from shift work to day work over 32 months follow-up among men (adapted from Jansen et al. (2010))

		n	Change from shift work to day work RR[a] (95 % CI)
Work-family conflict among three-shift workers	Yes	242	1.77 (1.19–2.63)
	No	485	1
Work-family conflict among five-shift workers	Yes	149	1.32 (0.78–2.24)
	No	783	1
Work-family conflict among irregular shift workers	Yes	77	0.81 (0.50–1.31)
	No	374	1

[a]adjusted for age, educational level, and presence of a long-term illness

opposed to a forward rotating shift schedule (Van Amelsvoort et al. 2004), and greater working hours/week than five-shift work or irregular shift work, factors that in addition to difficulties in combining work and family life may further increase the probability to decide to leave shift work.

3.5.2 Adaptation of Working Hours

To examine whether work-family conflict predicted a reduction of working hours, analyses were conducted among day workers only, with stratification for gender and working hours. As shown in Table 4, work-family conflict among female fulltime workers was associated with an almost three-fold higher risk of reducing working hours over one-year of follow-up, but was not significantly associated with reducing work hours in fulltime working men, after adjusting for age, educational level, and the presence of a long-term illness. In part-time workers, work-family conflict was associated with a significantly increased risk of reducing working hours over one-year follow-up, both in women and men, even after adjusting for age, educational level, and the presence of a long-term illness. Possibly, for some part-time workers the already realized fewer working hours earlier proved insufficient to better combine work and family life, resulting in a higher probability of further reductions in working hours. Although the number of men working part-time was rather small, and, therefore, these findings should be interpreted with

Table 4 Work-family conflict as a predictor of a reduction in working hours over one and two year follow-up, according to fulltime and part-time employment in day workers (adapted from Jansen et al. (2010))

	n	Reduction in working hours over one year follow-up	Reduction in working hours over two year follow-up
		RR[a] (95 % CI)	RR[a] (95 % CI)
Fulltime workers (≥36 h/week)			
Work-family conflict among men			
Yes	434	1.34 (0.81–2.22)	1.53 (1.05–2.21)
No	4572	1	1
Work-family conflict among women			
Yes	82	2.80 (1.42–5.54)	2.13 (1.24–3.66)
No	721	1	1
Part-time workers (<36 h/week)			
Work-family conflict among men			
Yes	15	4.03 (1.28–12.68)	4.54 (1.64–12.56)
No	238	1	1
Work-family conflict among women			
Yes	73	1.99 (1.04–3.82)	1.68 (0.95–2.97)
No	1061	1	1

[a]adjusted for age, educational level, and presence of a long-term illness

caution, results were striking. While adjustments were made for age, educational level and the presence of a long-term illness, alternative reasons, other than work-family conflict, for this increased probability of further reductions in working hours cannot be ruled out (Jansen et al. 2010).

It appeared valuable to examine different time lags with respect to adjustments in working hours among day workers as a consequence of work-family conflict, because, then, further differential effects emerged regarding the role of gender. Whereas the effects of work-family conflict on a reduction of working hours were substantial and significant among women when a one-year follow-up was considered, effects decreased after two years of follow-up, but, nonetheless, remained significant. For men a different picture appeared. While among male fulltime workers, work-family conflict was not associated with reducing working hours over one year of follow-up, significant effects appeared when a two-year follow-up period was considered. These findings indicate that generally women, compared to men, appeared to adjust their working hours faster as a consequence of work-family conflict (Jansen et al. 2010).

Apart from differential time lags in which adaptations in working hours are being made, gender differences also emerged when the magnitude of the reduction in working hours was investigated. That is, besides effects of work-family conflict on a general reduction in working hours, we also examined whether work-family conflict predicted a change specifically from fulltime (≥36 h/week) to part-time (<36 h/week) work at one year follow-up. These analyses demonstrated that work-family conflict among fulltime day workers predicted a change to part-time work between article baseline and one year follow-up in women, but not in men, after correction for age, educational level, and the presence of a long-term illness. When a two-year follow-up period was considered, effects decreased among women and remained non-significant in men, after correction for age, educational level, and the presence of a long-term illness. These findings indicate that besides reducing working hours faster as a consequence of conflict between work and family life, the magnitude of the adjustment is also larger among women than men (Jansen et al. 2010). Naturally, within couples, decisions on the hours that might be worked are not usually taken by individuals in isolation but rather in the context of households as a whole (Bielenski et al. 2002), and employees' decisions towards labor participation depend on the division of roles among the members of the household. Since in nearly all EU countries women still take up the main share of unpaid household, family work and child care (Bielenski et al. 2002; Corral and Isusi 2005), the prevalence of women in part-time jobs is high. It may be hypothesized that for example in a dual-income couple dealing with work-family conflict, the female partner will reduce working hours first as a means to better reconcile work and family life. If this adaptation, however, over time appears to be insufficient to better balance work and family life, the male partner might consider adjusting working hours thereafter. Hence, examining adjustments in working time arrangements among couples rather than in individuals may be an interesting avenue for further research to gain a better understanding of gender differences in the relationship between work-family conflict and working time arrangements.

These studies provide evidence for a longitudinal relation between work-family conflict and subsequent changes in working time arrangements, indicating that employees try to adapt to work-family conflict by switching from shift to day work, and by reducing working hours over time. As such, these studies clearly illustrate important secondary selection processes taking place both in shift and day workers (Jansen et al. 2010). While work-family conflict has in earlier studies been shown to be a risk factor for adverse outcomes, for example, related to poorer health or increased sick leave (e.g., Allen et al. 2000; Jansen et al. 2003a, 2006, Lidwall et al. 2010), these studies add that work-family conflict moreover has significant implications for labor participation, in terms of adjustments of working time arrangements over time.

4 Implications for Research and Practice

Based on data from the ongoing MCS, the role of various characteristics of working time arrangements was investigated in several longitudinal studies, demonstrating a clear reciprocal relation, indicating that working time arrangements play a significant role both in the etiology and in the consequences of conflict between work and family life over time, with relevant differences in these relations for men and women.

Several methodological and conceptual issues should be addressed. A first issue concerns the measurement time lag. The ideal time lag for longitudinal research on reciprocal relations between working time arrangements and work-family conflict remains elusive to date. In theory, if the time lag is too short, meaningful outcomes may not have sufficiently unfolded yet. On the other hand, an excessively long time lag may provide more opportunities for adaptations that could negate an anticipated reversed effect (Tang 2014). In the study on the role of working time arrangements in the etiology of work-home interference we used an eight-month follow-up period. Although working time arrangements were clear risk factors for work-home interference after eight months of follow-up, it is likely, however, that different aspects of working time arrangements, such as shift work or overtime work, may have a different time course of cause and effect. For future studies it is valuable to explore different time lags in studies on the impact of working time arrangements in the onset of work-family conflict. When we focused on the reciprocal relation between working time arrangements and work-family conflict, we did explore multiple time lags though and various follow-up periods were explored to obtain more insight into the time period when adaptations occur. When employees consider adjusting their working times to resolve conflict between work and family life, the exploration of different time lags becomes very relevant. That is, a switch from shift to day work may be more difficult to realize in daily practice, will probably take a longer period of time, and may also have more financial consequences compared to a reduction of working hours or quitting overtime work as a means to resolve work-family conflict. Our results suggest that the time lag when adaptations

of working time arrangements are realized sometimes may be rather long and that this time lag appears different when considering the various components of working time arrangements and when considering the role of gender. These findings should be taken into account when designing future prospective studies on consequences of work-family conflict (Jansen et al. 2010). Closely related to the time lag is the time window at which workers are being studied, for example at what point during their career. For example, the average age of the employees in the MCS at baseline measurement in 1998 was 41 years. As such they were already in the middle of an ongoing process both with regard to working time arrangements and combining work and family. In that respect, the term baseline is not a true reference condition, because employees experiencing work-family conflict may have already chosen day work instead of shift work, or part-time work and less overtime work, as an option to reduce work-family conflict. The reciprocal effects between work-family conflict and working time arrangements clearly pointed in this direction. Consequently, a selection bias may have taken place before our baseline measurement and/or during follow-up, reducing all observed associations. Another issue to consider concerns the definitions and operationalizations used to assess work-family conflict and working time arrangements. In the MCS different operationalizations for work-family conflict were used. While in several studies we could rely on the SWING questionnaire to distinguish between the directions of conflict from work to family and vice versa, and incorporate dimensions of time and energy conflict consistent with COR theory, in other studies, however, work-family conflict was measured by only one item asking employees whether they were able to adequately combine work and family life. One-item measures may raise concern about likelier lower reliability and validity, and should be kept in mind when interpreting the results. However, since this measure of work-family conflict showed a significant trend with all items of the shortened SWING (Geurts et al. 2005) on directions and domains of work-family conflict, we assume that our item was sufficiently broad to represent an overall measure of work-family conflict (Jansen et al. 2003a). For future studies it may be valuable to explore the duration, severity, and source of work-family conflict in more detail for understanding its impact further. As regards working time arrangements a broad range of different characteristics were distinguished related to both work schedules and working hours. This distinction was of high relevance because it revealed important differences between specific work-time components in the reciprocal relation with work-family conflict. In recent years, more and more innovative working time arrangements have been introduced, including various types of flexible work arrangements (e.g., Allen et al. 2013; Higgins et al. 2014) such as teleworking, compressed work weeks etcetera. Longitudinal studies are needed to untangle cause-effect relationships between these relatively new flexible work arrangements policies and work-family conflict. Further, although the assessment of working time arrangements can be considered as fairly objective, it should be noted that in the studies on working time arrangements and work-family conflict we used self-reported data only. As such, common method variance, which reflects a systematic method error due to the use of a single rater or single source (Rindfleisch et al. 2008), may have caused an

overestimation of the strength of the observed associations between working time arrangements and work-family conflict. However, this would particularly apply to the cross-sectional analyses, and probably be somewhat less of a problem in the longitudinal analyses, since the time separation reduces the likelihood that the earlier responses and earlier moods will affect later responses (Rindfleisch et al. 2008). But as we cannot fully rule out this potential type of bias the use of multiple sources of data collection might be valuable to further extend this area of research. Another issue to be addressed concerns adjustment for other factors from, for example, the domains of work, health, or personal situation, in studies on working time arrangements and work-family conflict (e.g., Byron 2005; Jansen et al. 2003a, 2004). Factors known to play a role in the etiology of work-family conflict should definitely be taken into account when studying the specific role of working time arrangements in the onset of work-family conflict. However, when studying the reciprocal relation, investigating the impact of work-family conflict on adjustments in working time arrangements, one should be cautious when considering correcting for these factors. Adjusting for these factors would actually mean a correction for the causes or origin of work-family conflict, and, hence, inappropriate for studying consequences of work-family conflict. We therefore sometimes refrained from adjustment or limited adjustments in our studies on the reciprocal relation to age, educational level, and long-term illness. Future studies should reveal which factors play a prominent role in the impact of work-family conflict on changes in working time arrangements that should be taken into account.

Taken together, what do the findings from the MCS contribute to the knowledge and insight into the relation between working time arrangements and work-family conflict? While the majority of studies in this field have relied on cross-sectional designs, investigations on the normal causal relation and the reverse relation have been overlooked so far. The MCS demonstrated however, through applying longitudinal designs, clear reciprocal relations between working time arrangements and work-family conflict over time. While causal inferences cannot (or hardly) be proven (Rothman and Greenland 2005; Zapf et al. 1996), and much debate is ongoing on the (use of) criteria for causality, overall agreement does exist as to the essential prerequisite of temporality. Temporality refers to the necessity for a cause to precede an effect in time. The temporality criterion is inarguable, insofar as any claimed observation of causation must involve the putative cause C preceding the putative effect D (Rothman and Greenland 2005). Our studies met this temporality criterion since they have shown that specific characteristics of working time arrangements proved to be risk factors in the onset of work-family conflict over time, as we excluded prevalent cases of work-family conflict at baseline measurement where possible. Moreover, temporality was also demonstrated in the reciprocal relation, showing that those people struggling to combine work and family life had a higher probability to adjust their work schedules and/or working hours over time compared to those not reporting conflict between work and family life (Jansen et al. 2010; Van Amelsvoort et al. 2004). Furthermore, in these studies various time lags were explored, with relevant differences in time course of cause and effect between men and women for example. Consistency of these reciprocal

relations should be examined in upcoming studies, to explore whether the associations are also observed in different populations and under different circumstances. While our studies had a prospective design, e.g., to investigate the effect of work-family conflict on changes in working time arrangements, a further advancement would be to examine a change in exposure before the actual change in outcome. As regards the reversed relation, this for example implies that a change in work-family conflict should be assessed before the change in working time arrangements. This point is particularly relevant in studies, like the current one, where employees generally have already been in the labor market for quite some years and hence in the middle of an ongoing process both with regard to choices in working time arrangements and combining work and family life. Moreover, whereas thus far the focus within a single study has primarily been on one particular direction of the relation, e.g. the impact of working hours in the onset of work-family conflict over time, ideally the dynamics of the full reciprocal relation covering both directions over time should be incorporated altogether in one study, by combining multiple waves of data over an even longer time span. That is, by studying these dynamics, e.g. investigating the role of working hours in the onset of work-family conflict as well as potential subsequent adaptations of working hours over time as a consequence of work-family conflict, a more comprehensive insight would be obtained. Such longitudinal observational studies, investigating both changes in exposure before changes in outcome and the dynamics between these concepts over time, as well as (natural) experiments, will reveal further details of the causal mechanism and the confounding or mediating factors involved. This knowledge should be gathered first, before effective interventions can be developed and implemented, because they require a full understanding of the multifactorial etiology of work-family conflict and its consequences.

As regards generalizability of the findings, it should be mentioned that findings on associations between working time arrangements and work-family conflict generally are highly context dependent. For example, research has mostly focused on factors in the environment of the person, such as work and home characteristics and only rarely where they joined with other factors, such as roles and cultural contexts (Putnik et al. 2016). The work-home interface is affected by social roles and perception of roles. For instance, the way men and women combine work and home roles may differ depending on their gender role ideologies and their beliefs and norms of appropriate division of work and home tasks (Galovan et al. 2010). Qualitative research has supported this statement, showing that men and women's gender identities can differently impact the combination of work and home duties (Emslie and Hunt 2009). Our findings on changes in working hours should probably also be seen within the context of the Dutch setting, with its one and a half earner model, where in the vast majority of dual-income couples, the male partner works fulltime and the female partner part-time (Leufkens 2009). Moreover, the possibilities to adapt working time arrangements, e.g., start working part-time, are dependent on the job (characteristics) and organizational context. Moreover, these possibilities further depend on the economic situation, financial aspects and the social security system within a country or context. Compared to other European

countries, Dutch women are less inclined to put out a great part of childcare to someone outside of the household and as a consequence, their situation on the labor market is usually adapted to the situation at home (Fokkema 2002). Indeed, we observed that fulltime working women with high work-home interference had a substantially higher probability of changing their working hours over time, compared to those reporting lower work-home interference. For men, similar findings were observed, although the associations were less strong. This secondary selection, where employees have already adapted e.g., their working time arrangements to facilitate combining work and family life, could also be an explanation for the lower proportion of women reporting work-family conflict in the MCS, because it could be argued that this selection might be stronger among women, since women have culturally accepted ways of coping with work-family conflict, for example by working part-time as an option that permits more time for their families.

To conclude, while conflict between work and family is undesirable in itself, studies have also shown that work-family conflict is also a risk factor for other adverse outcomes, for example related to poorer health or increased sick leave (e.g., Jansen et al. 2003a, 2006; Lidwall et al. 2010). Moreover, relevant reciprocal relations between working time arrangements and work-family conflict have been demonstrated, indicating that important secondary selection processes may take place, in terms of reductions in working hours, and transitions with respect to work schedule. For the employee this may be an intended choice, or may be driven by necessity. For the employer or at a society level this process may have substantial and unintended consequences with respect to labor participation, where downshifting and increased mobility or even early exit from the labor force may ensue. When considering the high prevalence of specific working time characteristics, e.g., shift work, and the high prevalence of work-family conflict, as well as the observed effect sizes, the consequences of work-family conflict over time are high beyond expectation and warrant primary prevention of work-family conflict. Since components of working time arrangements have in earlier studies been shown to be clear risk factors in the etiology of work-family conflict and are in essence dynamic and modifiable factors, that can be subject to change when necessary or requested, they may be among the most concrete starting points for actual prevention of conflict between work and family life (Jansen et al. 2010). While the effectiveness of these factors remains to be demonstrated through (natural) experiments first, examples with respect to the role of working hours as preventive measures might include the limitation of overtime work, compensation of overtime work, increasing the control over working hours, by providing employees the opportunity to take a day off when necessary and also by increasing the predictability of working hours, by informing employees about the work roster at an early stage, by providing flexible start and ending times, and/or the ability to reduce the amount of working hours when necessary. However, it should also be kept in mind that the impact of these measures is very context sensitive and should be tailored for specific subgroups. That is the effectiveness, need or use of these measures may be different across the work career, may differ for men and women, is dependent on the specific occupation and or educational level, and as such require a tailored approach.

References

Adkins, C. L., & Premeaux, S. F. (2012). Spending time: The impact of hours worked on work-family conflict. *Journal of Vocational Behavior, 80*(2), 380–389.

Albertsen, K., Rafnsdóttir, G. L., Grimsmo, A., Tómasson, K., & Kauppinen, K. (2008). Workhours and worklife balance. *Scandinavian Journal of Work Environment and Health, 5*, 14–21.

Allen, T. D., Herst, D. E. L., Bruck, C. S., & Sutton, M. (2000). Consequences associated with work-to-family conflict: A review and agenda for future research. *Journal of Occupational Health Psychology, 5*(2), 278–308.

Allen, T. D., Johnson, R. C., Kiburz, K. M., & Shockley, K. M. (2013). Work-family conflict and flexible work arrangements: Deconstructing flexibility. *Personnel Psychology, 66*(2), 345–376.

Amstad, F. T., Meier, L. L., Fasel, U., Elfering, A., & Semmer, N. K. (2011). A meta-analysis of work-family conflict and various outcomes with a special emphasis on cross-domain versus matching-domain relations. *Journal of Occupational Health Psychology, 16*(2), 151–169.

Bakhuys Roozeboom, M. (2009). *Rise in number of overtime hours worked*. European Foundation for the Improvement of Living and Working Conditions: European Working Conditions Observatory. http://www.eurofound.europa.eu/ewco/2009/01/NL0901019I.htm. Accessed 01 June 2015.

Barnett, R. C. (1998). Toward a review and reconceptualization of the work/family literature. *Genetic, Social, and General Psychology Monographs, 124*(2), 125–182.

Barnett, R. C., & Gareis, K. C. (2000). Reduced-hours employment: The relationship between difficulty of trade-offs and quality of life. *Work and Occupations, 27*(2), 168–187.

Bellavia, F. M., & Frone, M. R. (2005). Work-family conflict. In J. Barling, E. K. Kelloway, & M. R. Frone (Eds.), *Handbook of work stress* (pp. 113–147). London: Sage.

Bielenski, H., Bosch, G., & Wagner, A. (2002). *Working time preferences in sixteen European countries*. Luxembourg: Office for Official Publications of the European Communities.

Bøggild, H., Burr, H., Tüchsen, F., & Jeppesen, H. J. (2001). Work environment of Danish shift and day workers. *Scandinavian Journal of Work, Environment & Health, 27*(2), 97–105.

Byron, K. (2005). A meta-analytic review of work-family conflict and its antecedents. *Journal of Vocational Behavior, 67*(2), 169–198.

Caruso, C. C. (2006). Possible broad impacts of long work hours. *Industrial Health, 44*(4), 531–536.

Casper, W. J., Eby, L. T., Bordeaux, C., Lockwood, A., & Lambert, D. (2007). A review of research methods in IO/OB work-family research. *Journal of Applied Psychology, 92*(1), 28–43.

Checkoway, H., Pearce, N., & Kriebel, D. (2004). *Research methods in occupational epidemiology*. New York: Oxford University Press.

Clays, E., Kittel, F., Godin, I., Bacquer, D. D., & Backer, G. D. (2009). Measures of work-family conflict predict sickness absence from work. *Journal of Occupational and Environmental Medicine, 51*(8), 879–886.

Corral, A., & Isusi, I. (2005). *Part-time work in Europe*. Dublin: European Foundation for the Improvement of Living and Working Conditions.

Costa, G. (2003). Shift work and occupational medicine: An overview. *Occupational Medicine, 53*(2), 83–88.

Dugan, A. G., Matthews, R. A., & Barnes-Farrell, J. L. (2012). Understanding the role of subjective and objective aspects of time in the work-family interface. *Community, Work & Family, 15*(2), 149–172.

Eby, L. T., Casper, L. M., Lockwood, A., Bordeaux, C., & Brinley, A. (2005). Work and family research in IO/OB: Content analysis and review of the literature (1980–2002). *Journal of Vocational Behavior, 66*(1), 124–197.

Emslie, C., & Hunt, K. (2009). 'Live to work' or 'work to live'? A qualitative study of gender and work-life balance among men and women in mid-life. *Gender, Work & Organization, 16*(1), 151–172.

European Foundation for the Improvement of Living and Working Conditions. (2007). Overtime. http://eurofound.europa.eu/observatories/eurwork/industrial-relations-dictionary/overtime. Accessed 01 June 2015.

European Foundation for the Improvement of Living and Working Conditions. (2012). *Fifth European working conditions survey: Overview report*. Luxembourg: Publications Office of the European Union.

Fokkema, T. (2002). Combining a job and children: Contrasting the health of married and divorced women in the Netherlands? *Social Science and Medicine, 54*(5), 741–752.

Frone, M. R., Russell, M., & Cooper, M. L. (1992a). Antecedents and outcomes of work-family conflict: Testing a model of the work-family interface. *Journal of Applied Psychology, 77*(1), 65–78.

Frone, M. R., Russell, M., & Cooper, M. L. (1992b). Prevalence of work-family conflict: Are work and family boundaries asymmetrically permeable? *Journal of Organizational Behavior, 13*(7), 723–729.

Fuss, I., Nubling, M., Hasselhorn, H. M., Schwappach, D., & Rieger, M. A. (2008). Working conditions and work-family conflict in german hospital physicians: Psychosocial and organisational predictors and consequences. *BMC Public Health, 8*, 353.

Galovan, A. M., Fackrell, T., Buswell, L., Jones, B. L., Hill, E. J., & Carroll, S. J. (2010). The work-family interface in the United States and Singapore: Conflict across cultures. *Journal of Family Psychology, 24*(5), 646–656.

Gao, Y., Shi, J., Niu, Q., & Wang, L. (2013). Work-family conflict and job satisfaction: Emotional intelligence as a moderator. *Stress and Health, 29*(3), 222–228.

Geurts, S. A. E., Taris, T. W., Kompier, M. A. J., Dikkers, J. S. E., Van Hooff, M. L. M., & Kinnunen, U. M. (2005). Work-home interaction from a work psychological perspective: Development and validation of a new questionnaire, the SWING. *Work & Stress, 19*(4), 319–339.

Grandey, A. A., & Cropanzano, R. (1999). The conservation of resources model applied to work-family conflict and strain. *Journal of Vocational Behavior, 54*(2), 350–370.

Greenhaus, J. H. (1988). The intersection of work and family roles: Individual, interpersonal, and organizational issues. *Journal of Social Behavior and Personality, 3*(4), 23–44.

Greenhaus, J. H., & Beutell, N. J. (1985). Sources and conflict between work and family roles. *Academy of Management Review, 10*(1), 76–88.

Greenhaus, J. H., Collins, K. M., Singh, R., & Parasuraman, S. (1997). Work and family influences on departure from public accounting. *Journal of Vocational Behavior, 50*(2), 249–270.

Greenhaus, J. H., Parasuraman, S., & Collins, K. M. (2001). Career involvement and family involvement as moderators of relationships between work-family conflict and withdrawal from a profession. *Journal of Occupational Health Psychology, 6*(2), 91–100.

Grice, M. M., McGovern, P. M., & Alexander, B. H. (2008). Flexible work arrangements and work-family conflict after childbirth. *Occupational Medicine, 58*(7), 468–474.

Härmä, M. (2006). Workhours in relation to work stress, recovery and health. *Scandinavian Journal of Work, Environment & Health, 32*(6), 502–514.

Higgins, C., Duxbury, L., & Julien, M. (2014). The relationship between work arrangements and work-family conflict. *Work, 48*(1), 69–81.

Hill, A. B. (1965). The environment and disease: Association or causation? *Proceedings of the Royal Society of Medicine, 58*, 295–300.

Hobfoll, S. E. (1989). Conservation of resources. A new attempt at conceptualizing stress. *American Psychologist, 44*(3), 513–524.

Hobfoll, S. E. (2001). The influence of culture, community, and the nested-self in the stress process: Advancing Conservation of Resources theory. *Applied Psychology: An International Review, 50*(3), 337–370.

Hobfoll, S. E., & Shirom, A. (2001). Conservation of Resources Theory. Applications to stress and management in the workplace. In: R. T. Golembiewski (Ed.), *Handbook of organizational behavior* (pp. 57–80). New York: Dekker.

International Agency for Research on Cancer Working Group on the evaluation of carcinogenic risks to humans. (2010). Shiftwork. In: Painting, firefighting, and shiftwork. *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans 98*, 563–764.

Jansen, N. W. H. (2003). *Working time arrangements, work-family conflict, and fatigue.* Doctoral dissertation, Maastricht, the Netherlands: Maastricht University.

Jansen, N. W. H., Kant, I., Kristensen, T. S., & Nijhuis, F. J. N. (2003a). Antecedents and consequences of work-family conflict: A prospective cohort study. *Journal of Occupational and Environmental Medicine, 45*(5), 479–491.

Jansen, N. W. H., Kant, I., Van Amelsvoort, L. G. P. M., Nijhuis, F. J. N., & Van den Brandt, P. A. (2003b). Need for recovery from work: Evaluating short-term effects of working hours, patterns and schedules. *Ergonomics, 46*(7), 664–680.

Jansen, N. W. H., Van Amelsvoort, L. G. P. M., Kristensen, T. S., Van den Brandt, P. A., & Kant, IJ., (2003c). Work schedules and fatigue: A prospective cohort study. *Occupational and Environmental Medicine, 60*(Suppl 1), i47–i53.

Jansen, N. W. H., Kant, I., Nijhuis, F. J. N., Swaen, G. M. H., & Kristensen, T. S. (2004). Impact of worktime arrangements on work-home interference among Dutch employees. *Scandinavian Journal of Work, Environment & Health, 30*(2), 139–148.

Jansen, N. W., Kant, IJ., Van Amelsvoort, L. G., Kristensen, T. S., Swaen, G. M., & Nijhuis, F. J. (2006). Work-family conflict as a risk factor for sickness absence. *Occupational and Environmental Medicine, 63*(7), 488–494.

Jansen, N. W., Mohren, D. C., Van Amelsvoort, L. G., Janssen, N., & Kant, I. (2010). Changes in working time arrangements over time as a consequence of work-family conflict. *Chronobiology International, 27*(5), 1045–1061.

Kant, I., Jansen, N. W., Van Amelsvoort, L. G., Van Leusden, R., & Berkouwer, A. (2008). Structured early consultation with the occupational physician reduces sickness absence among office workers at high risk for long-term sickness absence: a randomized controlled trial. *Journal of Occupational Rehabilitation, 18*(1), 79–86.

Kant, IJ., Bültmann, U., Schröer, C. A. P., Beurskens, A. J. H. M., Van Amelsvoort, L. G. P. M., & Swaen, G. M. H. (2003). An epidemiological approach to study fatigue in the working population: The Maastricht cohort study. *Occupational and Environmental Medicine, 60*(Suppl 1), i32–i39.

Kinnunen, U., & Mauno, S. (1998). Antecedents and outcomes of work-family conflict among employed women and men in Finland. *Human Relations, 51*(2), 157–177.

Kristensen, T. S. (2000). Workplace intervention studies. *Occupational Medicine, 15*(1), 293–305.

Leufkens, K. (2009). Full-time job plus part-time job most satisfactory combination. http://www.cbs.nl/en-GB/menu/themas/dossiers/vrouwen-en-mannen/publicaties/artikelen/archief/2009/2009-2644-wm.htm?Languageswitch=on. Accessed 01 June 2015.

Lexis, M. A., Jansen, N. W., Huibers, M. J., Van Amelsvoort, L. G., Berkouwer, A., Tjin A Ton, G., et al. (2011). Prevention of long-term sickness absence and major depression in high-risk employees: a randomised controlled trial. *Occupational and Environmental Medicine, 68*(6), 400–407.

Lidwall, U., Marklund, S., & Voss, M. (2010). Work-family interference and long-term sickness absence: a longitudinal cohort study. *European Journal of Public Health, 20*(6), 676–681.

Loudoun, R. J., & Bohle, P. L. (1997). Work/Non-work conflict and health in shiftwork: Relationships with family status and social support. *International Journal of Occupational and Environmental Health, 3*(Suppl 2), S71–S77.

Meijman, T. & Schaufeli, W. (1996). Psychische vermoeidheid en arbeid; Ontwikkelingen in de A&O-psychologie [Mental fatigue and work. Developments in Work and Organizational Psychology]. *Psycholoog 31*(6), 236–241.

Michel, J. S., Kotrba, L. M., Mitchelson, J. K., Clark, M. A., & Baltes, B. B. (2011). Antecedents of work-family conflict: A meta-analytic review. *Journal of Organizational Behavior, 32*(5), 689–725.

Mohren, D. C. L., Jansen, N. W. H., van Amelsvoort, L. G. P. M., & Kant, IJ. (2007). *An epidemiological approach of fatigue and work*. Maastricht: Programma Epidemiologie van Arbeid en Gezondheid, Maastricht University.

Mounstephen, A., & Sharpe, M. (1997). Chronic fatigue syndrome and occupational health. *Occupational Medicine, 47*(4), 217–227.

Nijp, H. H., Beckers, D. G., Geurts, S. A., Tucker, P., & Kompier, M. A. (2012). Systematic review on the association between employee worktime control and work-non-work balance, health and well-being, and job-related outcomes. *Scandinavian Journal of Work, Environment & Health, 38*(4), 299–313.

Nohe, C., Meier, L. L., Sonntag, K., & Michel, A. (2015). The chicken or the egg? A meta-analysis of panel studies of the relationship between work-family conflict and strain. *Journal of Applied Psychology, 100*(2), 522–536.

Pärnänen, A., Sutela, H., & Mahler, S. (2007). *Combining family and full-time work*. Dublin: European Foundation for the Improvement of Living and Working Conditions.

Peeters, M. C. W., Montgomery, A. J., Bakker, A. B., & Schaufeli, W. B. (2005). Balancing work and home: how job and home demands are related to burnout. *International Journal of Stress Management, 12*(1), 43–61.

Perrewé, P. L., Hochwarter, W. A., & Kiewitz, C. (1999). Value attainment: An explanation for the negative effects of work-family conflict on job and life satisfaction. *Journal of Occupational Health Psychology, 4*(4), 318–326.

Pisarski, A., Brook, C., Bohle, P., Gallois, C., Watson, B., & Winch, S. (2006). Extending a model of shift-work tolerance. *Chronobiology International, 23*(6), 1363–1377.

Putnik, K., Houkes, I., Jansen, N., Nijhuis, F., & Kant, IJ. (2016). Work-home interface in a cross-cultural context: A framework for future research and practice. *Manuscript submitted for publication*

Rindfleisch, A., Malter, A. J., Ganesan, S., & Moorman, C. (2008). Cross-sectional versus longitudinal survey research: Concepts, findings, and guidelines. *Journal of Marketing Research, 45*(3), 261–279.

Rothman, K. J., & Greenland, S. (2005). Causation and causal inference in epidemiology. *American Journal of Public Health, 95*(Suppl 1), S144–S150.

Siermann, C. (2009). The Netherlands has highest rate of part-timers in Europe. http://www.cbs.nl/en-GB/menu/themas/arbeid-sociale-zekerheid/publicaties/artikelen/archief/2009/2009-2821-wm.htm?Languageswitch=on. Accessed 01 June 2015.

Smith Major, V., Klein, K. J., & Ehrhart, M. G. (2002). Work time, work interference with family, and psychological distress. *Journal of Applied Psychology, 87*(3), 427–436.

Tang, K. (2014). A reciprocal interplay between psychosocial job stressors and worker well-being? A systematic review of the "reversed" effect. *Scandinavian Journal of Work, Environment & Health, 40*(5), 441–456.

Valcour, M. (2007). Work-based resources as moderators of the relationship between work hours and satisfaction with work-family balance. *Journal of Applied Psychology, 92*(6), 1512–1523.

Van Amelsvoort, L. G., Jansen, N. W., & Kant, I. (2006). Smoking among shift workers: More than a confounding factor. *Chronobiology International, 23*(6), 1105–1113.

Van Amelsvoort, L. G. P. M., Jansen, N. W. H., Swaen, G. M. H., Van den Brandt, P. A., & Kant, I. (2004). Direction of shift rotation in three-shift workers in relation to psychological health and work-family conflict. *Scandinavian Journal of Work, Environment & Health, 30*(2), 149–156.

Van der Hulst, M., & Geurts, S. (2001). Associations between overtime and psychological health in high and low reward jobs. *Work & Stress, 15*(3), 227–240.

Voydanoff, P. (2005). Social integration, work-family conflict and facilitation, and job and marital quality. *Journal of Marriage and Family, 67*(3), 666–679.

Wagena, E., & Geurts, S. (2000). SWING: Ontwikkeling en validering van de 'Survey Werk-thuis Interferentie-Nijmegen' [SWING: development and validation of the 'Survey Work-home Interaction Nijmegen']. *Gedrag en Gezondheid, 28*(3), 138–157.

Walker, J. (1985). Social problems of shiftwork. In: S. Folkard & T. H. Monk (Eds.) *Hours of work. Temporal factors in work-scheduling* (pp. 211–225). New York: John Wiley & Sons.

Wang, J. L., Patten, S. B., Currie, S., Sareen, J., & Schmitz, N. (2012). Predictors of 1-year outcomes of major depressive disorder among individuals with a lifetime diagnosis: a population-based study. *Psychological Medicine, 42*(2), 327–334.

Zapf, D., Dormann, C., & Frese, M. (1996). Longitudinal studies in organizational stress research: A review of the literature with reference to methodological issues. *Journal of Occupational Health Psychology, 1*(2), 145–169.

Work-Life Conflict in 'Flexible Work': Precariousness, Variable Hours and Related Forms of Work Organization

Philip Bohle

Abstract This chapter examines the relationships between different forms of 'flexible work' (precarious work, flexible working hours), selected work organization variables and work-life conflict. The growth of precarious (insecure, contingent) work has been a major contributor to the expansion of variable and unpredictable working hours, especially in developed economies. It is also associated with other negative aspects of work organization, such as diminished control at work, which may contribute to elevated work-life conflict. Focusing principally on Australian evidence, this chapter explores the relationships between these variables. Although jurisdictional differences in regulatory regimes are likely to have some influence on the strength of the relationships, international evidence is surprisingly consistent. It suggests the nature and prevalence of precarious work, and the level of control that workers can exert over their work schedules, must be carefully managed and regulated if work-life balance is to be protected and enhanced.

1 Introduction

Current debates about major challenges in the workplace, such as enhancing the workforce participation of women and older workers, frequently emphasise the importance of flexible work (Berg et al. 2014). Flexible work arrangements are often defined as work policies and practices that provide workers with a degree of control over how, where or when they work (see Hill et al. 2001; Lambert et al. 2008; Masuda et al. 2012). They focus on various aspects of work, such as where it is performed (e.g. telecommuting), how tasks and responsibilities are allocated (e.g. job sharing) and working hours (e.g. compressed working weeks or flexible hours) (Berg et al. 2014; Hayman 2009; Masuda et al. 2012). Research indicates that greater flexibility for workers can have various positive effects, such as reduced job pressure, improved job

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satisfaction, and enhanced health and wellbeing (Angrave and Charlwood 2015; Bohle et al. 2011; Masuda et al. 2012; Russell et al. 2009), although the effectiveness of different forms of flexibility may vary (Russell et al. 2009). For workers, more flexible working hours offer a particularly valuable means to diminish work-life conflict and enhance participation in family, social and leisure activities (Berg et al. 2014; Costa et al. 2006). Compared to other flexible working arrangements, flexible working hours have been most consistently and strongly linked to lower work-life conflict, although there is evidence of cultural differences in their effects (Masuda et al. 2012).

Somewhat paradoxically, the insecure and contingent forms of work organization now widely known as 'precarious work' are often described as 'flexible' too. They are generally aimed, however, at achieving the goals of employers, such as reducing labour costs and diminishing the power of workers and trade unions (Costa et al. 2006; Quinlan et al. 2001a,b). Consequently, the benefits mostly accrue to employers. It is therefore important to distinguish between employer-oriented flexibility and worker-oriented flexibility (Berg et al. 2014; Costa et al. 2004, 2006).

Contrary to accepted beliefs, there is not strong or consistent evidence that gender and marital status are linked to differences in levels of work-life conflict (e.g. Byron 2005; Hämmig et al. 2009; Hayman 2009; Hill et al. 2001; Sav and Harris 2013), although there is evidence of differences in the causes, nature and effects of the conflict (Byron 2005; Hämmig et al. 2009). A meta-analytic review of 60 studies indicated that work organization variables, such as working hours, are much more strongly associated with work-family conflict (Byron 2005). The expansion of precarious work since the 1970s (Quinlan et al. 2001b) has been an important driver of extensive changes in working hours. The 8-hour workday and 40-hour working week, or similar arrangements, were considered 'standard' for much of the 20th century (at least for males). However, the dominance of standard hours has been heavily undermined by the expansion of various forms of variable hours, such as on-call or casual work and 'zero hour' contracts, that have no set daily or weekly hours and often highly unpredictable work schedules (Berg et al. 2014; Bohle et al. 2004). In general, variable and unpredictable working hours are associated with greater work-conflict, rather than less (Bohle et al. 2004, 2011; Costa et al. 2006), which undermines claims that precarious work offers a beneficial form of flexibility for workers. On the other hand, even highly variable hours may not increase conflict if workers have sufficient control over them (Bohle et al. 2011; Costa et al. 2006; Hayman 2009).

As many different work and employment practices have been labelled flexible work, it is unsurprising that evidence about their effectiveness is mixed (Hayman 2009). Apart from differences between the types of flexibility examined, inconsistent findings may reflect other differences between studies, such as the outcome variables evaluated, the cultural and organizational contexts of the research, and whether the flexibility options are actually used by workers (Hayman 2009; Masuda et al. 2012). This chapter examines the impact of employer-oriented and worker-oriented flexibility and associated work organization variables on work-life conflict. It illustrates the complexity of the relationships between these variables and identifies implications for interventions intended to introduce effective flexibility for workers.

2 Precarious Work

The growth of precarious work has profoundly changed labour markets, particularly in developed countries where standard hours had been strongly established. Full-time, ongoing (or 'permanent') jobs have declined and been replaced by various forms of precarious work, such as casual, temporary or sub-contract work (Henly and Lambert 2014; Cranford et al. 2003). Precariousness is most often defined to include work contracts that are insecure, with no presumption of long-term tenure (Benach et al. 2014). It also includes arrangements known as 'contingent work' (Hipple 2001); that is, work offered only when required by employers, such as seasonal or casual work. Precariousness often dominates the low-wage sectors of the labour market and is associated with restricted access to sick leave, paid holidays and other benefits (Berg et al. 2014; Campbell 2004).

A large body of research on the effects of precarious work on health and wellbeing has now accumulated. Most studies indicate that precarious workers have poorer outcomes on many measures of occupational health and safety (Benach et al. 2014; Landsbergis et al. 2014; Quinlan and Bohle 2008; Quinlan et al. 2001a, b; Virtanen et al. 2005). This diverse range of measures includes factors such as health and safety knowledge and training levels as well as more common outcomes such as injury, disease, mental health and sickness absence (Quinlan et al. 2001a, Virtanen et al. 2005). Different forms of precarious work, such as temporary employment and subcontracting, may have different patterns of risk (Louie et al. 2006; Moore et al. 2004; Seifert et al. 2007, Virtanen et al. 2005). Even within the broad category of temporary work, Virtanen et al. (2005) found that a multiple-outcome morbidity index increased between temporary workers as the instability of their contracts increased from those contracted directly by a single employer (low instability) to a group with several types of temporary contracts (intermediate stability) to those specified as agency, on-call, subcontract or seasonal workers (high instability). Impaired health or disability arising from work may also present an impediment to positive participation in social and domestic life.

Although regulatory differences between, and within, countries can affect the specific employment conditions applying to precarious work, research suggests there are notable consistencies in the effects that particular types of precarious work have on health and wellbeing across legal jurisdictions (Quinlan et al. 2001a). Of course, the impact of precarious work on health and safety is not always negative (Richardson et al. 2012). For example, the variable hours often associated with casual employment may be counterbalanced to some extent by lower work intensity and more limited exposure to some physical and psychosocial hazards (Bohle et al. 2004, 2011; Mc Namara et al. 2011). Even within a particular form of precarious work, such as casual employment, differences in organizational practices can affect the *degree* of precariousness to which individuals or groups of workers are exposed (Hannif and Lamm 2005).

Formal contractual employment status may not therefore be an adequate measure of precariousness, and a poor predictor of its effects, in some circumstances

(Lewchuk et al. 2008; Quinlan and Bohle 2009). Measures based on contractual insecurity or contingency also fail to capture the precariousness experienced by many workers in nominally secure, ongoing jobs (De Cuyper and De Witte 2007; De Cuyper et al. 2009). Endemic downsizing and the expansion of outsourcing and subcontracting are common examples of management practices that have spill-over effects, extending precariousness to workers in jobs that are formally secure and ongoing (Quinlan and Bohle 2009; Vives et al. 2010).

Various factors may contribute to precariousness, which has prompted efforts to devise multidimensional measures (Hannif and Lamm 2005). An excellent example is the Employment Precariousness Scale (EPRES) developed by Vives et al. (2010). This measure includes six subscales: 'temporariness' (e.g. contract duration), disempowerment (in the negotiation of employment conditions), vulnerability (e.g. discriminatory or unjust treatment), wages (e.g. insufficient to cover basic needs), workplace rights (e.g. paid holidays or maternity leave) and the capacity to exercise workplace rights (e.g. taking holidays or sick leave). An important benefit is that it provides a quantitative index of the degree of precariousness experienced by workers. The EPRES is largely concerned with objective working conditions but is designed to collect self-report data and includes some largely subjective questions, such as those about the respondent's ability to exercise rights to holidays and sick leave.

Workers' perceptions of precariousness may actually be stronger predictors of health and wellbeing than having a precarious employment contract in some circumstances (Quinlan and Bohle 2009; Strazdins et al. 2004). While perceived job insecurity is the most common subjective measure (Vives et al. 2010), there is evidence that perceived precariousness is a broader, multidimensional phenomenon. A recent model divides perceived precariousness into three key dimensions: *job insecurity*, *powerlessness* and *insignificance* (Bohle et al. under review) and can be used to measure the degree of precariousness perceived by workers. 'Objective' job insecurity can be inferred from employment contracts (e.g. casual employment) while perceived (or 'subjective') job insecurity exists when workers fear or worry about job loss (Landsbergis et al. 2014; Strazdins et al. 2004). Objective and subjective insecurity may exist in tandem or separately. Perceived insecurity has been more consistently linked with psychological and physical ill health than objective insecurity in cross-sectional and longitudinal studies (Strazdins et al. 2004).

Powerlessness refers to a low level of control or influence at work. For example, precarious workers may report little control over how and when job tasks are done or an inability to negotiate employment conditions or exercise workplace rights (Vives et al. 2010; Wynhausen 2005). Powerlessness can also include a wider range of subjective experience, including insufficient knowledge of the workplace to exert control, lack of control over work organization (such as working hours), and inability to control events at work and prevent negative outcomes. Insignificance concerns the extent to which workers perceive themselves to be undervalued, unappreciated or denied respect by managers and employers, which can contribute to a sense of 'invisibility'. Evidence for this phenomenon emerged from qualitative research. Pocock and Masterman-Smith (2008), for example, reported a lack of dignity was an over-arching theme in interviews with low-paid (and mostly

precarious) workers, who widely reported they were not valued or appreciated. After working in a series of precarious jobs herself, Wynhausen (2005, p. 32) described the invisibility she felt as a precarious worker. In one illustration, she recounted how acquaintances failed to recognise her when she served them food and beverages. Feelings of invisibility or worthlessness are common among workers undermined by insecure work and exploitative pay systems (Pocock and Masterman-Smith 2008).

Initial empirical findings indicated that job insecurity, powerlessness and insignificance were each associated with health and work-life conflict in a sample of 1015 Australian workers aged between 18 and 74 (Bohle et al. under review). Compared to employment status (ongoing vs casual employment), perceived precariousness was more strongly related to mental health, and to job and working hours control, but had weaker associations with the length and variability of working hours. These results were consistent for job insecurity, powerlessness and insignificance measured independently and for a composite (additive) measure of the three. Significantly, perceived precariousness produced substantially stronger associations than employment status with work–life conflict. Employment status explained little of the variation in work-life conflict (0.5 %) but the perceived precariousness composite measure explained more (11 %). Of the individual perceived precariousness dimensions, powerlessness explained the highest proportion of the variation in work-life conflict (10 %), followed by insignificance (6 %) and job insecurity (4 %).

These findings suggest that precarious work is best understood as a multidimensional phenomenon that is usually employer-driven and can impose varying levels of disadvantage on workers. Employment status, multidimensional objective indices and perceived precariousness are therefore valuable complementary measures of precariousness that may be more or less applicable in particular contexts. Although the perceived precariousness measure described above was weakly correlated with employment status, it displayed a different pattern of associations with various organizational, health and quality of life variables. Of particular interest in this context was the much stronger association between perceived precariousness and work-life conflict, which was consistent irrespective of whether the overall composite measure or the separate measures of job insecurity, powerlessness or insignificance were used.

3 Work Organization and Psychosocial Variables Linked to Precariousness: Implications for Work-Life Conflict

Precarious work is associated with other important work organization and psychosocial variables that affect work-life conflict. This section briefly examines a selection of these variables: variable hours, control over working hours, and pressure, disorganization and regulatory failure.

3.1 Variable Working Hours

Research has often linked variable working hours with poorer health (e.g. Boivin et al. 2007; Costa et al. 2004; Dembe et al. 2005; Henly and Lambert 2014). There is also evidence that work-life conflict either moderates or mediates the effects of variable hours and shift work on health (Bohle and Tilley 1989; Krausz et al. 2000; Mc Namara et al. 2011; Pisarski et al. 1998; Pisarski et al. 2006). Regular working times, in terms of starting and finishing times and days of the week, provide predictability and facilitate planning of social and family life (Berg et al. 2014).

For employers, the primary attraction of various forms of precarious work is arguably to minimise costs and transfer financial risks, arising from variations in demand for their products or services, to workers. Indeed, casual workers are often assigned much more variable working hours than workers in ongoing employment (Bohle et al. 2004, 2011). Employers and politicians often argue that the variable hours in casual work are flexible for the worker, and hence family-friendly, but research often contradicts this assertion (e.g. Hayman 2009). For example, interviews with casual hotel workers in Sydney, Australia, highlighted highly variable and unpredictable working hours with low control (Bohle et al. 2004). Casuals were often allocated longer working days, longer working weeks or more weekend work than ongoing employees, while at other times they were given very little work at all. They reported shift lengths varying from two to 18 h and weekly working hours that ranged from zero to 73 h. Starting and finishing times of shifts varied extensively, some shifts were split between the early morning and mid-afternoon, and workers were often notified of the starting time for a shift and not when it would finish. The workers linked the high work-life conflict they reported to unpredictable and socially undesirable working times, low control over their work schedules and fear they would lose their jobs if they did not accept the hours they were offered. Quantitative studies have supported these qualitative findings. A study of Australian call centre workers confirmed the link between casual employment and more variable working hours, which were associated with greater dissatisfaction with work schedules and, in turn, greater work-life conflict (Bohle et al. 2011).

These studies underline the impact of variable working hours on work-life conflict in a very common form of precarious work. The qualitative study, in particular, clearly illustrates the nature and magnitude of the variability in daily and weekly working hours experienced by the casual workers. It also illustrates how unpredictability associated with variable hours can be exacerbated by negative management practices, for instance by telling workers shift starting times but not finishing times. The quantitative study also found more variable working hours in casual work and confirmed the link, via dissatisfaction with work schedules, to greater work-life conflict. These results point to the potential for greater worker control over working hours to reduce work-life conflict.

3.2 Control Over Working Hours

Despite variable working hours generally having negative effects on health and work-life conflict, flexible work arrangements can reduce work-life conflict and enhance social and domestic life. In general, workers who exert a degree of control over work schedules report less work-life conflict (Hayman 2009; Henly and Lambert 2014; Krausz et al. 2000; Mc Namara et al. 2011). For example, Mc Namara et al. (2011) found that hotel workers in ongoing employment reported significantly greater control over their working hours than casual employees, which in turn was associated with less work-life conflict and greater psychological wellbeing.

Costa et al. (2006) distinguished between two forms of flexible working hours: 'variability', which refers to hours that are largely under the control of employers, and 'flexibility', which refers to hours that are subject to greater individual worker control and discretion. Using European data collected in 15 countries, they derived three-level measures of variability (variable, partially variable, fixed) and flexibility (flexible, partially flexible, rigid). They found both variables were significantly related to almost all of the 23 health and wellbeing variables examined. Flexibility was associated with more positive outcomes in terms of job satisfaction, various health and injury variables, and work-life conflict (measured in terms of 'unfavourable adjustment to family and social commitments'). Conversely, variability was unfavourably associated with similar range of health variables and work-life conflict. In an analysis including various demographic and work-related variables, flexibility was one of the three factors most strongly related to health and wellbeing, and had the second-strongest (inverse) relationship with work-life conflict. Overall, the most favourable outcomes were associated with higher flexibility and lower variability.

An Australian study supported the findings above using a different way to measure flexibility and variability (Bohle et al. 2011). Two-week retrospective logs of shift starting and finishing times from Australian call centre workers were used to calculate variations in working hours for each worker, using mean absolute deviations of starting times, finishing times and daily shift length. Schedule control was measured using three self-report items (e.g. 'I have sufficient control over the shifts that I work'). The results indicated that greater variability was associated with greater dissatisfaction with working hours and, in turn, greater work-life conflict. However, the interaction of schedule control and variability was also associated with dissatisfaction with working hours and work-life conflict. This result indicated that the greater the level of schedule control, the smaller the effect of variable hours on dissatisfaction (and vice versa). In other words, even when hours were highly variable, high control (or worker-oriented 'flexibility' as defined by Costa et al. (2006)) reduced negative effects. Conversely, when control was low and variability high (employer-oriented 'variability') the negative effects were greatest.

Flexible hours, or 'flexitime', arrangements are perhaps the most common form of worker-oriented flexibility. While research generally indicates they are effective in reducing work-life conflict, some studies do not. Hayman (2009) examined an important intervening variable, the perceived 'usability' of the flexible work

arrangement, which helps to explain the inconsistent findings. 'Perceived usability' refers to the extent to which workers feel free to use flexible work arrangements that are formally available to them (Hayman 2009, p. 328). It may be affected by factors such as organizational culture or perceived negative effects on career advancement or other rewards at work. Hayman's findings confirmed that workers who perceived flexible hours to be 'usable' reported less work-life conflict and greater 'work-personal life' enhancement. Perceived usability may therefore represent a critical initial element of worker control, and therefore of interventions designed to enhance control. Without it, workers are less likely exercise control when it is formally available to them.

3.3 *Pressure, Disorganization and Regulatory Failure*

Various models have been developed to explain the effects of work organization and psychosocial factors on health, wellbeing and worker behaviour. Perhaps most prominent are *job strain* (Karasek 1979) and *effort-reward imbalance* (ERI, Siegrist 1996). Karasek (1979) defined job strain as a combination of high job demands and limited work control but later expanded the model to include effects of social support (Karasek and Theorell 1990). Elements of this model have been linked to health in many occupational groups. For example, Marmot et al. (1997, 1998) found that psychosocial conditions at work, particularly low job control, were contributors to the social gradient in health. However, empirical support for important elements of the model, particularly the interaction between work demands and control, has been mixed at best (Sargent and Terry 1998; Schreurs and Taris 1998; Shirom et al. 2008).

Siegrist (1996) proposed that an imbalance between effort and rewards at work adversely affects health and wellbeing. Many studies have subsequently identified negative relationships between imbalance and various indices of physical and mental health and wellbeing (e.g. Gilbert-Ouimet et al. 2012; Wang et al. 2012). Kinman and Jones (2008) also reported that effort and rewards explained 42 % of the variation in work–life conflict among university employees. Comparisons of job strain and ERI indicate that ERI is generally the stronger predictor of health and wellbeing (e.g. Calnan et al. 2004; Ostry et al. 2003).

The Pressure, Disorganization and Regulatory Failure (PDR) framework has recently been developed as an alternative explanation for the effects of work organization and psychosocial factors on health and safety at work (Bohle et al. 2015). The PDR variables are likely to have negative effects in any work context, but they may be particularly useful for explaining associations between precarious work and poorer health and safety. Pressure consists of two related components: *financial pressure* and *reward pressure*. Financial pressure arises from inadequate income, which may be associated with factors such as contingent work, variable working hours or a lack of benefits (such as paid holidays and sick leave, or premiums for night, evening or weekend work). For example, variable income from casual work

may provide insufficient funds for workers and their families to meet financial commitments, such rent payments, or to secure mortgages or other loans. Reward pressure arises from employment arrangements (such as subcontracting) and payment systems (such as piecework) that require or encourage workers to work too intensely, sacrifice the quality of their work, or take shortcuts in health and safety.

Disorganization concerns disrupted and inefficient work arising from ineffective communication and failures to follow appropriate procedures. It may reflect ineffective formal and informal communication between groups of workers, such as employees and contractors, or between workers and management. Ineffective communication may contribute to inadequate knowledge of procedures or work responsibilities and to the activities of some workers disrupting the work of others. Another contributing factor may be excessive use of inexperienced or poorly trained workers, combined with ineffective induction, training and supervision, which are often found in workplaces with high concentrations of precarious workers. Disorganization arising from downsizing or restructuring may contribute to role ambiguity, uncertainty and ineffective decision-making that, in turn, have negative effects on mental health (Isaksson et al. 1999; Reissman et al. 1999). Regulatory Failure concerns failures in the application of labour standards, the allocation of employer responsibilities, and monitoring and enforcement of legal requirements concerning work and the workplace. It also refers to limitations of workers' knowledge of relevant rules, standards and responsibilities and to their capacity or willingness to report problems. Bernstein et al. (2006), for example, identified several regulatory failures associated with precarious work: inadequate worker protection, discrimination, and limitations of compliance and enforcement.

Pressure, disorganization and regulatory failure may each contribute to work-life conflict. For example, workers experiencing elevated levels of financial and pressure, perhaps due to poor hourly pay rates or piecework, may be encouraged to improve their incomes by seeking longer and more antisocial working hours. Disorganisation associated with downsizing may encourage long working hours and presenteeism and therefore increase work–life conflict (Simpson 2000). Inefficient and disrupted communication, which is a core element of the disorganization construct, may also increase work-life conflict by, for example, impairing or discouraging workers' use of flexible working hours arrangements. Regulatory failure may contribute to work-life conflict through, for example, the breakdown of protections against discrimination by managers or employers, particularly among more vulnerable precarious workers. An initial cross-sectional study of Australian workers aged between 45 and 65 identified links between PDR and work-life conflict (Bohle et al. 2015). Each PDR variable was significantly related to work-life conflict, with reward pressure having the strongest association, followed by regulatory failure, financial pressure and disorganization. In comparison to effort-reward imbalance, the PDR variables displayed slightly stronger associations with mental health and slightly weaker ones with work-life conflict. Initial analyses of longitudinal data drawn from the same study suggest that PDR also predicts work-life conflict over time.

4 Structural Relationships Between Precariousness, Working Hours and Work Schedule Control and Their Effects on Work-Life Conflict

This section focuses on Australian research examining the structural relationships between precarious work, variable working hours, perceived work schedule control and work-life conflict. The form of precarious work examined is casual employment and it is compared with ongoing ('permanent') work. In Australia, casual employment is defined as work in which the employee does not have access to various rights and benefits, including notice of dismissal, redundancy or severance pay, paid annual leave or sick leave, and paid public holidays (Campbell 2004). Casual employees comprised 19 % of the Australian workforce in 2012, the most recent year for which data are available (Australian Bureau of Statistics 2013).

The study of call centre workers in Sydney described in 3.2 above identified a set of structural relationships between precariousness (casual work), variable hours, work schedule control, work-life conflict and health (Bohle et al. 2011). The final structural model is presented in Fig. 1. It indicated that casual work was directly associated with working hours variability and that variability was, in turn, directly associated with the level of dissatisfaction with working hours, which was associated with greater work-life conflict. Importantly, however, the interaction between worker control over work schedules and hours variability was associated as strongly with hours dissatisfaction, and therefore indirectly with work-life conflict, as the variability of hours alone. This interaction indicated that the negative effect of

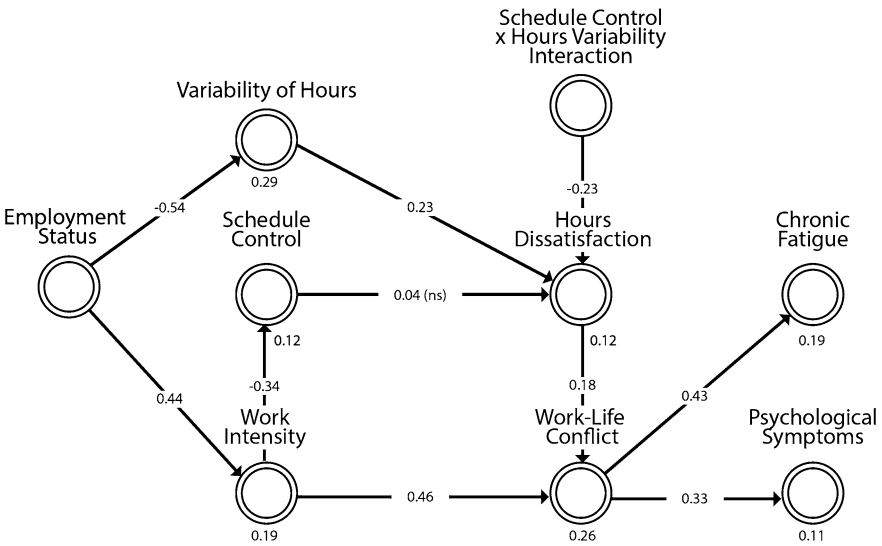

Fig. 1 Structural relationships between employment status, variability of working hours, schedule control, work-life conflict and health (*Source* Bohle et al. 2011)

variable hours on dissatisfaction and work-life conflict diminished as worker control over the work schedule control increased. Ongoing workers reported greater work intensity than casual workers, which was associated with less work schedule control and greater work-life conflict. These findings illustrate the complexity of the relationships between some of the work organisation variables that can influence work-life conflict. This complexity is a significant challenge to effective management of working hours and work-life conflict.

Similarly, Mc Namara et al. (2011) examined the structural relationships between precarious work (casual employment) and various work organization variables, including excessive working hours, control over work schedules and work-life conflict. Dissatisfaction with working hours and the interaction of schedule control with variability of working hours were not measured. However, this study produced evidence supporting the relationship between work schedule control and work-life conflict and the contribution of excessive working hours to work-life conflict. Once again, work intensity was more likely to be experienced by ongoing employees and was associated directly with work-life conflict.

5 Conclusions

Work organization can be a powerful, and often negative, influence on workers' domestic and social lives. Flexible work arrangements can help to diminish negative effects including work-life conflict. It is important, however, to distinguish between employer-oriented and worker-oriented forms of flexibility. Precarious work, which is usually employer-oriented, often produces greater work-life conflict, particularly if it entails variable and unpredictable hours over which workers exert limited control. Preliminary research also suggests that elements of perceived precariousness—job insecurity, powerlessness and insignificance—may contribute to work-life conflict. So, too, may work organisation variables closely associated with precariousness, such as pressure, disorganisation and regulatory failure. On the other hand, flexible working time arrangements that boost worker control provide a particularly effective form of worker-oriented flexibility that can reduce work-life conflict and enhance participation in work, family and social life. They are likely to be more effective if workers perceive them to be usable, they are administered consistently, and participation in them does not produce negative consequences at work (Hayman 2009). Ensuring flexible work arrangements are usable and effective is a major challenge facing labour market policy makers, employers, trade unions and workers themselves.

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References

Angrave, D., & Charlwood, A. (2015). What is the relationship between long working hours, over-employment, under-employment and the subjective well-being of workers? Longitudinal evidence from the UK. *Human Relations, 68*(9), 1491–1515.

Australian Bureau of Statistics. (2013). *6359.0 Forms of employment, November 2012*. Canberra: Australian Bureau of Statistics. Retrieved from http://www.abs.gov.au

Benach, J., Vives, A., Amable, M., Vanroelen, C., Tarafa, G., & Muntaner, C. (2014). Precarious employment: Understanding an emerging social determinant of health. *Annual Review of Public Health, 35*, 229–253.

Berg, P., Bosch, G., & Charest, J. (2014). Working-time configurations: A framework for analyzing diversity across cultures. *Industrial and Labor Relations Review, 67*(3), 805–837.

Bernstein, S., Lippel, K., Tucker, E., & Vosko, L. F. (2006). Precarious employment and the law's flaws: Identifying regulatory failure and securing effective protection for workers. In L. F. Vosko (Ed.), *Precarious employment: Understanding labour market insecurity in Canada* (pp. 203–220). Montreal: McGill-Queen's University Press.

Bohle, P., Pitts, C., Mc Namara, M. & Quinlan, M. (under review). Powerlessness, insignificance and job insecurity: Evaluating a new measure of perceived precariousness.

Bohle, P., Quinlan, M., Kennedy, D. & Williamson, A. (2004). Working hours, work-life conflict and health: A comparison of precarious and "permanent" employment, *Revista de Saúde Pública (Journal of Public Health*), *38*, 19–25 (Suplemento, Dezembro).

Bohle, P., Quinlan, M., Mc Namara, M., Pitts, C., & Willaby, H. (2015). Health and well-being of older workers: Comparing their associations with effort–reward imbalance and pressure, disorganisation and regulatory failure. *Work & Stress*, *29*(2), 114–127.

Bohle, P., & Tilley, A. J. (1989). The impact of night work on psychological well-being. *Ergonomics, 32*(9), 1089–1099.

Bohle, P., Willaby, H., Quinlan, M., & McNamara, M. (2011). Flexible work in call centres: Working hours, work-life conflict and health. *Applied Ergonomics, 42*, 219–224.

Boivin, D. B., Tremblay, G. M., & James, F. O. (2007). Working on atypical schedules. *Sleep Medicine, 8*(6), 578–589.

Byron, K. (2005). A meta-analytic review of work-family conflict and its antecedents. *Journal of Vocational Behavior, 67*, 169–198.

Calnan, M., Wadsworth, E., May, M., Smith, A., & Wainwright, D. (2004). Job strain, effort–reward imbalance, and stress at work: Competing or complementary models? *Scandinavian Journal of Public Health, 32*, 84–93.

Campbell, I. (2004). Casual work and casualisation: How does Australia compare? *Labour & Industry, 15*(2), 85–111.

Costa, G., Åkerstedt, T., Nachreiner, F., Baltieri, F., et al. (2004). Flexible Working Hours, Health, and Well-Being in Europe: Some Considerations from a SALTSA Project. *Chronobiology International, 21*(6), 831–844.

Costa, G., Sartori, S., & Åkerstedt, T. (2006). Influence of flexibility and variability of working hours on health and well-being. *Chronobiology International, 23*(6), 1125–1137.

Cranford, C. J., Vosko, L. F., & Zukewich, N. (2003). The gender of precarious employment in Canada. *Relations Industrielles-Industrial Relations, 58*(3), 454–482.

De Cuyper, N., & De Witte, H. (2007). Job insecurity in temporary versus permanent workers: Associations with attitudes, well-being, and behaviour. *Work & Stress, 21*(1), 65–84.

De Cuyper, N., Notelaers, G., & De Witte, H. (2009). Job insecurity and employability in fixed-term contractors, agency workers, and permanent workers: Associations with job satisfaction and affective organizational commitment. *Journal of Occupational Health Psychology, 14*(2), 193–205.

Dembe, A. E., Erickson, J. B., Delbos, R. G., & Banks, S. M. (2005). The impact of overtime and long work hours on occupational injuries and Illnesses: New evidence from the United States. *Occupational and Environmental Medicine, 62*(9), 588–597.

Gilbert-Ouimet, M., Brisson, C., Vezina, M., Milot, A., & Blanchette, C. (2012). Repeated exposure to effort–reward imbalance, increased blood pressure, and hypertension incidence among white-collar workers: Effort–reward imbalance and blood pressure. *Journal of Psychosomatic Research, 72*, 26–32.

Hämmig, O., Gutzwiller, F., & Bauer, G. (2009). Work-life conflict and associations with work- and nonwork-related factors and with physcial and mental health outcomes: A nationally representative cross-sectional study in Switzerland. *BMC Public Health, 9*, 435.

Hannif, Z., & Lamm, F. (2005). When non-standard work becomes precarious: Insights from the New Zealand call centre industry. *Management Revue, 16*(3), 324–350.

Hayman, J. R. (2009). Flexible work arrangements: Exploring the linkages between perceived usability of flexible work schedules and work/life balance. *Community, Work and Family, 12* (3), 327–338.

Henly, J. R., & Lambert, S. J. (2014). Unpredictable work timing in retail jobs: Implications for employee work-life conflict. *Industrial and Labor Relations Review, 67*(3), 986–1016.

Hill, E. J., Hawkins, A. J., Ferris, M., & Weitzman, M. (2001). Finding an extra day a week: The positive influence of perceived job flexibility on work and family life balance. *Family Relations, 50*(1), 49–58.

Hipple, S. (2001). Contingent work in the late 1990s. *Monthly Labor Review, 124*(3), 3–27.

Isaksson, K., Hellgren, J., & Petterson, P. (1999). Repeated downsizing: Attitudes and well-being for surviving personnel in a Swedish retail company. In K. Isaksson, C. Hogstedt, C. Eriksson, & T. Theorell (Eds.), *Health Effects of the new labour market* (pp. 85–101). New York, NY: Kluwer Academic Publishers.

Karasek, R. A. (1979). Job demands, job decision latitude, and mental strain: Implications for job redesign. *Administrative Science Quarterly, 24*, 285–308.

Karasek, R. A., & Theorell, T. (1990). *Healthy work: Stress, productivity and the reconstruction of work life*. New York, NY: Basic Books.

Kinman, G., & Jones, F. (2008). Job-related efforts, rewards and over-commitment: Predicting strain in academic employees. *International Journal of Stress Management, 15*, 381–395.

Krausz, M., Sagie, A., & Bidermann, Y. (2000). Actual and preferred work schedules and scheduling control as determinants of job-related attitudes. *Journal of Vocational Behavior, 56*(1), 1–11.

Lambert, A. D., Marler, J. H., & Gueutal, H. G. (2008). Individual differences: Factors affecting employee utilization of flexible work arrangements. *Journal of Vocational Behavior, 73*, 107–117.

Landsbergis, P. A., Grzywacz, J. G., & LaMontagne, A. D. (2014). Work organization, job insecurity, and occupational health disparities. *American Journal of Industrial Medicine, 57*, 495–515.

Lewchuk, W., Clarke, M., & de Wolff, A. (2008). Working without commitments: Precarious employment and health. *Work, Employment & Society, 22*(3), 387–406.

Louie, A. M., Ostry, A. S., Quinlan, M., & Keegel, T. (2006). Empirical study of employment arrangements and precariousness in Australia. *Relations Industrielles, 61*(3), 465.

Marmot, M., Bosma, H., Hemingway, H., Brunner, E., & Stansfeld, S. (1997). Contribution of job control and other risk factors to social variations in coronary heart disease. *The Lancet, 350*, 235–239.

Marmot, M. G., Fuhrer, R., Ettner, S. L., Marks, N. F., Bumpass, L. L., & Ryff, C. D. (1998). Contribution of psychosocial factors to socioeconomic differences in health. *The Milbank Quarterly, 76*, 403–448.

Masuda, A. D., Poelsmans, S. A. Y., Allen, T. D., Spector, P. E., et al. (2012). Flexible work arrangements availability and their relationship with work-to-family conflict, job satisfaction, and turnover intentions: A comparison of three country clusters. *Applied Psychology: An International Review, 61*(1), 1–29.

Mc Namara, M., Bohle, P., & Quinlan, M. (2011). Precarious employment, working hours, work-life conflict and health in hotel work. *Applied Ergonomics, 42*, 225–232.

Moore, S., Grunberg, L., & Greenberg, E. (2004). Repeated downsizing contact: The effects of similar and dissimilar layoff experiences on work and well-being outcomes. *Journal of Occupational Health Psychology, 9*(3), 247–257. doi:10.1037/1076-8998.9.3.247

Ostry, A., Kelly, S., Demers, P., Mustard, C., & Hertzman, C. (2003). A comparison between the effort–reward imbalance and demand control models. *BMC Public Health, 3*, 10–21.

Pisarski, A., Bohle, P., & Callan, V. J. (1998). Effects of coping strategies, social support and work-nonwork on shift workers' health. *Scandinavian Journal of Work, Environment & Health, 24*(suppl. 3), 141–145.

Pisarski, A., Brook, C., Bohle, P., Gallois, C., Watson, B., & Winch, S. (2006). Extending a model of shiftwork tolerance. *Chronobiology International, 23*(6), 1363–1377.

Pocock, B., & Masterman-Smith, H. (2008). *Living low paid: The dark side of prosperous Australia*. Crows Nest, N.S.W: Allen & Unwin.

Quinlan, M., & Bohle, P. (2008). Under pressure, out of control or home alone? Reviewing research and policy debates on the OHS effects of outsourcing and home-based work. *International Journal of Health Services, 38*(3), 489–523.

Quinlan, M., & Bohle, P. (2009). Over-stretched and unreciprocated commitment: Reviewing research on the OHS effects of downsizing and job insecurity. *International Journal of Health Services, 39*, 1–44.

Quinlan, M., Mayhew, C., & Bohle, P. (2001a). The global expansion of precarious employment, work disorganisation and occupational health: A review of recent research. *International Journal of Health Services, 31*(2), 335–414.

Quinlan, M., Mayhew, C., & Bohle, P. (2001b). The global expansion of precarious employment, work disorganisation and occupational health: Placing the debate in a comparative historical context. *International Journal of Health Services, 31*(3), 507–536.

Reissman, D. B., Orris, P., Lacey, R., & Hartman, D. E. (1999). Downsizing, role demands, and job stress. *Journal of Occupational and Environmental Medicine, 41*(4), 289–293.

Richardson, S., Lester, L., & Zhang, G. (2012). Are casual and contract terms of employment hazardous for mental health in Australia? *Journal of Industrial Relations, 54*(5), 557–578.

Russell, H., O'Connell, P. J., & McGinnity, F. (2009). The impact of flexible working arrangements on the work-life conflict and work pressure in Ireland. *Gender, Work and Organization, 16*(1), 73–97.

Sargent, L. D., & Terry, D. J. (1998). The effects of work control and job demands on employee adjustment and work performance. *Journal of Occupational and Organisational Psychology, 71*, 219–236.

Sav, A., & Harris, N. (2013). Work-life conflict in Australian Muslims: Is gender important? *Gender in Management, 28*(8), 486–504.

Schreurs, P. J. G., & Taris, T. W. (1998). Construct validity of the demand–control model: A double cross-validation approach. *Work and Stress, 12*, 66–84.

Seifert, A. M., Messing, K., Riel, J., & Chatigny, C. (2007). Precarious employment conditions affect work content in education and social work: Results of work analyses. *International Journal of Law and Psychiatry, 30*(4), 299–310.

Shirom, A., Toker, S., Berliner, S., & Shapira, i. (2008). The job demand–control–support model and stress related low-grade inflammatory responses amongst healthy employees: A longitudinal study. *Work and Stress, 22*, 138–152.

Siegrist, J. (1996). Adverse health effects of high-effort/low-reward conditions. *Journal of Occupational Health Psychology, 1*(1), 27–41.

Simpson, R. (2000). Presenteeism and the impact of long hours on managers. In D. Winstanley & J. Woodall (Eds.), *Ethical issues in contemporary human resource management* (pp. 156–171). Basingstoke: Macmillan Business.

Strazdins, L., D'Souza, R. M., Lim, L. L. Y., Broom, D. H., & Rodgers, B. (2004). Job strain, job insecurity, and health: Rethinking the relationship. *Journal of Occupational Health Psychology, 9*(4), 296–305.

Virtanen, M., Kivimaki, M., Joensuu, M., Virtanen, P., Elovainio, M., & Vahtera, J. (2005). Temporary employment and health: A review. *International Journal of Epidemiology, 34*, 610–622.

Vives, A., Amable, M., Ferrer, M., Moncada, S., Llorens, C., Muntaner, C., et al. (2010). The Employment Precariousness Scale (EPRES): Psychometric properties of a new tool for epidemiological studies among waged and salaried workers. *Occupational and Environmental Medicine, 67*, 548–555.

Wang, J. L., Smailes, E., Sareen, J., Schmitz, N., Fick, G., & Patten, S. (2012). Three job-related stress models and depression: A population-based study. *Social Psychiatry and Psychiatric Epidemiology, 47*, 185–193.

Wynhausen, E. (2005). *Dirt cheap: Life at the wrong end of the job market*. Sydney: MacMillan.

Part III
Consequences of Shift Work and Non-standard Work Hours for Workers and Their Families

Parents Working Non-standard Schedules and Schools Operating in Two Shifts: Effects on Sleep and Daytime Functioning of Adolescents

Biserka Radošević-Vidaček, Adrijana Košćec and Marija Bakotić

Abstract This chapter examines how parental engagement in shift work affects sleep and daytime functioning in adolescents. The subject is introduced by an overview of biological and contextual factors that determine sleep in adolescents, and of parental influences on adolescents' sleep. In a new study, we explored the effects of parents' shift work on sleep quality and daytime functioning of adolescents. Data came from primary-school adolescents (11–14 years) and secondary-school adolescents (15–18 years) from Croatia (N = 1368), who were living with both employed parents, of whom both, one or neither were shift workers. The adolescents' school schedule alternated between a week of morning classes and a week of afternoon classes. We did not find any negative effect of parents' shift work on the sleep quality of adolescents. However, we found a significant negative effect on depressed mood for all adolescents ($p < 0.01$, eta = 0.10), and a negative effect on daytime sleepiness limited to secondary-school adolescents ($p < 0.05$, eta = 0.22). Sleepiness made the greatest contribution to depressed mood ($\beta = 0.42$, $p < 0.001$), but it did not cancel out the contribution of shift work (when both parents were shift workers) as a predictor of depressed mood ($\beta = 0.09$, $p < 0.001$). The results add to previous knowledge on the negative effects of parents' engagement in shift work on the sleep patterns of adolescents. Implications for future studies are discussed.

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1 Introduction

According to the bioecological approach (Bronfenbrenner and Morris 2006) activities and relations within a family are shaped by a broad context that includes factors such as the parents' workplace and the child's school. One way in which these two factors impact family life is through the temporal organization of the lives of family members.

The main external factor affecting the temporal structure of a 24 h period for the majority of parents is working time. In addition to standard working time, parents' employment can take various non-standard forms that are common in many countries, e.g. Australia (Australian Bureau of Statistics 2009), Canada (Williams 2008), the US (Presser 2005) and countries of the European Union (Eurofound 2012). Data from 27 EU countries showed that 21 % of wage earners did shift work, 5 % worked at night often/very often per month, 18 % worked during weekends, and 22 % worked on call. Men and women were equally likely to work shifts and on weekends, but night work and work on-call were more likely in male wage earners (Eurofound 2012). Couples without children and couples living with children did not differ in prevalence of shift work, work on night shifts, or weekend work. However, more couples with children worked on-call, and on-call work was more common as the age of children increased.

For adolescents, the main external factor affecting the temporal structure of the 24 h period is the school schedule, just as working time affects the temporal organisation of the 24 h period of their parents. In a majority of countries classes for adolescents start in the morning and end in the afternoon. However, in some countries classes do not necessarily start in the morning because schools lack sufficient capacity, or because adolescents are employed during the day (Bray 1990; Fischer et al. 2008). Such schools organize classes in two or more shifts, and students can attend classes on a fixed shift schedule—at the same time every school day—or they can change shifts, e.g. on a weekly basis.

Therefore, the daily time structure in a family with employed parents and adolescent children can be quite complex. Volger et al. (1988) demonstrated the complexity of this structure when looking at fathers working different non-standard shifts with their children attending school in the morning. If we also take into account different possible forms of mothers' working schedules and different possible schedules of school time of adolescent children, there are many possibilities for match or mismatch between the parent's and adolescent's 24 h routine.

The effects of parents' non-standard working time on the development and well-being of adolescent children have been studied within different conceptual models (Barnett and Gareis 2007; Crouter and McHale 2005; Davis et al. 2006; Li et al. 2014), and the non-standard working time has been shown to be a risk factor for some domains of adolescents' health and development (Li et al. 2014). However, only a few studies have looked at the effect of parental work schedules on adolescents' sleep (Adam et al. 2007; Chen et al. 2013; Lowson et al. 2013; Radosevic-Vidacek and Koscec 2004; Wight et al. 2009), although numerous other

protective and risk factors for adolescents' sleep have been studied—as reviewed recently by Bartel et al. (2015), Becker et al. (2015) and Owens et al. (2014). Such studies need to explore the complex relations between the characteristics of parental working time and the school time of adolescents, taking into account other possible contextual and moderating factors, and should try to identify which factors mediate possible associations.

2 Sleep and Daytime Functioning of Adolescents

Adolescents' sleep need ranges between 8.50 and 9.25 h per night (Carskadon et al. 1980) but many adolescents throughout the world do not get enough sleep because their sleep patterns show specific changes in the period of adolescence (e.g. as reviewed by Gradisar et al. 2011).

The changes in sleep patterns of adolescents are driven by biological changes in the circadian and homeostatic processes regulating sleep and wakefulness. They are also reinforced or stimulated by various psychosocial factors, such as peer and parental influences, and contextual factors, such as school start time, employment, and the availability and use of electronic devices in the bedroom.

Studies on the circadian phase in adolescence have found that with advancing age and in comparison to pre-pubertal children adolescents show more pronounced eveningness, i.e. they show a phase delay for various activities occurring within the 24 h period (e.g. Andrade and Menna-Barreto 2002; Carskadon et al. 1993; Diaz-Morales et al. 2007; Gau and Soong 2003; Giannotti et al. 2002; Kim et al. 2002; Koscec et al. 2014; Randler et al. 2009). The evening preferences of adolescents are associated with later bedtimes, later wake-up times, and shorter sleeps on school days, and with greater sleep irregularity between school nights and weekend nights.

Regarding the homeostatic process regulating sleep in adolescence, a slower accumulation of sleep pressure was found (Carskadon et al. 1980; Taylor et al. 2005). The interaction of the phase delay in circadian rhythms and slower accumulation of sleep pressure contribute significantly to the difficulties adolescents have with falling asleep in the evening. Using technology for socializing and entertaining late in the evening may cause a further delay of the circadian phase because of exposure to artificial light and reduction of the remaining sleep pressure (Crowley and Carskadon 2010).

The main contextual factor associated with adolescents' sleep is school time. In many countries a morning start of classes significantly determines the time when adolescents wake up and how long they sleep (e.g. Andrade and Menna-Barreto 2002; Chen et al. 2014; Tynjala et al. 1993; Vedaa et al. 2012; Wolfson and Carskadon 1998). An early start of classes is not in tune with a delay in phase of adolescents' circadian rhythms, because it requires them to go to bed at a time when their alertness is still high, and to be active at a time of day when their wakefulness is still low.

However, not all adolescents attend school on a fixed morning schedule. The majority of schools in Croatia, for example, organize classes both in the morning

and in the afternoon, with an alternating schedule. On a school week with a morning schedule Croatian adolescents do not get enough sleep, just like their counterparts in other countries, with evening types getting less than 7 h of sleep per night. However, every other week, when they attend school in the afternoon, the later start time of school does not limit their wake-up time and their actual sleep patterns are more in agreement with the delays of their circadian phase. Consequently, they wake up later, and even the evening types—the most affected by a morning start of classes—sleep on average 8.7 h, the amount of sleep necessary for their age (Koscec et al. 2014). A similar advantage of school scheduled for the afternoon was found in Mexican adolescents (Valdez et al. 1996).

Many studies have pointed to the relationship between inadequate sleep and sub-optimal daytime functioning of adolescents (as reviewed by e.g. Becker et al. 2015; Dahl and Lewin 2002; Koscec et al. 2008; O'Brien 2009; Owens et al. 2014). It has been demonstrated that adolescents who do not get enough sleep have more behavioural problems, have more trouble remaining awake during the day, show poorer academic performance, have higher levels of anxiety and depression, consume more alcohol and drugs, have lower self-esteem and achievement motivation, have an increased risk of suicidal ideation, have problems with excess weight, and have increased sleepiness while driving.

3 Influence of Parents on Adolescents' Sleep

Family processes, which include various parenting practices and styles, have been postulated to be mediators in the association between parents' non-standard work schedules and the well-being of children (Li et al. 2014). In the period adolescence they shape sleep of adolescents together with adolescents' increasing attempt to achieve autonomy over their sleep. The developmental stage at which adolescents begin to move towards autonomy in decisions about sleep may also depend on whether parents and adolescents perceive that a particular sleep behaviour (e.g. going to bed late on school nights) belongs to the domain of health or the personal domain (Smetana et al. 2005).

The parental control of sleep can also be related to parents' knowledge about the sleep of their adolescent children. Parents are relatively good at estimating sleep problems that are observable, but often do not recognize that an adolescent has a sleep problem (Roeser et al. 2012; Short et al. 2013a). In addition, parents perceive the sleep patterns of adolescents as more optimal than reported in adolescents' surveys and diaries (Short et al. 2013b). Therefore, the use of parental reports as valid estimates of adolescent sleep has been questioned, and the importance of educating parents about healthy sleep behaviour has been stressed (Short et al. 2013b).

3.1 Parenting Practices

The influence of parents on the sleep of adolescent children has mostly been examined in the domain of parenting practices related to bedtime. Studies about parental control of bedtime in various countries have shown that control is more prevalent during the school week than at weekends, and that parents are increasingly willing to give up control over bedtime as adolescents develop (Carskadon 1990, 2002; Giannotti et al. 2002, 2005; Loessl et al. 2008; National Sleep Foundation 2006; Nusrat et al. 2012; Radosevic-Vidacek and Koscec 2004; Randler et al. 2009; Short et al. 2011).

When studying parental practices regarding the control of bedtime it should be taken into account that adolescents do not necessarily follow the bedtime set by parents but go to bed later (Gangwisch et al. 2010; National Sleep Foundation 2006). A further question is whether parents believe that they should control the actual bedtime of adolescents and are willing and able to control it, e.g. by entering the bedroom, ensuring that the adolescent does not perform any activity in bed, and that various devices present in the bedroom are switched off and that the light is turned off (Buxton et al. 2015; Meijer et al. 2001).

While most studies explored whether parents or adolescents set the bedtime and at what time, the study by Wray-Lake et al. (2010) pointed to a need for exploring joint parent-adolescent decisions about bedtime. This kind of decision about bedtime could possibly explain some differences in reports about the parental control of bedtime made by adolescents and parents.

Most parental practices have a positive effect on the sleep duration of adolescents (Adam et al. 2007; Buxton et al. 2015; Gangwisch et al. 2010; Maume 2013; Meijer et al. 2001; Pieters et al. 2014; Randler et al. 2009; Short et al. 2011, 2013c). However, results on the effects of parental practices on sleep quality are mixed. Meijer et al. (2001) found that none of the parental practices (as reported by children) was associated with sleep quality at the transition to adolescence. Based on parental reports, Buxton et al. (2015) found that always enforcing a bedtime rule was a significant predictor of excellent sleep quality in children and adolescents aged 6–17 years. Maume (2013) showed that an increase in parental monitoring from early adolescence (age 12 years) to mid-adolescence (age 15 years) had a negative effect on sleep quality.

A small number of studies have indicated that positive effects of parental practices regarding set bedtime extend to the daytime functioning of adolescents, including lower levels of tiredness and less difficulty maintaining wakefulness (Short et al. 2011), and lower risk for depression and suicidal ideation (Gangwisch et al. 2010).

It is pertinent to ask whether the parentally set bedtime clashes with the circadian and homeostatic processes that determine how ready the adolescent is for sleep, and whether interfering with these processes constitutes a risk factor for prolonged sleep latency. Short et al. (2011) showed that a group of adolescents who had a parentally set bedtime and another without a set bedtime did not differ in sleep latency, indicating that a parentally set bedtime did not force adolescents to attempt to

initiate sleep before they were physiologically ready for it. However, experimental studies have indicated that it is possible to advance the bedtime of adolescents to some extent, with positive effects on some aspects of sleep and cognitive performance, but with possible negative effects on sleep latency and time in bed (Dewald-Kaufmann et al. 2013; Sadeh et al. 2003).

Data on parental assistance in waking-up have been reported less often (Carskadon 2002; Giannotti et al. 2002; Radosevic-Vidacek and Koscec 2004). The results of these studies show that during the school week parents participate more in the awakening of younger than older adolescents. Parental participation in the awakening of adolescents has been characterized more as 'assistance' than control (Carskadon 2002), at least on weekdays when wake-up time is mainly determined by school start-time and the time required for travel to school. On school days the presence of parents is a welcome aid to awakening. However, parents can also assist in awakening from a distance, e.g. from work, through pre-arranged wake-up calls or calls made to check whether an adolescent is awake (a practice which might be used particularly when a parent knows that the adolescent has problems with awakening).

3.2 Parenting Styles and Other Parents' Characteristics

Associations between the sleep of adolescents and various parental styles have been explored, including the style characterized by wider behavioural control, positive styles characterized by warmth, closeness, connectedness, support, involvement and commendation, and negative styles characterized by reproach, restriction, inconsistency and conflicts (Adam et al. 2007; Bajoghli et al. 2013; Brand et al. 2009a, b; Buxton et al. 2015; Kuo et al. 2015; Tynjala et al. 1999; Vazsonyi et al. 2015; Vignau et al. 1997; Yen et al. 2008). Several studies have explored associations between the sleep characteristics of adolescents and their parents (Bajoghli et al. 2013; Chen et al. 2014; Gau and Merikangas 2004; Kalak et al. 2012; Tu et al. 2015; Zhang et al. 2010). They indicate that the strength of associations between mother-adolescent and father-adolescent sleep are related to the different parenting roles of mothers and fathers, and that these associations may be modified by contextual factors of adolescents' school time and parents' employment A daily concordance between the sleep of the primary caregiver (in most cases the mother) and the sleep of adolescents was also found (Fuligni et al. 2015).

As discussed in the review by Meltzer and Montgomery-Downs (2011), studies on the associations between parenting style, family problems, home atmosphere, parents' sleep and adolescents' sleep suggest that these relationships are dynamic. Poor parenting or family functioning may affect the sleep of adolescents, and be a result of poor or insufficient sleep of the parents themselves. Poor sleep in parents may be related to various factors, including poor sleep in their adolescent children, anxiety while waiting for adolescents to return home, or delayed sleep because of late-evening out-of-school activities of adolescents (Meltzer and Montgomery-Downs 2011). But disturbed and insufficient sleep in parents can also be related to factors outside the

family, as is the case for parents engaged in shift work, and as has been shown in numerous studies on the sleep of shift workers (e.g. as reviewed by Akerstedt 2003).

4 Parents' Non-standard Working Time and Sleep of Adolescents

The most direct way in which non-standard working arrangements may affect adolescents is through the dimension of time. How much time parents have for adolescents and at what time they are available to interact, help and monitor their adolescent children is significantly determined by various dimensions of working time patterns, and the associated commuting time (Crouter and McHale 2005; Presser 2005). Harma et al. (2015) identified 29 variables and arranged them into four dimensions of working time patterns potentially relevant for health: length of working hours, time of day worked, shift intensity (regarding consecutive shifts and recovery time between the shifts) and the so-called dimension of 'social aspects of the working hours' (regarding distribution of free days, irregularity and predictability of working hours, and control of work time). In the case of parents engaged in shift work these characteristics may be relevant not only to the health of parents, but also to the time parents devote to their children and to the quality of their parenting processes.

The results of studies on the effects of non-standard work patterns on the time parents spend with children are mixed. As discussed by Li et al. (2014), some studies showed that parents with non-standard work patterns spent more time with children, and were more likely to be present when children returned home from school. Other studies did not find that different work patterns in parents led to differences in time spent with children, or that parents with nonstandard work patterns spent less time with children. Therefore, it seems that the interaction of various characteristics of parents' working time patterns and adolescents' daily time patterns may have different effects on the time parents and adolescents have for each other.

In their comprehensive model of relationships between parents' non-standard work schedules and children's well-being Li et al. (2014) postulated and discussed several mediators and moderators that could affect children, in addition to the time dimension.

One group of mediators consists of resources which—in addition to time available for children—include parental physical and psychological well-being, income, human capital (e.g. parental education, skills and training) and psychosocial capital (e.g. parents' mental health, the quality of their relationship and attitudes about the parental role in bringing up children). The associations between long working hours and shift work and disturbed circadian rhythms, insufficient sleep, sleepiness, fatigue, injuries and increased risk of some diseases has been studied extensively (e.g. as reviewed by Akerstedt 2003; Harma 2006; Knutsson

2003). Associations between shift work and diminished mental health have also been found (Bara and Arber 2009).

The other group of possible mediators consists of family processes and includes parenting, the parent-child relationship and the home environment. For example, Davis et al. (2006) found that the impact of non-standard work patterns on parent-adolescent relationships in American families differed between mothers and fathers. More relationship intimacy was reported between adolescents and shift working mothers than for day working mothers. However, fathers engaged in shift work knew less about the activities of their adolescent children than daytime working fathers. This study indicates the importance of mediators—which are also included in the conceptual model by Li et al. (2014)—comprising the age and gender of the child and parent, family structure, reasons for atypical work schedules, and income.

In addition to our study (Radosevic-Vidacek and Koscec 2004), only four studies were found that looked at the effects of parental working hours and work patterns on the sleep of adolescents (Adam et al. 2007; Chen et al. 2013; Lowson et al. 2013; Wight et al. 2009), while one further study looked at the effects in much younger children aged 6–7 years (Magee et al. 2012).

Adam et al. (2007) studied sleep in American children and adolescents (aged 12–19 years) and its associations with various family functioning variables (warmth of parenting style, behavioural control through rules, family conflict, stress of parenting and parent psychological distress). As further factors, they explored the number of working hours of both the family head and the spouse/cohabiter. The family head worked on average 42 h, and the spouse 23 h, and there were large variations in working hours of both the family head and spouse. The number of working hours of either the family head or the spouse did not predict adolescents' hours of sleep, bedtime or wake-up time in regression analyses. The data in this study were collected from the primary caregivers of adolescents. In contrast, Wight et al. (2009) analysed time-use data collected from American adolescents aged 15–17 years. The study explored family characteristics that might have predicted whether adolescents would be asleep by 10:00 p.m. and whether they would sleep at least 9 h, and included mothers' part-time hours or full-time hours. The study did not find that part-time work in mothers was associated with adolescents' sleep.

Studies on the associations between the sleep of adolescents and the sleep of parents engaged in shift work appear to be few in number. Lowson et al. (2013) studied sleep over 2 weeks in the families of nurses working rotating shifts involving night shifts of 10–12 h, with varied starting times. Sleep diaries were used to collect daily data from the nurses, their husbands and children on the patterns and quality of sleep, and their alertness and mood. The study found a negative impact of night shifts on the sleep, alertness and mood of nurses, and different effects on children dependent on their age. When mothers were working night shifts pre-adolescent children delayed their bedtime. However, mothers' work on night shifts did not affect the sleep of adolescents but improved their mood; they felt less tense and more calm before sleep.

The study by Chen et al. (2013) looked at various possible predictors of sleep problems in adolescents aged 15–17 years from Taiwan. Family working time—which was operationalized as night work of the head of household and night work of other family member(s)—was included among the possible predictors. The sleep problems analysed were: difficulties falling asleep, difficulties maintaining sleep, and non-restorative sleep. After controlling for other confounding factors, night shift work by the head of household was shown to significantly predict difficulties with falling asleep and maintaining sleep. The authors did not discuss possible mechanisms relating night work by the head of the family and these two domains of sleep problems in adolescents.

5 Parents Working in Shifts and Adolescents Attending School According to a Rotating Shift System: Croatian Case

In our previous study on the effects of non-standard parental work schedules on the sleep of Croatian adolescents (Radosevic-Vidacek and Koscec 2004), the adolescents themselves had a non-standard school schedule. This is because the majority of Croatian schools lack sufficient space, so that schools must operate in two shifts, one shift in the morning and the other in the afternoon. The concept of a rotating shift system is familiar in the context of adult shift working. In effect, the same system is applied to the organisation of children's and adolescents' education in Croatia. Students attend school during the morning on 1 week and in the afternoon of the following week. This arrangement is then repeated as a weekly rotation. This weekly-rotating schedule has a positive effect on the sleep of adolescents. It enables them to wake up later and sleep longer during the whole week when school is in the afternoon, so that during that week even evening types on average sleep as much as is considered necessary for their age (Koscec et al. 2014).

A comparison of families with both, one or neither parents involved in shift work (Radosevic-Vidacek and Koscec 2004) showed some differences in the sleep characteristics of adolescents. Data indicated that in families of shift workers older adolescents woke up earlier on school days when classes were scheduled in the morning and consequently slept shorter than adolescents with parents working standard hours. They were also more likely to use alarm clocks for awakening. The earlier awakening in older adolescents further shortened sleep already reduced due to morning start of classes. The reasons for this earlier awakening might be associated with an increased level of responsibility that older adolescents were expected to assume in families of shift workers. If, because of their work schedule, parents were not at home before their children left for school in the morning, older adolescents might be solely responsible for their preparation for school, e.g. preparing a

meal, or responsible for helping younger siblings or caring for older members of the family. These tasks are more likely to be performed by parents if they are at home.

In our 2004 study we also found a more pronounced delay of weekend bedtimes in older adolescents whose parents were shift workers. We tried to explain this delay by speculating about parents being role models for adolescent sleep, since parents engaged in shift work usually delay and reduce sleep, or even exchange night for day sleep. This is not in line with a sleep-hygiene recommendation to parents that they should be role models by making sleep a high priority for themselves and the family. However, since shifting sleep patterns are inevitable for shift workers additional efforts are necessary to educate parents about the benefits of identifying and setting appropriate bedtimes, and to educate adolescents about healthy sleep so that they can make informed choices about their own sleep (Bakotic et al. 2009; Bonnar et al. 2014; Cassoff et al. 2014; Carskadon 2011).

Our 2004 study had some limitations. In trying to explain the mode through which the involvement of parental shift work affected the sleep of adolescents our study explored only parental practices regarding bedtime and awakening. The unanswered question is whether any other characteristics of shift workers' families and their households, such as family structure, sleep environment and the time adolescents need to travel to school, may have contributed to the observed differences. Further, our study did not explore the sleep quality of adolescents; this may be affected by the mismatch of the parents' wake period and the adolescent's sleep period. The only known study exploring sleep quality found that shift work by the head of household significantly predicted difficulties with falling asleep and maintaining sleep among adolescents (Chen et al. 2013). And finally, we did not extend our study to the effects of parents' non-standard working schedules on the daytime functioning of adolescents. As reviewed earlier in this chapter, the sleep characteristics of adolescents are known to affect their daytime functioning in various ways. Insufficient sleep and irregular sleep patterns are known to be associated with increased sleepiness, more depressed moods, poor academic achievement and higher levels of risk-taking behaviours (e.g. reviews by Becker et al. 2015; Dahl and Lewin 2002; Koscec et al. 2008; Owens et al. 2014). Considering that the effects of parents' shift work on adolescents' sleep have, so far, been revealed as relatively small, the question is whether the effects are limited only to sleep, or whether parents' shift work also affects daytime functioning. Studies which have found effects of non-standard working patterns on some measures of daytime functioning, including depression (Han and Miller 2009), general mental health (Dockery et al. 2009), risky behaviours (Han et al. 2010), and academic achievement (Han and Fox 2011), did not explore the role of sleep in the development of poor daytime functioning of adolescents whose parents had non-standard working patterns.

We therefore decided to extend our earlier study and explore whether the sleep quality and daytime functioning of adolescents differed between families in which parents worked standard hours and families in which parents worked in shifts. In addition, we wanted to examine whether family structure and some contextual characteristics of households—which were not included in our first study—differed between families with differing parental engagement in shift work, so that we could

control for their effect in our analyses of associations between parents' non-standard work schedules and the sleep and daytime functioning of adolescents.

5.1 Methods

5.1.1 Participants

For this study we used the same extensive data set on sleep and daytime functioning of adolescents collected using the Croatian version of the School Sleep Habits Survey (SSHS) (Wolfson and Carskadon 1998), part of which was analyzed in our previous study on parent shift workers (Radosevic-Vidacek and Koscec 2004).

Data were collected from 2363 primary (P) and secondary (S) school students. The students from the final four grades of primary schools (modal age 11–14 years), and from secondary schools with 4 year programs (modal age 15–18 years) participated. Students attended schools from Monday to Friday, one week in the morning (typically from 8:00 a.m. to 1:00 p.m.) and the following week in the afternoon (typically from 2 p.m. to 7:00 p.m.). Students usually had six class periods during one school day, each lasting 45 min. The details of the study and participants are described in Radosevic-Vidacek and Koscec (2004).

The sample for the analyses consisted of data from students who were living at home (99 %; N = 2338), with both parents (87 %; N = 2055), whose parents were both employed out of the home (62 %; N = 1466), and who did not have missing data on parents' work schedules (59 %; N = 1386). In the sample there were 656 primary-school students with mean age 12.2 years (SD = 1.2), and 730 secondary-school students with mean age 16.1 years (SD = 1.2). There were 716 females (N_P = 331, N_S = 385) and 670 males (N_P = 325, N_S = 345).

5.1.2 Measures

Socio-demographic Data Information about age, gender, school type (primary and secondary) and grade were registered by students in the SSHS.

Parents' Working Schedule Two questions from the SSHS were used to determine the work schedules of both parents: "Does your mother/father work outside the home? If so what is her/his working time?" The work schedule categories from which students could choose answers were: (a) only day shift or morning shift; (b) only evening shift; (c) only night shift; (d) works in different shifts. According to their answers the students were divided into three groups. The first group consisted of 555 students neither of whose parents was a shift worker, that is they worked a standard day or morning shift (N_P = 237, N_S = 318). The second group was composed of 563 students with one parent working evening shifts, or night shifts, or in rotating shifts (N_P = 273, N_S = 290). In this group there were 349

fathers and 214 mothers who were working non-standard hours. The third group comprised 286 students whose parents both worked evening shifts, night shifts or rotating shifts (N_P = 146, N_S = 122). Out of 1099 parents working non-standard hours 1070 (97 %) were rotating shift workers.

Contextual Factors Data about family structure were derived from responses to the SSHS questions about members of the family living with the student (mother/stepmother, father/stepfather, younger or older siblings and other relatives living together with the adolescent). All participants (N = 1466) in the selected sample were living with both parents. Families consisted also of younger sibling/siblings for 774 participants (53 %), older sibling/siblings for 658 participants (45 %), and other relatives for 507 participants (35 %).

Information about the sleep environment was collected using two questions. Students reported in what kind of room they slept (bedroom, living room or other kind of room) and whether they shared a room for sleeping with other members of the family. Reports showed that 1377 participants (94 %) slept in a bedroom, 51 (4 %) in a living room, and 36 (2 %) in another kind of room. Because few participants reported that they slept in a living room or another room, we combined reports for these two categories into one. Slightly more than half of the sample (N = 768, 52 %) slept alone, while 695 participants (47 %) shared a room in which they were sleeping with another member of the family.

Students also reported the times when they left home for school in the morning. Since primary and secondary schools have the same start-time for morning classes (8:00 a.m.), the time when students have to leave for school mainly depends on the distance between their homes and school, and on how they travel to school. A long travelling time may require an early departure time from home, restricting an adolescent's wake-up time and reducing sleep duration more than for an adolescent whose living and travelling circumstances are more favourable.

Students did not report about their employment because Croatian adolescents during full formal secondary education do not engage in temporary work.

Sleep Quality Five questions from the SSHS were used to assess difficulties initiating sleep, fragmented sleep, sleep disturbed by dreams and premature awakening.

Difficulties initiating sleep were assessed by means of questions about sleep latency and difficulties falling asleep. Students were asked to estimate their sleep latency over the previous 2 weeks, and separately for school weeks with morning and afternoon schedules and for weekends. The question asked students how many minutes it took to fall asleep after going to bed. Since distributions of sleep latency estimates were significantly positively skewed (skewness > +1) estimates were re-coded into three categories, similar to the method of Buysse et al. (1989). The first category consisted of latencies shorter than 16 min, the second of latencies 16–30 min, and the third of latencies longer than 30 min. The students were also asked how often during the last 2 weeks they found it difficult to fall asleep, with 'Never', 'Once', 'Twice', 'Several times' and 'Every night' as possible answers. Because of the relatively small number of reports in categories 'Once', 'Twice', 'Several times'

and ‘Every night’ we combined reports for ‘Once’ and ‘Twice’ into one category and ‘Several times’ and ‘Every night’ into another.

To assess fragmented sleep students reported how many times they usually woke up at night, with possible answers: ‘No waking’, Once’, Two or three times’, ‘More than three times’. The students could also select the answer ‘I have no idea’, and 88 (6.0 %) did so. These answers were coded as missing. Because of the relatively small number of reports in categories “Two or three times’ and ‘More than three times’ we combined these two categories into one.

Sleep disturbed by dreams was assessed by answers to the question about how often during the last 2 weeks students had nightmares or bad dreams during the night, with ‘Never’, ‘Once’, ‘Twice’, ‘Several times’ and ‘Every night’ as possible answers. The same five possible answers were used to assess how often during the last 2 weeks students experienced premature awakening, i.e. were awakened too early in the morning and couldn’t get back to sleep. Because of the relatively small number of reports in categories ‘Once’, ‘Twice’, ‘Several times’ and ‘Every night’ for both questions, we collapsed reports for ‘Once’ and ‘Twice’ into one category and ‘Several times’ and ‘Every night’ into another.

Daytime Functioning We used measures of sleepiness, depressed mood, academic performance and frequency of injuries from the SSHS as indices of daytime functioning.

Sleepiness was assessed by means of a modified version of the Sleepiness Scale (SS). The scale asks whether students have struggled to stay awake or have fallen asleep in nine different situations during the last 2 weeks (the item about driving a car from the original scale was omitted because it is not applicable to Croatian adolescents younger than 18 years). Each item is scored as no = 1, struggled to stay awake = 2, fallen asleep = 3, both struggled to stay awake and fallen asleep = 4. Item scores are summed to obtain a total scale score (min = 9, max = 36) with higher scores indicating higher levels of sleepiness. The nine-item SS has demonstrated adequate internal consistency (alpha = 0.70) on the results of the whole sample in this study (N = 2288). Wolfson and Carskadon (1998) obtained the same alpha value for the ten-item SS.

Depressed Mood was measured using the Depressed Mood Scale (DMS) (Kandel and Davies 1982). The items ask students to rate how often during the last 2 weeks they were bothered by different things, e.g., worrying too much, feeling unhappy, sad or depressed. Each of the 6 items are rated on a 3-point scale (1 = not at all, 2 = sometimes, 3 = often). Scores are summed to obtain a total score (min = 6, max = 18), with higher scores indicating a more depressed mood. The scale showed good internal consistency (alpha = 0.81) on the results of the whole sample in this study (N = 2288), and the obtained alpha value was similar to value (alpha = 0.79) found by Wolfson and Carskadon (1998).

Academic Performance was assessed using reports about grades students most typically received in school. Possible answers were: “Excellent”, “Excellent and Very good”, “Very good”, “Very good and Good”, “Good”, “Good and Sufficient”,

"Sufficient" or "Sufficient and Insufficient". The answers were rated on an 8-point scale (min = 1, max = 8) with higher scores indicating poorer grades.

Injury Frequency was assessed using the 15-item list from the SSHS. Students reported whether they were hurt or injured in each of the described ways/situations over the last 6 months. Primary-school adolescents reported up to 8 injuries in that period, and secondary-school adolescents up to 11 injuries. The distribution of reported injuries was significantly positively skewed (skewness > +1), so we combined reports into three categories: one for those reporting no injuries, the second for 1–2 reported injuries, and the third for more than 2 injuries.

5.1.3 Data Analyses

Differences in the categorical variables were tested by means of χ^2 tests. Each χ^2 test was performed separately for primary and secondary-school adolescents.

Differences in times when adolescents left for school in the morning, Sleepiness and Depressed Mood scores and academic performance were analysed by three-way ANOVA. Three between-subject factors were used: gender of the adolescent (2 levels), type of school (2 levels: primary vs. secondary), and parents' working schedule (3 levels: neither parent working shifts, one parent working shifts, both parents working shifts). Significant interaction effects were further examined by means of the simple main effects analyses performed separately for primary and secondary-school students. To explore how well parents' engagement in shift work and adolescents' daytime sleepiness would predict depressed moods in adolescents, a hierarchical linear regression was computed which controlled for the effect of gender.

All analyses were conducted using SPSS.

5.2 Results

5.2.1 Contextual Factors

Families of primary-school adolescents with different parental engagement in shift work differed only in one aspect of family structure. More primary-school adolescents with one parent shift worker (57.9 %; N = 154) or both parents shift workers (57.9 %; N = 84) lived with younger siblings, in comparison to adolescents whose parents worked standard hours (47.2 %; N = 109) ($\chi^2 = 6.35$, df = 2, $p < 0.05$). Similar differences were not found for older adolescents from secondary schools ($\chi^2 = 1.81$, df = 2, $p > 0.05$). No differences were found between the families regarding likelihood of living with older siblings (primary-school adolescents $\chi^2 = 0.17$, df = 2, $p > 0.05$; secondary-school adolescents $\chi^2 = 1.12$, df = 2, $p > 0.05$) or other relatives (primary-school adolescents $\chi^2 = 2.22$, df = 2, $p > 0.05$; secondary-school adolescents $\chi^2 = 2.25$, df = 2, $p > 0.05$).

The sleep environment of adolescents did not differ significantly between families with different parental engagement in shift work, regarding either the kind of room used for sleeping (primary-school adolescents $\chi^2 = 0.89$, df = 2, $p > 0.05$; secondary-school adolescents $\chi^2 = 0.52$, df = 2, $p > 0.05$), or whether a room was shared for sleeping with another family member (primary-school adolescents $\chi^2 = 3.83$, df = 2, $p > 0.05$; secondary-school adolescents $\chi^2 = 0.26$, df = 2, $p > 0.05$).

Primary-school adolescents from families with different parental engagement in shift work left for school in the morning on average at very similar times (neither parent shift worker: $M_P = 7.55$ h, SD = 0.21, N = 232; one parent shift worker: $M_P = 7.54$ h, SD = 0.18, N = 268; both parents shift workers: $M_P = 7.54$ h, SD = 0.18, N = 141). This was also the case for secondary-school adolescents from different families (neither parent shift worker: $M_S = 7.11$ h, SD = 0.47, N = 316; one parent shift worker: $M_S = 7.02$ h, SD = 0.56, N = 289; both parents shift workers: $M_S = 7.03$ h, SD = 0.49, N = 121). There was no significant main effect of parents' work schedule on the time when adolescents left for school in the morning, $F(2,1335) = 2.43$, $p > 0.05$. However, there was a significant main effect of school (primary vs. secondary), $F(1,1355) = 478.76$, $p < 0.001$, eta = 0.511, which was a result of differing distances of primary and secondary schools, and therefore travelling times from adolescents' homes. Primary schools are located in the vicinities of primary-school adolescents' homes and they could leave for school on average 0.49 h later than secondary-school adolescents ($M_p = 7.55$, SD = 0.19; $M_s = 7.06$, SD = 0.51).

5.2.2 Sleep Quality

There were no significant differences between adolescents from different families in reported sleep latencies when on morning schedule (primary-school adolescents $\chi^2 = 1.18$, df = 4, $p > 0.05$; secondary-school adolescents $\chi^2 = 5.99$, df = 4, $p > 0.05$), afternoon schedule (primary-school adolescents $\chi^2 = 3.21$, df = 4, $p > 0.05$; secondary-school adolescents $\chi^2 = 1.22$, df = 4, $p > 0.05$), or weekend (primary-school adolescents $\chi^2 = 3.48$, df = 4, $p > 0.05$; secondary-school adolescents $\chi^2 = 4.17$, df = 4, $p > 0.05$). Similarly, there were no significant differences in reports of how often it was difficult for them to fall asleep over the previous 2 weeks (primary-school adolescents $\chi^2 = 2.30$, df = 4, $p > 0.05$; secondary-school adolescents $\chi^2 = 9.06$, df = 4, $p > 0.05$).

Adolescents from different families were equally likely to report the frequency of night awakenings over the previous 2 weeks (primary-school adolescents $\chi^2 = 7.12$, df = 4, $p > 0.05$; secondary-school adolescents $\chi^2 = 4.59$, df = 4, $p > 0.05$). They were also equally likely to report how often their sleep was disturbed by bad dreams during the last 2 weeks (primary-school adolescents $\chi^2 = 3.88$, df = 4, $p > 0.05$; secondary-school adolescents $\chi^2 = 3.58$, df = 4, $p > 0.05$).

Adolescents from different families also did not differ in frequency of premature awakenings in the same period (primary-school adolescents $\chi^2 = 5.83$, df = 4, $p > 0.05$; secondary-school adolescents $\chi^2 = 3.60$, df = 4, $p > 0.05$).

Table 1 Measures of daytime functioning of adolescents as a function of parental engagement in shift work and adolescent school

	Neither parent shift worker			One parent shift worker			Both parents shift workers		
	N	M	SD	N	M	SD	N	M	SD
Sleepiness P	231	12.85	3.78	259	12.48	3.76	140	12.45	3.18
Sleepiness S	313	14.00	3.75	286	14.38	3.82	121	15.00	5.09
Sleepiness all	544	13.51	3.80	545	13.47	3.91	261	13.64	4.35
Depressed Mood P	222	9.14	2.71	252	9.24	2.78	136	9.73	2.70
Depressed Mood S	318	10.30	2.81	288	10.29	2.93	122	11.24	2.84
Sleepiness all	540	9.82	2.82	540	9.80	2.90	258	10.44	2.86
Academic Performance P	233	4.21	0.67	271	4.10	0.75	145	4.10	0.70
Academic Performance S	317	3.80	0.70	286	3.77	0.66	122	3.84	0.65
Academic Performance all	550	3.97	0.71	557	3.93	0.73	267	3.98	0.69
	N	**%**		**N**	**%**		**N**	**%**	
Injury Frequency P									
0	61	30.7		71	32.0		37	31.1	
1-2	94	47.2		98	44.1		57	47.9	
> 2	44	22.1		53	23.9		25	21.9	
Injury Frequency S									
0	97	32.8		78	28.9		26	23.9	
1-2	124	41.9		117	43.3		44	40.4	
> 2	75	25.3		75	27.8		39	35.8	

P primary-school adolescents, S secondary-school adolescents

Note Theoretical range: Sleepiness 9-36; Depressed Mood 6-18; Academic Performance 1-8; Number of data varies between variables because participants did not respond to all of the questions on the SSHS

5.2.3 Daytime Functioning

Means and standard deviations for Daytime Sleepiness, Depressed Mood and Academic Performance of primary and secondary-school adolescents in relation to parents' engagement in shift work are presented in Table 1. The table also shows numbers and percentages of adolescents with different frequencies of injuries over the previous 6 months in relation to the parents' involvement in shift work. The effect of parents' engagement in shift work on the daytime functioning of adolescents was found for Sleepiness and Depressed Mood. As shown in Table 2, there was a significant interaction between the effects of parents' work schedules and adolescents' school (primary vs. secondary) on Sleepiness scores, $F(2,1338) = 3.17$, $p < 0.05$, with very small effect size (eta = 0.07). Further tests of the simple

Table 2 Three-way analysis of variance for sleepiness, depressed mood and academic performance as a function of parents' work schedule, adolescents' gender and school

	Sleepiness			Depressed Mood			Academic Performance		
	df	F	Partial eta^2	df	F	Partial eta^2	df	F	Partial eta^2
Parents' work schedule	2	0.61	0.001	2	7.45**	0.011	2	1.17	0.002
Gender	1	1.12	0.001	1	30.50***	0.022	1	69.06***	0.048
School	1	70.28***	0.050	1	57.00***	0.041	1	78.18***	0.054
Parents' work schedule x Gender	2	1.63	0.002	2	0.21	0.000	2	0.46	0.001
Parents' work schedule x School	2	3.17*	0.005	2	0.75	0.001	2	1.97	0.003
Gender x School	1	0.10	0.000	1	6.95**	0.005	1	1.01	0.001
Parents' work schedule x Gender x School	2	0.81	0.001	2	2.87	0.004	2	0.70	0.001
Error	1338			1326			1362		

*p < 0.01
** p < 0.01
***p < 0.001

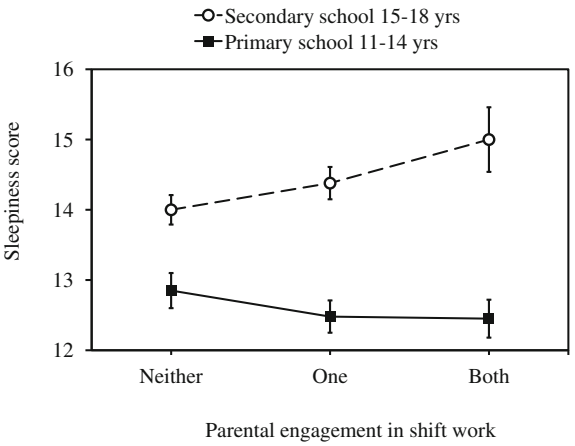

Fig. 1 Mean score on sleepiness scale for primary- and secondary-school adolescents from families with different parental engagement in shift work. *Error Bars* represent standard errors

effects of parents' work schedule on the sleepiness of adolescents within each level of school indicated that the effect was significant for secondary-school adolescents ($F(2,1338) = 3.02$, $p < 0.05$), with close to medium effect size (eta = 0.22). No effect was observed for primary-school adolescents ($F(2,1338) < 1$). Figure 1 shows that secondary school adolescents whose parents were both shift workers

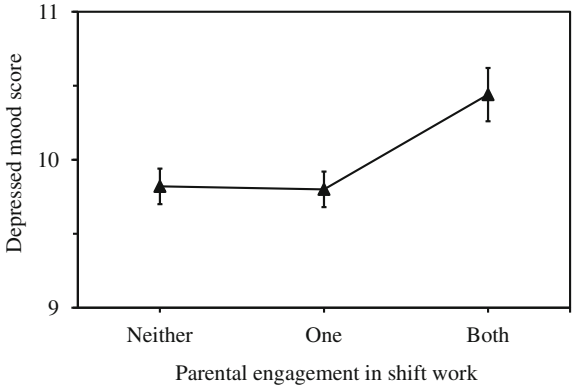

Fig. 2 Mean score on depressed mood scale for adolescents from families with different parental engagement in shift work. *Error Bars* represent standard errors

obtained relatively higher average scores on the Sleepiness Scale in comparison to adolescents with only one or neither parent involved in shift work. In contrast, variations in average scores on the Sleepiness Scale, were of negligible size for primary-school adolescents. The average Sleepiness scores of primary-school adolescents were lower than scores for secondary-school adolescents in all three groups of families, and a significant medium size effect of school was demonstrated, $F(1,1338) = 70.28$, $p < 0.001$, eta = 0.22.

There was also (Table 2) a significant main effect of parental engagement in shift work on Depressed Mood scores, $F(2,1326) = 7.45$, $p < 0.01$, although with small effect size (eta = 0.10). Figure 2 shows that adolescents whose parents both worked in shifts obtained on average relatively higher scores for Depressed Mood, in comparison to adolescents who had only one parent or neither parent working in shifts.

There was no significant effect of parents' engagement in shift work on Academic Performance (Table 2) and Injury Frequency (primary-school adolescents $\chi^2 = 0.699$, df = 4, $p > 0.05$; secondary-school adolescents $\chi^2 = 5.532$, df = 4, $p > 0.05$).

In order to see whether parents' engagement in shift work contributes to the prediction of depressed moods in secondary-school adolescents or whether its contribution would be cancelled out by daytime sleepiness, we performed hierarchical multiple regression analysis, controlling for adolescent gender (Table 3). When gender was entered alone, it significantly predicted 5 % of variance in depressed mood, $F(1716) = 41.90$, $p < 0.001$), adjusted $R^2 = 0.05$. When, in the second model, sleepiness was added, it significantly improved the prediction, $F(1715) = 169.60$, $p < 0.001$, R^2 change = 0.18. As indicated by the R^2 change, 18 % of additional variance in depressed mood was predicted. In the third model, when variables for parents' engagement in shift work were added, they significantly improved the prediction, $F(2713) = 4.10$, $p < 0.05$, R^2 change = 0.01. However, as indicated by the R^2 change, only 1 % of additional variance in depressed mood was predicted. The entire group of variables significantly predicted depressed mood, $F(4713) = 57.87$, $p < 0.001$, and the adjusted $R^2 = 0.24$ indicated that this was a

Table 3 Hierarchical Multiple Regression Analysis Summary Predicting Depressed Mood of Secondary-School Adolescents from Parents' Engagement in Shift work and Adolescent Daytime Sleepiness, When Controlling for Adolescent Gender (N = 718)

Variable	r	B	SEB	β	R^2	ΔR^2
Step 1					0.055	0.055
Gender	0.235	1.359	0.210	0.235***		
Step 2					0.236	0.181
Gender	0.235	1.247	0.189	0.216***		
Sleepiness	0.436	0.304	0.023	0.426***		
Step 3					0.245	0.009
Gender	0.235	1.254	0.189	0.217***		
Sleepiness	0.436	0.299	0.023	0.419***		
One parent shift worker	–0.042	–0.039	0.207	–0.007		
Both parents shift workers	0.122	0.700	0.271	0.091**		
Constant		5.422	0.367			

One parent shift worker and Both parents shift workers are dummy-coded with None parent shift worker as the baseline; Adolescent gender is coded 0 = male, 1 = female; r –zero-order correlation coefficient; B –unstandardized regression coefficient; SEB standard error of B; β –standardized regression coefficient; R^2–multiple correlation coefficient square; ΔR^2 – change in multiple correlation coefficient square from one model to another.
** $p < 0.01$
*** $p < 0.001$

larger than typical effect (Cohen 1988). In the third model, sleepiness had the highest predictive value ($\beta = 0.42$, $p < 0.01$), but when both parents worked in shifts this added to the prediction over and above the predictive contributions of gender and sleepiness alone ($\beta = 0.09$, $p < 0.01$).

5.3 Discussion

The purpose of this study was to examine how parental engagement in shift work affects the sleep quality and daytime functioning of adolescents. We looked at the family of employed parents as a unit, taking into account the work schedules of both parents. The majority of parents working non-standard hours worked in rotating shifts (97 %). The adolescents themselves attended school on a rotating shift basis—one week in the morning and the following week in the afternoon.

5.3.1 Contextual Factors

Our present study explored certain contextual factors which may have affected sleep in families that differed with respect to parents' engagement in shift work. Family size and crowded households—which require sharing a room or bed for sleeping—are among such factors. The extent of bedroom or bed sharing and the effects of that sharing on sleep are country specific. Thus, more than 75 % of Pakistani adolescents share their bedroom, and 45 % also share their bed (Nusrat et al. 2012). In contrast, only 25 % of younger and 20 % of older American adolescents share their bedrooms (Buxton et al. 2015), and an even lower percentage (17 %) of Dutch adolescents share bedrooms (Meijer et al. 2001). Positive effects of bedroom or bed sharing on sleep were observed in Italian and Pakistani adolescents (LeBourgeois et al. 2005; Nusrat et al. 2012), and negative effects in American and Dutch adolescents (Buxton et al. 2015; Meijer et al. 2001).

In our present study, 53 % of Croatian adolescents lived with younger siblings, 45 % with older siblings, and 35 % lived in extended families with other relatives. The room for sleeping was shared with one or more members of the family for 47 % of Croatian adolescents. These contextual factors did not differ between families when neither, one or both parents were engaged in shift work. The exception was for primary-school adolescents who were more likely to live with younger siblings when one or both parents were shift workers. However, this difference did not affect the likelihood that adolescents in these families shared a room for sleeping more often, and ultimately it did not affect the likelihood of reporting signs of poor sleep quality.

We did not find any differences in the times when adolescents left for school with respect to the engagement of their parents in shift work. Therefore, among the three groups of families studied, possible differences in the availability of parents to drive adolescents to school or differing home-school distances did not affect the times when adolescents had to leave for school. However, our study did point to a hidden effect of the school schedule in secondary schools. Namely, although classes in secondary and primary schools start at the same time, secondary schools are often quite far from adolescents' homes, whereas typically primary schools are close to adolescents' homes. So, starting from 15 years of age—when adolescents in Croatia change from primary to secondary schools—the majority of secondary-school adolescents no longer walk to school but use public transport and have to leave for school on average 49 min earlier.

5.3.2 Sleep Quality

Chen et al. (2013) found that for Taiwanese adolescents involvement of the head of the household in night shift work significantly predicted difficulties with falling asleep and maintaining sleep; data were reported for a 4-week period.

We hypothesised that rotating shift work in parents might disturb the sleep of Croatian adolescents because of the overlap of parents' wake periods with

adolescents' sleep periods. In the evening this might happen if parents are awake because they need to leave for a night shift, or because they have just returned from an afternoon/evening shift at the time when adolescents should start to sleep or already be asleep. However, we did not find that adolescents with shift working parents were more likely to report longer sleep latencies, or to report more frequent difficulty falling asleep over a previous 2-week period. Similarly, they did not report more awakenings per night. In the morning, overlap of parent's wakefulness period and an adolescent's sleep period might happen if the parent had returned from a night shift, or because the parent has to wake up very early to attend an early morning shift. However, we did not find that adolescents with shift working parents were more likely to report premature awakenings over a 2-week period in comparison to adolescents with day-working parents.

Finally, parents who are not present at normal times of day, or whose behaviour and mood might indicate that they are not tolerating shift work may have less focus on their parenting role, and this might add to adolescents' other concerns and increase the likelihood to report bad dreams. Our results did not confirm this hypothesis.

However, the SSHS questions on sleep quality ask adolescents to report on sleep quality over a previous 2-week period, and might not be sensitive enough to measure the possible effects of various working time patterns. For example, possible effects of the night shift would not be registered if a weekly rotating schedule for parents did not include night shifts in that period. On the other hand, for the case of fast rotating shifts the 2-week period may be too long as an evaluation period if the effects are related to short spells of a particular shift.

5.3.3 Daytime Functioning

Our present study found that parental engagement in shift work has a negative effect on sleepiness, but only in secondary-school adolescents (ages 15–18 years). This medium-sized effect—taken together with the findings from our previous study (Radosevic-Vidacek and Koscec 2004)—indicates that the negative effects of parental shift work on sleep patterns and daytime sleepiness are limited to older adolescents.

Insufficient sleep, poor sleep quality and daytime sleepiness have been associated with depressed moods in many cross-sectional and longitudinal studies of adolescents (Becker et al. 2015). In addition, some family and parental characteristics have been associated with adolescent depression together with poor or insufficient sleep or increased daytime sleepiness. Negative effects on adolescent depression have been associated with a parental practice to set a late bedtime at or after midnight (Gangwisch et al. 2010), family relations characterized by conflicts (Yen et al. 2008), lower levels of perceived closeness with the mother and father and lower perceived family connectedness (Mueller et al. 2011).

Depression and general mental health in adolescents have also been explored in relation to parents' non-standard working time patterns. In a longitudinal study,

Han and Miller (2009) explored relationships between mothers' and fathers' work schedules and depression in American adolescent at ages 13 and 14. For mothers working fixed night shifts and fathers working fixed evening shifts adolescent depression increased as the number of years worked by parents on their respective shift systems increased. The negative effect of the mother's night shifts was mediated through a lower quality of home environment and less frequent meals together, and the negative effect of the father's evening shifts was mediated through lower father-adolescent closeness. However, some other unfavourable factors associated with mother's night work could have contributed to these results. In contrast, it was also found that for mothers and fathers working in variable shifts there were positive effects on adolescent depression. The effects for mothers were mediated through a higher likelihood of knowing who their adolescent children were spending time with away from home. However, this kind of shift pattern was associated with some factors indicating advantaged living circumstances so that working mothers might have had the option to choose flexible shifts which enabled parental monitoring of adolescent behaviour.

In a study of Australian adolescents aged 15–20 years (Dockery et al. 2009), associations between parents' non-standard working time patterns and adolescents' mental health were explored both in single and two-parent families. A significant effect of nonstandard hours on the mental health of adolescents was observed only for adolescents living in single parent families.

Our study found a small negative effect of parental engagement in shift work on depressed moods in secondary-school adolescents. Further regression analysis showed that shift work—both parents shift working—was a predictor of depressed mood among secondary-school adolescents over and above the contributions of both gender and sleepiness. Our results on the effect of parental shift work on depressed moods in primary-school adolescents implied that parents' shift work had a negative effect on depressed mood without having any effect on either sleep or daytime sleepiness.

To-date, therefore, the results of studies on the effects of non-standard work patterns on depression and mental health of adolescents are mixed. Effects differ between single and two-parent families, between fathers' and mothers' shift work, and between different types of shift work, and indicate that some effects related to country-specific characteristics of a particular type of shift work may be operating.

The effects of parents' engagement in shift work on measures of daytime functioning found in our present study should be viewed bearing in mind the complexity of the relationships between parents' working time patterns and adolescents' school schedules in Croatia. The weekly rotating system of school time required for most Croatian adolescents provides excellent opportunities for sleep during those weeks with an afternoon schedule, so that sleep needs are properly met (Koscec et al. 2014). However, at the same time the afternoon schedule poses special parenting challenges for parents working standard hours, since during this schedule they are able to interact with children only in the evenings. In contrast, parents engaged in rotating shift work who are allowed some flexibility in their choice of shifts may balance work and parenting roles more effectively. To shed more light on this aspect it would

be useful to perform a study exploring the sleep and daytime functioning of adolescents whose classes are scheduled only in the morning, in families in which none, one or both parents are involved in shift working.

5.3.4 Study Limitations

As already stated by Radosevic-Vidacek and Koscec (2004) the SSHS does not provide definitions of different forms of working times, and this may affect the reliability of reports about parent's working time as provided by children. In addition, the survey was not designed to study parental working time in detail. Therefore we lack exact information on some characteristics of parents' rotating shifts that may have contributed to the results observed in our two studies. We do not know whether a parent's shift rota included night work or work on weekends, whether they worked in fast or slow rotating shift systems, the specific start and end-times of their shifts and shift length. We also do not know whether some of our parents worked extended shifts but we consider it unlikely that they worked part-time. Part-time work is very uncommon in Croatia; only 4 % of women and 2 % of employed men work on a part-time basis (Croatian Bureau of Statistics 2014). We also lack information about how many years parents have worked in shifts and information about other characteristics of parents' employment which could influence the quality of their parenting, including the type and quality of their jobs.

6 Conclusions

Although child and adolescent development is a continuous process and parents' engagement in non-standard working time patterns may extend over several periods of development, it is of particular interest to delineate the effects of parents' non-standard working time patterns on sleep during the period of adolescence. A specific set of biological, psychosocial and contextual changes occur in adolescence that affect the sleep, and all these factors eventually combine to have an impact on the daytime functioning of adolescents (Carskadon 2011). In addition, various factors including parents' working time patterns may have different effects and these effects are exerted in different ways depending on the child's and parent's life stage (Steinberg and Silk 2002).

Our 2004 study and our present study help to fill the gap in research on the effects of parents' non-standard working time patterns on the sleep of adolescents. Our studies show that parental shift work matters for some aspects of sleep and daytime functioning in adolescents, and that its effects differ in early and late adolescence.

Most of the observed effects were small, as found in other studies on the effects of parents' non-standard working time patterns on children's well-being (Li et al. 2014). In addition, when our results are reviewed, several other points need to be

considered. Firstly, certain limitations in our studies should be taken into account, especially the lack of data characterizing parents' shift work and job quality. Secondly, the effects should be viewed in the context of the weekly rotating schedule of classes, which—while creating much better opportunities for fulfilling the sleep needs of Croatian adolescents—generates special challenges for parents even if they work standard hours. Thirdly, the results should be viewed with reference to the characteristics of Croatian families and the Croatian labour market, which typically demands and offers full-time work for both genders, with rotating shifts as the most common type of non-standard working time schedule.

Our studies did not explore the mechanisms by which the effects of parents' shift work on sleep and daytime functioning in adolescents operate. Mediators and moderators of associations between parental shift work and adolescents' sleep warrant further research. In this chapter we have reviewed a range of parental practices and styles, family characteristics and relations, and other contextual factors that have been explored in relation to the sleep of adolescents. These factors may be usefully considered in future research on the associations between non-standard parental working time and the sleep of adolescents. Associations between working time patterns and particular confounders and covariates in different societies (Li et al. 2014) also suggest a need for large-scale multinational studies.

References

Adam, E. K., Snell, E. K., & Pendry, P. (2007). Sleep timing and quantity in ecological and family context: A nationally representative time-diary study. *Journal of Family Psychology, 21*(1), 4–19.

Akerstedt, T. (2003). Shift work and disturbed sleep/wakefulness. *Occupational Medicine (Oxford, England), 53*(2), 89–94.

Andrade, M. M. M., & Menna-Barreto, L. (2002). Sleep patterns of high school students living in Sao Paolo, Brazil. In M. A. Carskadon (Ed.), *Adolescent sleep patterns: Biological, social and psychological influences* (pp. 118–131). New York: Cambridge University Press.

Australian Bureau of Statistics. (2009). Work, life and family balance. *Australian Social Trends* 4102.0. September 1–7. http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/3BF8FB413BA384C5CA25763A0018C30E/$File/41020_balance.pdf. Accessed 30 March 2015.

Bajoghli, H., Alipouri, A., Holsboer-Trachsler, E., & Brand, S. (2013). Sleep patterns and psychological functioning in families in Northeastern Iran; evidence for similarities between adolescent children and their parents. *Journal of Adolescence, 36*(6), 1103–1113.

Bakotic, M., Radosevic-Vidacek, B., & Koscec, A. (2009). Educating adolescents about healthy sleep: Experimental study of effectiveness of educational leaflet. *Croatian Medical Journal, 50* (2), 174–181.

Bara, A.-C., & Arber, S. (2009). Working shifts and mental health—findings from the British household panel survey (1995-2005). *Scandinavian Journal of Work, Environment & Health, 35*(5), 361–367.

Barnett, R. C., & Gareis, K. C. (2007). Shift work, parenting behaviors, and children's socioemotional well-being—a within-family study. *Journal of Family Issues, 28*(6), 727–748.

Bartel, K. A., Gradisar, M., & Williamson, P. (2015). Protective and risk factors for adolescent sleep: A meta-analytic review. *Sleep Medicine Reviews, 21*, 72–85.

Becker, S. P., Langberg, J. M., & Byars, K. C. (2015). Advancing a biopsychosocial and contextual model of sleep in adolescence: A review and introduction to the special issue. *Journal of Youth and Adolescence, 44*(2), 239–270.

Bonnar, D., Gradisar, M., Moseley, L., Coughlin, A. M., Cain, N., & Short, M. A. (2014). Evaluation of school-based sleep interventions: does adjunct bright light therapy and parental involvement improve treatment outcomes? *Journal of Sleep Research, 23*, 50–51.

Brand, S., Gerber, M., Hatzinger, M., Beck, J., & Holsboer-Trachsler, E. (2009a). Evidence for similarities between adolescents and parents in sleep patterns. *Sleep Medicine, 10*(10), 1124–1131.

Brand, S., Hatzinger, M., Beck, J., & Holsboer-Trachsler, E. (2009b). Perceived parenting styles, personality traits and sleep patterns in adolescents. *Journal of Adolescence, 32*(5), 1189–1207.

Bray, M. (1990). The quality of education in multiple-shift schools—how far does a financial saving imply an educational cost. *Comparative Education, 26*(1), 73–81.

Bronfenbrenner, U., & Morris, P. A. (2006). The bioecological model of human development. In R. M. Lerner & W. Damon (Eds.), *Hanbook of child psychology* (Vol. 1, pp. 793–828). Hoboken: John Wiley & Sons Inc.

Buxton, O. M., Chang, A. M., Spilsbury, J. C., Bos, T., Emsellem, H., & Knutson, K. L. (2015). Sleep in the modern family: Protective family routines for child and adolescent sleep. *Sleep Health, 1*(1), 15–27.

Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh sleep quality index—a new instrument for psychiatric practice and research. *Psychiatry Research, 28*(2), 193–213.

Carskadon, M. A. (1990). Patterns of sleep and sleepiness in adolescents. *Pediatrician, 17*(1), 5–12.

Carskadon, M. A. (2002). Factors influencing sleep patterns of adolescents. In M. A. Carskadon (Ed.), *Adolescent sleep patterns: Biological, social, and psychological influences* (pp. 4–26). New York: Cambridge University Press.

Carskadon, M. A. (2011). Sleep in adolescents: The perfect storm. *Pediatric Clinics of North America, 58*(3), 637–647.

Carskadon, M. A., Harvey, K., Duke, P., Anders, T. F., Litt, I. F., & Dement, W. C. (1980). Pubertal changes in daytime sleepiness. *Sleep, 2*(4), 453–460.

Carskadon, M. A., Vieira, C., & Acebo, C. (1993). Association between puberty and delayed phase preference. *Sleep, 16*(3), 258–262.

Cassoff, J., Gruber, R., Sadikaj, G., Rushani, F., & Knauper, B. (2014). What motivational and awareness variables are associated with adolescents' intentions to go to bed earlier? *Current Psychology, 33*(2), 113–129.

Chen, D. R., Truong, K. D., & Tsai, M. J. (2013). Prevalence of poor sleep quality and its relationship with body mass index among teenagers: Evidence from Taiwan. *Journal of School Health, 83*(8), 582–588.

Chen, T., Wu, Z. Q., Shen, Z. F., Zhang, J., Shen, X. M., & Li, S. H. (2014). Sleep duration in Chinese adolescents: Biological, environmental, and behavioral predictors. *Sleep Medicine, 15*(11), 1345–1353.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale: Lawrence Erlbaum.

Croatian Bureau of Statistics. (2014). *2014 Statistical yearbook of the Republic of Croatia*. Zagreb: Croatian Bureau of Statistics. http://www.dzs.hr/Hrv_Eng/ljetopis/2014/sljh2014.pdf. Accessed 1 March 2015.

Crouter, A. C., & McHale, S. M. (2005). Work, family, and children's time: Implications for youth. In S. Bianchi, L. Casper, & R. King (Eds.), *Work, family, helath and well-being* (pp. 47–64). London: Lawrence Erlbaum.

Crowley, S. J., & Carskadon, M. A. (2010). Modifications to weekend recovery sleep delay circadian phase in older adolescents. *Chronobiology International, 27*(7), 1469–1492.

Dahl, R. E., & Lewin, D. S. (2002). Pathways to adolescent health: Sleep regulation and behavior. *Journal of Adolescent Health, 31*(6), 175–184.

Davis, K. D., Crouter, A. C., & McHale, S. M. (2006). Implications of shift work for parent-adolescent relationships in dual-earner families. *Family Relations, 55*(4), 450–460.

Dewald-Kaufmann, J. F., Oort, F. J., & Meijer, A. M. (2013). The effects of sleep extension on sleep and cognitive performance in adolescents with chronic sleep reduction: An experimental study. *Sleep Medicine, 14*(6), 510–517.

Diaz-Morales, J. F., de Leon, C. D., & Gutierrez Sorroche, M. (2007). Validity of the Morningness-eveningness scale for children among Spanish adolescents. *Chronobiology International, 24*(3), 435–447.

Dockery, A., Li, J., & Kendall, G. (2009). Parents' work patterns and adolescent mental health. *Social Science and Medicine, 68*(4), 689–698.

Eurofound. (2012). *Working time and work–life balance in a life course perspective*. Dublin: Eurofound.

Fischer, F. M., Radosevic-Vidacek, B., Koscec, A., Teixeira, L. R., Moreno, C. R. C., & Lowden, A. (2008). Internal and external time conflicts in adolescents: Sleep characteristics and interventions. *Mind Brain and Education, 2*(1), 17–23.

Fuligni, A. J., Tsai, K. M., Krull, J. L., & Gonzales, N. A. (2015). Daily concordance between parent and adolescent sleep habits. *Journal of Adolescent Health, 56*(2), 244–250.

Gangwisch, J. E., Babiss, L. A., Malaspina, D., Turner, J. B., Zammit, G. K., & Posner, K. (2010). Earlier parental set bedtimes as a protective factor against depression and suicidal ideation. *Sleep, 33*(1), 97–106.

Gau, S. F., & Soong, W. T. (2003). The transition of sleep-wake patterns in early adolescence. *Sleep, 26*(4), 449–454.

Gau, S. S. F., & Merikangas, K. R. (2004). Similarities and differences in sleep-wake patterns among adults and their children. *Sleep, 27*(2), 299–304.

Giannotti, F., Cortesi, F., Sebastiani, T., & Ottaviano, S. (2002). Circadian preference, sleep and daytime behaviour in adolescence. *Journal of Sleep Research, 11*(3), 191–199.

Giannotti, F., Cortesi, F., Sebastiani, T., & Vagnonki, C. (2005). Sleeping habits in Italian children and adolescents. *Sleep and Biological Rhythms, 3*, 15–31.

Gradisar, M., Gardner, G., & Dohnt, H. (2011). Recent worldwide sleep patterns and problems during adolescence: A review and meta-analysis of age, region, and sleep. *Sleep Medicine, 12*(2), 110–118.

Han, W.-J., & Fox, L. E. (2011). Parental work schedules and children's cognitive trajectories. *Journal of Marriage and Family, 73*(5), 962–980.

Han, W.-J., & Miller, D. P. (2009). Parental work schedules and adolescent depression. *Health Sociology Review, 18*(1), 36–49.

Han, W.-J., Miller, D. P., & Waldfogel, J. (2010). Parental work schedules and adolescent risky behaviors. *Developmental Psychology, 46*(5), 1245–1267.

Harma, M. (2006). Workhours in relation to work stress, recovery and health. *Scandinavian Journal of Work, Environment & Health, 32*(6), 502–514.

Harma, M., Ropponen, A., Hakola, T., Koskinen, A., Vanttola, P., & Puttonen, S., et al. (2015). Developing register-based measures for assessment of working time patterns for epidemiologic studies. *Scandinavian Journal of Work, Environment & Health, 41*(3), 268–279.

Kalak, N., Gerber, M., Kirov, R., Mikoteit, T., Puehse, U., & Holsboer-Trachsler, E., et al. (2012). The relation of objective sleep patterns, depressive symptoms, and sleep disturbances in adolescent children and their parents: A sleep-EEG study with 47 families. *Journal of Psychiatric Research, 46*(10), 1374–1382.

Kandel, D., & Davies, M. (1982). Epidemiology of depressive mood in adolescents—an empirical study. *Archives of General Psychiatry, 39*(10), 1205–1212.

Kim, S., Dueker, G. L., Hasher, L., & Goldstein, D. (2002). Children's time of day preference: Age, gender and ethnic differences. *Personality and Individual Differences, 33*(7), 1083–1090.

Knutsson, A. (2003). Health disorders of shift workers. *Occupational Medicine-Oxford, 53*(2), 103–108.

Koscec, A., Radosevic-Vidacek, B., & Bakotic, M. (2008). Regulation of wakefulness and sleep in adolescence: Biological, behavioural and social aspects. *Suvremena Psihologija, 11*(2), 223–239.

Koscec, A., Radosevic-Vidacek, B., & Bakotic, M. (2014). Morningness-eveningness and sleep patterns of adolescents attending school in two rotating shifts. *Chronobiology International, 31* (1), 52–63.

Kuo, S., Updegraff, K., Zeiders, K., McHale, S., Umana-Taylor, A., & De Jesus, S. (2015). Mexican American adolescents' sleep patterns: Contextual correlates and implications for health and adjustment in young adulthood. *Journal of Youth and Adolescence, 44*(2), 346–361.

LeBourgeois, M. K., Giannotti, F., Cortesi, F., Wolfson, A. R., & Harsh, J. (2005). The relationship between reported sleep quality and sleep hygiene in Italian and American adolescents. *Pediatrics, 115*(1), 257–265.

Li, J. H., Johnson, S. E., Han, W. J., Andrews, S., Kendall, G., & Strazdins, L., et al. (2014). Parents' nonstandard work schedules and child well-being: A critical review of the literature. *Journal of Primary Prevention, 35*(1), 53–73.

Loessl, B., Valerius, G., Kopasz, M., Hornyak, M., Riemann, D., & Voderholzer, U. (2008). Are adolescents chronically sleep-deprived? An investigation of sleep habits of adolescents in the southwest of Germany. *Child: Care, Health and Development, 34*(5), 549–556.

Lowson, E., Middleton, B., Arber, S., & Skene, D. J. (2013). Effects of night work on sleep, cortisol and mood of female nurses, their husbands and children. *Sleep and Biological Rhythms, 11*(1), 7–13.

Magee, C. A., Caputi, P., & Iverson, D. C. (2012). Are parents' working patterns associated with their child's sleep? An analysis of dual-parent families in Australia. *Sleep and Biological Rhythms, 10*(2), 100–108.

Maume, D. J. (2013). Social ties and adolescent sleep disruption. *Journal of Health and Social Behavior, 54*(4), 498–515.

Meijer, A. M., Habekothe, R. T., & Van den Wittenboer, G. L. H. (2001). Mental health, parental rules and sleep in pre-adolescents. *Journal of Sleep Research, 10*(4), 297–302.

Meltzer, L. J., & Montgomery-Downs, H. E. (2011). Sleep in the family. *Pediatric Clinics of North America, 58*(3), 765–774.

Mueller, C. E., Bridges, S. K., & Goddard, M. S. (2011). Sleep and parent-family connectedness: Links, relationships and implications for adolescent depression. *Journal of Family Studies, 17* (1), 9–23.

National Sleep Foundation. (2006). *2006 Sleep in America Poll: Summary of findings*. Washington: National Sleep Foundation.

Nusrat, M., Khan, A., Hamid, S., Hussain, A., & Kadir, M. (2012). Bedtime and its correlates among secondary school children in Karachi, Pakistan. *Journal of the Pakistan Medical Association, 62*(11), 1168–1173.

O'Brien, L. M. (2009). The neurocognitive effects of sleep disruption in children and adolescents. *Child and Adolescent Psychiatric Clinics of North America, 18*(4), 813–823.

Owens, J., Adolescent Sleep Working, G., & Comm, A. (2014). Insufficient sleep in adolescents and young adults: An update on causes and consequences. *Pediatrics, 134*(3), E921–E932.

Pieters, D., De Valck, E., Vandekerckhoye, M., Pirrera, S., Wuyts, J., & Exadaktylos, V., et al. (2014). Effects of pre-sleep media use on sleep/wake patterns and daytime functioning among adolescents: The moderating role of parental control. *Behavioral Sleep Medicine, 12*(6), 427–443.

Presser, H. B. (2005). Embracing complexity: Work schedules and family life in a 24/7 economy. In S. M. Bianchi, L. M. Casper, & R. B. King (Eds.), *Work, family, health and well-being* (pp. 41–46). London: Lawrence Erlbaum.

Radosevic-Vidacek, B., & Koscec, A. (2004). Shiftworking families: Parents' working schedule and sleep patterns of adolescents attending school in two shifts. *Revista de Saude Publica, 38*, 38–46.

Randler, C., Bilger, S., & Francisco Diaz-Morales, J. (2009). Associations among sleep, chronotype, parental monitoring, and pubertal development among German adolescents. *Journal of Psychology, 143*(5), 509–520.

Roeser, K., Eichholz, R., Schwerdtle, B., Schlarb, A. A., & Kubler, A. (2012). Relationship of sleep quality and health-related quality of life in adolescents according to self- and proxy ratings: A questionnaire survey. *Frontiers in Psychiatry, 3*, 76–76.

Sadeh, A., Gruber, R., & Raviv, A. (2003). The effects of sleep restriction and extension on school-age children: What a difference an hour makes. *Child Development, 74*(2), 444–455.

Short, M. A., Gradisar, M., Gill, J., & Camfferman, D. (2013a). Identifying adolescent sleep problems. *Plos One, 8*(9), e75301.

Short, M. A., Gradisar, M., Lack, L. C., Wright, H. R., & Chatburn, A. (2013b). Estimating adolescent sleep patterns: Parent reports versus adolescent self-report surveys, sleep diaries, and actigraphy. *Nature and Science of Sleep, 5*, 23–26.

Short, M. A., Gradisar, M., Lack, L. C., Wright, H. R., Dewald, J. F., & Wolfson, A. R., et al. (2013c). A cross-cultural comparison of sleep duration between US and Australian adolescents: The effect of school start time, parent-set bedtimes, and extracurricular load. *Health Education & Behavior, 40*(3), 323–330.

Short, M. A., Gradisar, M., Wright, H., Lack, L. C., Dohnt, H., & Carskadon, M. A. (2011). Time for bed: Parent-set bedtimes associated with improved sleep and daytime functioning in adolescents. *Sleep, 34*(6), 797–800.

Smetana, J., Crean, H. F., & Campione-Barr, N. (2005). Adolescents' and parents' changing conceptions of parental authority. *New Directions for Child and Adolescent Development* (108), 31–46.

Steinberg, L., & Silk, J. S. (2002). Parenting adolescents. In M. H. Bornstein (Ed.), *Handbook of parenting* (Vol. 1, pp. 103–133). Mahwah: Lawrence Erlbaum.

Taylor, D. J., Jenni, O. G., Acebo, C., & Carskadon, M. A. (2005). Sleep tendency during extended wakefulness: Insights into adolescent sleep regulation and behavior. *Journal of Sleep Research, 14*(3), 239–244.

Tu, A. W., Watts, A. W., & Masse, L. C. (2015). Parent-adolescent patterns of physical activity, sedentary behaviors and sleep among a sample of overweight and obese adolescents. *J Phys Act Health,*. doi:10.1123/jpah.2014-0270

Tynjala, J., Kannas, L., Levalahti, E., & Valimaa, R. (1999). Perceived sleep quality and its precursors in adolescents. *Health Promotion International, 14*(2), 155–166.

Tynjala, J., Kannas, L., & Valimaa, R. (1993). How young Europeans sleep. *Health Education Research, 8*(1), 69–80.

Valdez, P., Ramirez, C., & Garcia, A. (1996). Delaying and extending sleep during weekends: Sleep recovery or circadian effect? *Chronobiology International, 13*(3), 191–198.

Vazsonyi, A. T., Harris, C., Terveer, A. M., Pagava, K., Phagava, H., & Michaud, P.-A. (2015). Parallel mediation effects by sleep on the parental warmth-problem behavior links: Evidence from national probability samples of Georgian and Swiss Adolescents. *Journal of Youth and Adolescence, 44*(2), 331–345.

Vedaa, O., Saxvig, I. W., Wilhelmsen-Langeland, A., Bjorvatn, B., & Pallesen, S. (2012). School start time, sleepiness and functioning in Norwegian adolescents. *Scandinavian Journal of Educational Research, 56*(1), 55–67.

Vignau, J., Bailly, D., Duhamel, A., Vervaecke, P., Beuscart, R., & Collinet, C. (1997). Epidemiologic study of sleep quality and troubles in French secondary school adolescents. *Journal of Adolescent Health, 21*(5), 343–350.

Volger, A., Ernst, G., Nachreiner, F., & Hanecke, K. (1988). Common free time of family members under different shift systems. *Applied Ergonomics, 19*(3), 213–218.

Wight, V. R., Price, J., Bianchi, S. M., & Hunt, B. R. (2009). The time use of teenagers. *Social Science Research, 38*(4), 792–809.

Williams, C. (2008). Work-life balance of shift workers. *Perspectives on Labour and Income.* Statistics Canada catalogue no. 75-001-x August pp. 5-16. http://www.statcan.gc.ca/pub/75-001-x/2008108/pdf/10677-eng.pdf. Accessed 30 March 2015.

Wolfson, A. R., & Carskadon, M. A. (1998). Sleep schedules and daytime functioning in adolescents. *Child Development, 69*(4), 875–887.

Wray-Lake, L., Crouter, A. C., & McHale, S. M. (2010). Developmental patterns in decision-making autonomy across middle childhood and adolescence: European American parents' perspectives. *Child Development, 81*(2), 636–651.

Irregular Work Shifts and Family Issues—The Case of Flight Attendants

Flaviany Ribeiro-Silva, Lucia Rotenberg and Frida Marina Fischer

Abstract This chapter deals with the particularities of the work schedule of flight attendants and its influence on social and family life. Characteristically, flight attendants work in shifts that involve irregular hours without preplanned rest periods, eventually including night and transmeridian flights, as well as stopovers away from home. All these factors jeopardize the flight attendants' social and family life. From the gender perspective, an extremely high proportion of flight attendants are female, and thus the implications of the sexual division of labor deserve particular consideration relative to both the professional and domestic spheres. Having to manage their homes from a distance poses an additional demand to this category of workers. Quantitative and qualitative analyses indicate mental stress related to depression and anxiety among flight attendants. According to some studies, female flight attendants feel lonely and a failure as partners and mothers. In addition, they have mixed feelings about their job and must elaborate complex strategies to balance work and family. Flight attendants are a relevant population for shift work studies as a function of the particular demands their work schedule imposes on the management of daily life, which exert significant impact on health and psychosocial outcomes that still require more thorough analysis.

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1 Introduction

The new economic order resulting from the intensive globalization of goods and services particularly from the 80s onwards led companies to implement or sustain practices of work organization that have adverse effects on health. Work intensification, job instability and conflict in the workplace became common occurrences, partly due to strong competition between enterprises and to the introduction of flexible work schedules, which are usually unfavorable to workers. While beneficial changes in working times are not expected to take place in the near future, several authors believe that the growth of "around the clock" services, which underwent significant expansion along the past four decades, will continue instead (Strazdins et al. 2006). Irregular work shifts have long been common in some areas of the services sector, like transportation, commercial aviation in particular. According to Shalla (2004), the growing deregulation of the airline industry had particular consequences for the working-time regime. Thus, for instance, schedules that do not consider the recommendations to reduce the extent of work at "unsociable hours" are now quite usual. In the particular case of flight attendants, Shalla further observes that their work became as undervalued as to achieve the status of a commodity.

There is a current concern among scholars, researchers and policy makers about the consequences of the impact of the expansion of the 24 h society on family life. For instance, one or both parents in three-fourths of Canadian families worked nights or weekends as early as in 2004 (Strazdins et al. 2004). Epidemiological data attest to the negative impact of such work schedules on the children's wellbeing, which is stronger among preschoolers (Strazdins et al. 2004). Those facts relative to shift work in general deserve more particular attention in the case of flight attendants.

The aim of this chapter is to present and discuss several aspects of the social and family life of female flight attendants. For that purpose, the first section describes some examples of their work schedule to call attention to several features related with shift irregularity and unpredictability, as well as to geographical issues, since per definition this job is performed far from the workers' homes. Because this is considered a "female profession", section two discusses the implications of the work schedules of flights attendants for family life. The perceptions of flight attendants about their marriage and family life and the strategies they elaborate to cope with the demands of home are the subject of section three, together with some health problems that are attributed to difficulties in the work-family interface. We conclude by emphasizing the relevance of family-friendly policies to reduce the impact of work schedules on workers' social and family lives.

2 Work Schedules of Flight Attendants in the Present-Day Aviation Industry

The economic significance of national and international transportation of people and cargo by air is enormous worldwide. A modality restricted to a small number of passengers just a few decades ago became extraordinarily popular. In the present time, traveling by plane might be less expensive compared to other private or public modes of transport. To be sure, the transportation sector is increasingly growing. Data from the Brazilian Air Transport Yearbook (ANAC 2013) show that the national fleet size underwent considerable increase, totaling 563 aircrafts at the end of 2013, thus becoming 8.7 % larger compared to the previous year. About 109 million passengers were carried in 2013, being 90 million in domestic and 19.2 million in international flights. Nevertheless, such wider availability of flights was not attended by a parallel increase in the number of employees per aircraft, which actually decreased from 118.0 to 106.3, on average, being a reflection of an overall trend in the aviation industry.

About 20 % of the total number of employees per aircraft (including line personnel, operations and maintenance) corresponds to the non-technical crew (flight attendants). In several countries, like Brazil and the United States, the number of employed flight attendants is in the order of tens of thousands (ANAC 2013; Bureau of Labor Statistics 2014).

The flight attendant profession is probably still attractive to many men and women as a function of its traditional/legendary glamour and the opportunity it affords to travel around the world and meet new people. Several websites include brief and objective descriptions of the work environment, injuries and illnesses, and work schedules of flight attendants. Thus, the section of the website of the Bureau of Labor Statistics (2014) on work schedules states: "Most flight attendants work full time, but they usually have variable schedules. Flight attendants often work nights, weekends, and holidays because airlines operate every day and have overnight flights (…). A typical on-duty shift is usually about 12–14 h per day. However, duty time can be increased for international flights. The Federal Aviation Administration (FAA) requires that flight attendants receive 9 consecutive hours of rest following any duty period before starting their next duty period." In turn, website Flight Attendant Express (2015), which defines itself as "your boarding pass to a dream career", brings a description of a "typical" working day, including irregular working times and long working hours, the need to be available on an on-call basis and to be ready to have personal plans interfered with by unscheduled flights, the will to spend many days far from home, to start work early in the morning or work all night until dawn, to arrive always on time and willing to work even at the most unfavorable times. Such a pitiful description of "A day in the life of a flight attendant" nonetheless ends on a bright note: readers are reminded of the

unique opportunity flight attendants have to travel to amazing places and meet celebrities, as well as of the looks of admiration they receive upon walking through the airport terminal in full uniform, with their wings on.

In the case of flight attendants, the organization of work specifically includes "irregular" flight schedules (i.e., flight dates and times change from 1 week to the next), night work, transmeridian flights (including time zone shifts), stopovers at distant towns, which in addition to the actual physical absence, makes any quick return home impossible, and eventual mismatches between the working schedule and social and family life. Itani (1998) described the particularities of the spatial and temporal organization of flight attendants' work in the terms of a "counterflow of time" vis-à-vis the family life routine.

We interviewed Brazilian female flight attendants to collect data on their monthly work schedule. Such schedules are overall characterized by irregular working hours relative to both the beginning and end of workdays.

According to the Brazilian legislation in force, the maximum workload for aircrews is 85 h per month, including flying, on-call and on-reserve hours. Flight crews must be granted eight rest days per month, such that two must fall on Friday/Saturday, Saturday/Sunday or Sunday/Monday. There must be at least a 12 h interval between two consecutive workdays. The maximum workday length is 14 h for relay crews and up to 11 h for simple or compound crews.[1]

It is worthwhile to stress that the work schedule of flight attendants also includes on-call periods, along which they stay at a place of their choice, but must be available for duty at all times and show up at the airport or any other place upon being called by their employers, and on-reserve periods, along which they have to remain available for duty at the workplace for a given number of hours. On-call and on-reserve hours are paid, albeit less than the flying hours.

Figure 1 depicts the work schedule for January 2015 of a Brazilian female flight attendant on domestic routes. She is 30 years old and has been a flight attendant for about 5 years. She is married to a pilot who works at the same airline. Her base is in the city of São Paulo, being the point of departure and arrival of several flights she is committed to fly each month. The analysis of Fig. 1 shows that in 13 out of 31 days the flight attendant was not at the base at nighttime, for example, at midnight. Although in this particular case, the flight attendant lives 700 km away from the base, her difficulty in relation to return home does not derive from the place of residence. Her difficulties are due to the irregular work shifts at aviation, which demand not only irregular work schedules, but also working at different cities. So, even though she resided at the base, in several working days she would have to spend the night in another city, due to the arrival or departure times of the

[1]According to the legislation in force for Brazilian flight crews, a simple crew is a minimum crew, eventually enlarged by the crew members needed for the performance of the flight. A compound crew is a simple crew enlarged by one pilot qualified as pilot-in-command, one flight engineer when the equipment thus requires, and 25 % of the number of flight attendants at least. A relay crew is a simple crew with more than one pilot qualified as pilot-in-command, one co-pilot, one flight engineer when the equipment thus requires, and 40 % of the number of flight attendants.

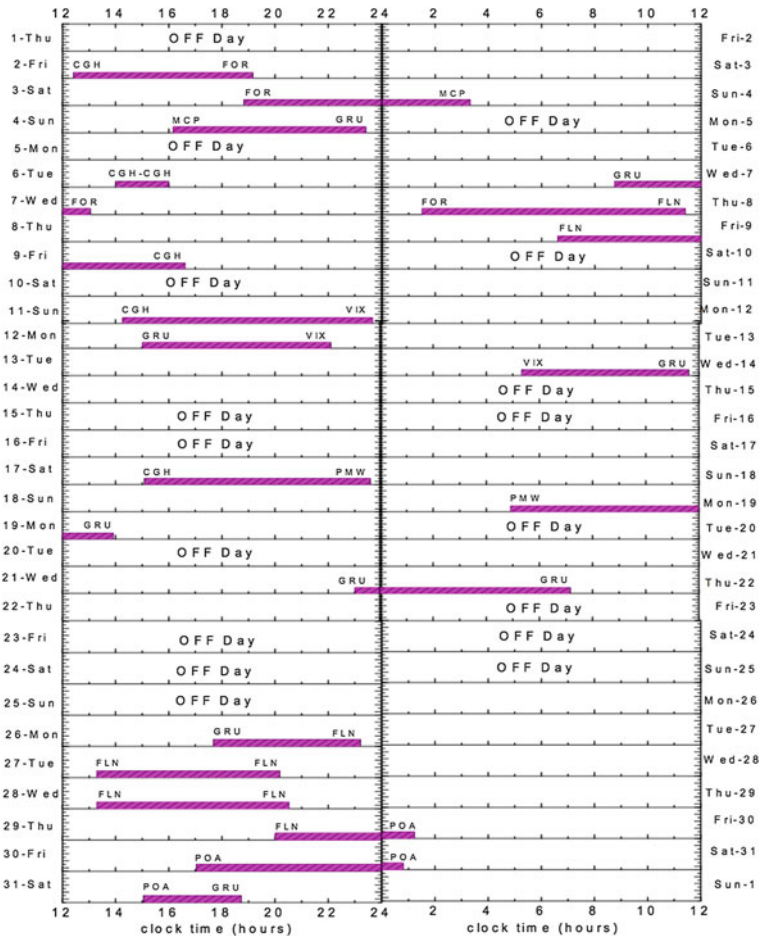

Fig. 1 National work schedule of a female flight attendant. Point of departure and final destination at each working day (Brazilian airports). CGH: Congonhas, São Paulo. FLN: Florianópolis, SC. FOR: Fortaleza, CE. GRU: Guarulhos, International São Paulo airport. MCP: Macapá, AP. VIX: Vitória, ES. PMW: Palmas, TO. POA: Porto Alegre, RS

aircraft. Thanks to a union agreement, she can fly gratis between the base and the town where she lives. She must report to the airport terminal at least 1 h before flights, and in stopovers, she must show up at the hotel lobby 1 h and 30 min before the flight. She has not yet had children, and intends to quit the profession when she becomes a mother. The schedule depicted in Fig. 1 (January 2015) shows that work started or finished in the early hours on some days, and that she worked day and night shifts. January is in the summer in the Southern hemisphere and the daylight

saving time (DST) was in force, but not all across the country, for which reason the time could be different at the departure and arrival airports, which eventually also were at different time zones. As a result, she had to cope with one-to-three hour differences relative to the time at her base in São Paulo (Guarulhos—GRU—or Congonhas—CGH—airport, as shown in Fig. 1). She had nine rest days during that month, lasting two or three consecutive days on two occasions.

She observed it is difficult for her to start work early in the morning and to finish late. The schedule depicted in Fig. 1 (January 2015) shows that work started or finished in the early hours on some days, and that she worked day and night shifts.

Figure 2 depicts the work schedule of a 38 year-old female flight attendant, who is married and has a 5 year-old son. Her base is in São Paulo, where she also lives. She has been a flight attendant for 12 years and has always worked at the same airline. She flies international routes only. Her work schedule includes flights between Brazil and Germany (Frankfurt—FRA) and between Brazil and the United States (Miami—MIA), involving 4 and 3 h time zone differences, respectively, while the Brazilian DST is in force. She told us that her son attends preschool and is taken care of by her mother and mother-in-law during the day, and her husband at night while she is away. Her husband does not work for the aviation industry and is very supportive of her career. She is unhappy with the fact she has to be away from home, and said she feels very tired when she comes back, being thus unable to play and chat too much with her son. Fortunately, thanks to the advances in communication technology, she can talk with her son via Internet while she is away. She believes that flying international routes is best, because she does not need to travel much across Brazilian cities, and thus the time spent commuting between her house and the airports is shorter.

According to Ribeiro-Silva et al. (2014), the work schedule behaves as a true social organizer of the daily life of flight attendants. This is to say, they plan their lives around their work schedule. In a recently published study, the abovementioned authors found that flight attendants tend to plan their lives around their working schedule, as the following expressions of two interviewees show: “we depend on the work schedule” (flight attendant A) or “my work schedule is my life, because it lets me know when I [have to] leave and [when I’ll] come back” (flight attendant B).

The limited predictability of workdays might represent one further hindrance to participation in family activities. Flight crews often spend nights at towns far from the base, and in some cases, they stay at the base only on rest days.

According to a collective agreement, the monthly work schedule must be delivered to flight crews in advance, and thus it is sent at the end of the previous month via mobile phone. Changes might be requested, being granted as a function of the availability of the other crewmembers.

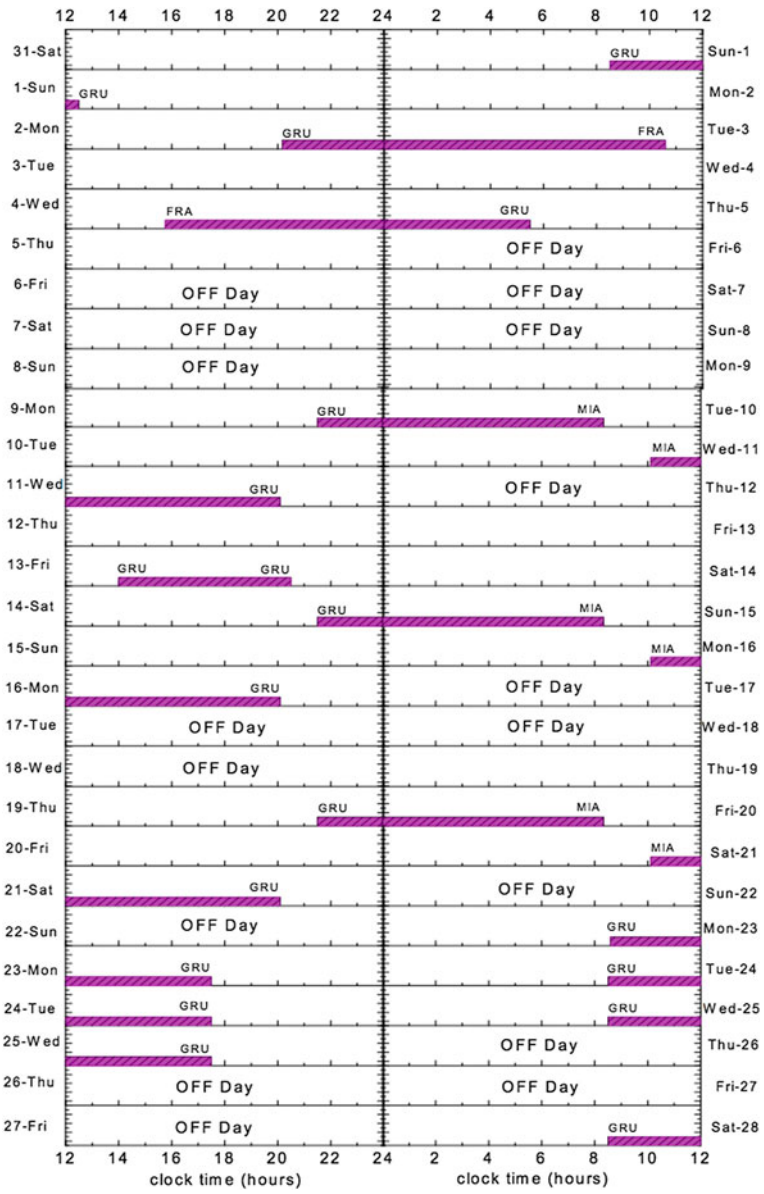

Fig. 2 International work schedule of a female flight attendant. Point of departure and final destination at each working day (international airports). FRA: Frankfurt. GRU: International São Paulo airport. MIA: Miami

3 Flight Attendants as a "Female" Profession—Implications for Family Life

The high prevalence of women among flight attendants (Lee et al. 2008) reflects the "sex-segregated" nature of the labor market, according to which some occupations are dominated by either men or women. According to several sociologists, the "female" professions are the ones that are in continuity with the "natural" tasks of women, which are characterized by caregiving (e.g., Walby et al. 1994). In this regard, Levy et al. (1984) observe, "flight attendant is a stereotypically 'feminine' occupation, but unlike many, it does not easily mesh well with the role of housewife" (p. 67).

Shalla (2004) performed a historical analysis of work in the aviation industry from the gender perspective based on data corresponding to Canadian airlines. She concluded that until the 70s, the work regime was shaped on the male-provider/dependent-housewife model. Since the nature of air transportation requires employees to stay away from home over long periods of time and the working times are somewhat unpredictable, female flight attendants were not allowed to marry or have children. At that time it was believed that female flight attendants could not fully commit to the job and to their tasks as mothers and homemakers at once.

That state of affairs changed dramatically during the following decades as a function of the women's worldwide movement for the right to remain in the paid labor market while simultaneously taking care of their homes and children. As many other categories of working women, likewise flight attendants had to fight for the right to keep their jobs and benefits upon becoming mothers. Shalla observes that, for instance, most female flight attendants in Canada were granted the rights to keep their jobs after marrying and to maternity leave only by the mid-60s (Shalla 2004).

Upon analyzing family relationships from the perspective of working-time regimes, it is worthwhile to bear in mind that the working times of parents define the amount of time they might devote to their spouse and children (Strazdins et al. 2004). As a function of the role society attributes to women within the home environment, men and women experience the work-family interface quite differently, as Fagan (2001) and Strazdins et al. (2006) remarked.

The next section is devoted to two interrelated aspects that stand out in the scientific literature on flight attendants: (1) the strategies they develop to cope with the challenges placed by home management and conjugal and parent-child relationships; and (2) the health problems and complaints they attribute to difficulties in the work-family interface.

4 Aspects Related to Conjugal and Parenting Roles—Difficulties and Strategies Related to Housework and Child-Care Duties

Female flight attendants are exposed to peculiar temporal and spatial circumstances in their professional life (Ribeiro-Silva et al. 2014), including frequent physical absence and the eventual impossibility to return home quickly, resulting in "mismatches" between their work schedule and social and family life. As a function of these characteristics and of the influence of gender issues on this particular occupational setting, the mother-child and conjugal relationships also exhibit singular features in this population (Ribeiro-Silva et al. 2014).

In studies conducted with Brazilian female flight attendants with children, the participants' narratives included mentions of the people who represent them while they are away (Ribeiro-Silva et al. 2014; Mello 2009). As illustrated by one of the cases described above, flight attendants have access to a support network, mostly composed of women charged with maintaining the household routine and ensuring the children's care and supervision. As Mello (2009) remarked, this is a strategy to manage the family organization and experience motherhood from a distance. This author emphasizes the fact that female flight attendants establish negotiations with relatives and friends to delegate or engage their cooperation in household duties and chores. Such negotiations are only possible when these women can count on a "*team*", namely, a group of people chosen by them and who will comply with the instructions they give in a systematic and continuous manner (Mello 2009). Such delegation of activities and duties might be considered as a strategy to ensure that the household and children's care tasks will be effectively accomplished.

In "*The lights are on; I must be at work: Aspects of "home" in the lives of flight attendants*", Whitelegg (2003) calls attention to the fact that female flight attendants manage their homes and families mainly by means of telephone calls (which might have possibly increased as a function of the development of communication technology via Internet): "They manage from afar, especially with cell phones. They call in the morning before the kids go to school and of course if something is wrong there is a great deal of anguish" (Whitelegg 2003, p. 9). However, while distance communication facilitates some household-related tasks, like purchasing appliances and hiring a handyman, it does not seem to solve some difficulties in the mother-child relationship (Ribeiro-Silva et al. 2014).

Indeed, in studies conducted with Brazilian female flight attendants, the frequency of complaints related to lack of time and of personal contact with the children was high (Ribeiro-Silva et al. 2014; Mello 2009). The authors of a study on maternal identity assert that the concern with the performance of the maternal function seems to prevail over other social roles carried out by women (Souza and Ferreira 2005). In other words, the experience of motherhood seems to be a milestone in the life of any woman (Ribeiro-Silva et al. 2014), which echoes the narratives of the female flight attendants interviewed by Ribeiro-Silva et al. (2014). Those authors concluded that the experience of motherhood aids in coping with the

adversities and difficulties derived from professional life, as the following narrative of one of the interviewees illustrates: "*To be a mom is not to think about yourself, my children always come first, now I only stand working in the aviation industry because of them*".

The fact of having children also seems to induce a change in motivational focus. While motivation seems to be first centered on aviation-related matters only, once children are born it shifts to the home and children's care. In the flight attendants' views, the meaning of life changes once they become mothers, in which context their personal safety and the certainty they will come back home unharmed are indispensable (Ribeiro-Silva et al. 2014).

The abovementioned study by Ribeiro-Silva et al. (2014) also indicates that among female flight attendants, the parent-child relationship tends to prevail over the conjugal one. Motherhood also seems to induce a change in the focus of attention in this regard, whereby flight attendants might eventually relegate their husbands or partners to the background. This situation was thoroughly analyzed by Oliveira and Marcondes (2004) in their study on motherhood, work and conjugal relationships in post-feminism.

Upon being queried as to their perception of their husbands or partners as parents, flight attendants emphasize that the moment the latter begin to spend a longer time at home, they seem to get more involved in the house routine and children's care (Ribeiro-Silva et al. 2014). These findings agree with the conclusions of Barnett and Gareis (2007) relative to women who perform shift work. Those authors found that under such circumstances, husbands or partners contribute more to the household chores and duties, leading to greater engagement in the children's care. As a result, the women tend to make a more positive evaluation of their conjugal and family relationships.

In turn, Jablonski and Saldanha da Silva (2011) found that couples who are both flight attendants have more tolerance of the specificities and time of each other's work. In addition, mutual support might be a beneficial factor for the couple's mental health and in their coping with the problems posed by home management and life as a whole.

It is worthwhile to observe that the flight attendants' complaints relative to the lack of time for family life do not only denote a source of current anguish, but also a concern with the quality of the mother-child relationship vis-à-vis the possible effects of the mother's absence on the children's development. So, for instance, one of the flight attendants interviewed by Ribeiro-Silva et al. (2014, p. 479) stated: "*My children grew up and I missed a lot. How much does my career affect the psychological side of my children? Want it or not, I'm not there a large part of the time*".

Some studies specifically addressed situations that involve conflict between the job demands and the domestic sphere. For instance, Whitelegg (2003) describes four distinct phases of the flight routine: leaving, in-flight, layover, and return. According to this author, in the stage of "leaving" flight attendants find it difficult to

say goodbye to their children and feel discomfort along the journey to the airport. For those reasons, they have resorted to symbolic tactics to enter the "flight-attendant mode", including the performance of professional routines and rituals. In the "in-flight" stage, many flight attendants claim to be too busy to think about anything to do with home. Contrariwise, others try to bring home into the workplace by means of photographs and by exchanging stories with their colleagues at the back of the aircraft during flights. "Layovers" allude to the time spent by flight attendants outside the aircraft, being unable to return home. Although they regard themselves as being "at work", they might also withdraw from the flight-attendant mode. The last stage is the one of "return", which takes place in two phases. The first is on leaving the airport, when they often call their partners, children, friends or parents to let them know they have landed. The second phase takes place upon actually entering the home, and is often the more difficult one, as they are very tired or disoriented, and always go through a ritual of adjustment to family and domestic life (Whitelegg 2003).

MacDonald et al. (2003) elaborated a measure of the "imbalance between work and nonwork obligations outside of work (including family)" (page 705) for a population of flight attendants. Analysis showed that such "imbalance" occurred in nearly one third of the participants, especially among those who had preschool-aged children, thus agreeing with the results reported by Strazdins et al. (2004) relative to shift workers in general. MacDonald et al. (2003) emphasize the difficulties met by female flight attendants not only as a function of the irregular shifts and long working hours, but also of the unforeseeable changes in flight schedules and the long periods they spend far from home and their beloved ones.

In their study on the views of current and former women flight attendants about the demands posed by professional life using focus groups and interviews, Ballard et al. (2004) found that issues related with anxiety and depression were a major concern for the participants. Within this context, isolation, solitude and the fear of being an inadequate mother were particularly highlighted, in addition to several issues proper to the relationship with passengers (Ballard et al. 2004). In a later epidemiological study that applied a questionnaire based on the data collected in the aforementioned qualitative study, Ballard et al. (2006) found that the psychological stress reported by current female flight attendants was due to the job characteristics and family difficulties. The latter conditions seemingly exerted influence on self-perceived health, as it was more often described as fair or poor by the current compared to the former flight attendants. Since perceived poor health is known to be associated with mortality and several health outcomes, the authors concluded that the difficulties arising from the conflict between the women's roles as workers and mothers are directly associated with unfavorable states of health among flight attendants (Ballard et al. 2006).

5 Final Remarks—the Relevance of Family-Friendly Policies for Flight Attendants

As a function of the difficulties met by flight attendants in their family relationships, the formulation of family-friendly policies is crucial in the aviation setting. The latter pose a challenge to employers and policymakers, since rosters are built to meet economic demands, rather than the workers' needs (Strazdins et al. 2006).

Several airlines have formulated some family-centered policies, for instance, in the case both members of a couple work in aircrews, since under such circumstances the conjugal and family life is strongly dependent on the work schedule established by the airline. Thus being, some airlines seek to match the flight schedule and rest days of such couples (Jablonski and Saldanha da Silva 2011).

As a part of the collective agreement agenda, some Brazilian airlines release female flight attendants from on-call and on-reserve service for 6 months after the end of the maternity leave. In addition, they do not alter their work schedule once it is established and ensure they return to the base after each workday so as not to jeopardize breastfeeding. To avoid potential risks to mother and child, as soon as a flight attendant learns she is pregnant, she is no longer allowed to fly, but stays at home, her salary being paid by the Social Security. Airlines also try to schedule the rest days on the dates requested by the aircrew members. It is worth noting that most such requests are related to family matters.

To summarize, the picture depicted in the present chapter demonstrates the relevance of including information on the working times of parents in the literature on the work-family relationship. According to Strazdins et al. (2004), "time is a family resource" (p. 1518), while shift work might be rated as "unsociable" vis-à-vis family life. The relevance of working times within the context of family relationships reflects on the "decent work" agenda formulated by the International Labor Organization (ILO), which "also includes the decent work in the area of working time. In principle the work arrangements should maintain "health and safety, be family-friendly, promote gender equality, enhance productivity, facilitate workers' choice and influence over their working hours" (Lee et al. 2007, p. 141). The irregular work schedules to which flight attendants are subjected are still far from meeting the criteria recommended by ILO.

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References

ANAC—Agencia Nacional de Aviação Civil (2013). *Anuário do transporte aéreo. Dados estatísticos e econômicos de 2013* [Air transport yearbook. Statistical and economic data for 2013]. http://www.anac.gov.br. Accessed Feb 27 2015.

Ballard, T. J., Romito, P., Lauria, L., Vigiliano, V., Caldora, M., Mazzanti, C., & Verdecchia, A. (2006). Self perceived health and mental health among women flight attendants. *Occupational and Environmental Medicine, 63*(1), 33–38.

Ballard, T. J., Corradi, L., Lauria, L., Mazzanti, C., Scaravelli, G., Sgorbissa, F., et al. (2004). Integrating qualitative methods into occupational health research: a study of women flight attendants. *Occupational and Environmental Medicine, 61*(2), 163–166.

Barnett, R. C., & Gareis, K. C. (2007). Shift work, parenting behaviors, and children's socioemotional well-being a within-family study. *Journal of Family Issues, 28*(6), 727–748.

Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook (2014). 15 Edition, Flight Attendants. http://www.bls.gov/ooh/transportation-and-material-moving/flight-attendants.htm. Accessed 27 Feb 2015.

Fagan, C. (2001). Time, money and the gender order: work orientations and working-time preferences in Britain. *Gender, Work & Organization*, *8*(3), 239–266.

Flight Attendant Express (2015). A day in the life of a flight attendant. http://www.airlineinflight.com/FlightAttendantSchoolStory/flight-attendant-story-page3.html. Accessed Feb 27 2015.

Itani, A. (1998). *Trabalho e saúde na aviação. A experiência entre o invisível e o risco* (Work and health in aviation. The experience between the invisible and the risk). São Paulo: Hucitec.

Jablonski, B., & Saldanha da Silva, M. (2011). D(e)scolar de casa: dilemas contemporâneos dos casais de aeronautas (Take off home: contemporary dilemmas for crew members couples). *Psicologia em Revista*, *17*(2), 196–210.

Lee, H., Wilbur, J., Kim, M. J. A., & Miller, A. M. (2008). Psychosocial risk factors for work-related musculoskeletal disorders of the lower-back among long-haul international female flight attendants. *Journal of Advanced Nursing, 61*(5), 492–502.

Lee, S., McCann D., & Messenger J. C. (2007). *Working time around the world: Trends in working hours, laws and policies in a global comparative perspective*. London and ILO, Geneva: Routledge. http://www.ilo.org/global/publications/magazines-and-journals/world-of-work-magazine/articles/WCMS_083945/lang–en/index.htm#P31_12306. Accessed March 3, 2015.

Levy, D. E., Faulkner, G. L., & Dixon, R. D. (1984). Career family of the flight attendant. *Journal of Social Relations, 11*(2), 67–85.

MacDonald, L. A., Deddens, J. A., Grajewski, B. A., Whelan, E. A., & Hurrell, J. J. (2003). Job stress among female flight attendants. *Journal of Occupational and Environmental Medicine, 45*(7), 703–714.

Mello, D. (2009). Comissárias de Voo: um olhar sobre a relação entre os tempos de trabalho e da vida familiar. [Female flight attendants: a view on the relationship between working times and family life] Dissertação de Mestrado, Escola Nacional de Saúde Pública – FIOCRUZ, Rio de Janeiro.

Oliveira, M. C., & Marcondes, G. S. (2004). Contabilizando perdas e ganhos: maternidade, trabalho e conjugalidade no pós feminismo. [Computing losses and gains: motherhood, work and conjugal relationships in post-feminism] In Anais do XIV Encontro Nacional de Estudos Populacionais, ABEP. GT Reprodução Humana e GT População e Gênero: nupcialidade, conjugalidade e família. Caxambu, Minas Gerais. http://www.abep.nepo.unicamp.br/site_eventos_abep/PDF/ABEP2004_503.pdf. Accessed 20 Feb 2015.

Ribeiro-Silva, F., Uziel, A. P., Rotenberg, L. (2014). Mulher, tempo e trabalho: o cotidiano de mulheres comissárias de voo (Woman, time and work: the daily life of women flight attendants). *Psicologia & Sociedade*, *26*(2), 472–482.

Shalla, V. (2004). Time warped: The flexibilization and maximization of flight attendant working time. *Canadian Review of Sociology, 41*(3), 345–368.

Souza, D. B. L., & Ferreira, M. C. (2005). Auto-estima pessoal e coletiva em mães e não-mães [Personal and collective self-esteem in mothers and non-mothers]. *Psicologia em Estudo*, *10* (1), 19–25.

Strazdins, L., Clements, M. S., Korda, R. J., Broom, D. H., & D'Souza, R. M. (2006). Unsociable work? Nonstandard work schedules, family relationships, and children's Well-Being. *Journal of Marriage and Family, 68*(2), 394–410.

Strazdins, L., Korda, R. J., Lim, L. L., Broom, D. H., & D'Souza, R. M. (2004). Around-the-clock: parent work schedules and children's well-being in a 24-h economy. *Social Science and Medicine, 59*(7), 1517–27.

Walby, S., Greenwell, J., Mackay, L., & Soothill, K. (1994). *Medicine and Nursing—professions in a changing health service*. London: Sage Publications.

Whitelegg, D. (2003). The lights are on: I must be at work: aspects of "home" in the lives of flight attendants. Emory Center for Myth and Ritual in American Life, Working Paper, 25, 2003.

Part IV
Individual Differences and Work-family Relationship

Gender Differences in Safety, Health and Work/Family Interference—Promoting Equity

Donatella Camerino

Abstract The European labor market is still acting to women's detriment. Among various projects, measures are in place against sex role segregation at work, vertical segregation within organizational hierarchies, and the uneven division of domestic labor. Strategic plans (Commission of the European Communities, 2007–2012) have been developed to address gender differences in safety and health at work and to promote equality. Inequalities reflect the histories of a particular country and its policies (cohort effects), life cycles (differential representations of social roles) and individual opportunities encountered during the life course to develop adequate coping strategies and working experience. For these reasons, gender issues are connected to age and historical period of birth determining differential needs in career, in length and scheduling of working hours. Because few studies in occupational health have examined these factors in Italy, we tried to carry out a review of studies focused on gender problems and their determinants with the intent to improve researches in occupational health and preventive projects. Moreover we analyzed studies about work related stress carried out on Italian workers to appreciate the presence of gender problems and determinants such as parenting responsibilities, work hours and work schedules, perceptions of organizational equity, work-family interference, flexibility and variability of working hours. Confirming gender inequalities, statistical analysis shows worse outcomes for females due to time pressure and lack of reward for efforts at work and at home. Interventions are discussed in terms of democratic participation in preventive programs as well.

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1 Introduction

> Hypatia (Alexandria of Egypt, 370–415 p.c.n.) was a great philosopher and a scientist, she devoted herself to mathematics and astronomy using advanced observation techniques. An example of virtue, she was also a woman not subject to political parties or factions, who not infrequently appeared in public places talking to public. She was sage and a teacher equipped with an authoritative word for every one… Still very young, she was barbarously murdered because she interfered by her scientific independence with the antagonism between Orestes' imperial and Cyril's ecclesiastic powers. The episode was one of the first signals that the independence of a spokesperson of science could not be accepted by politics and religions…worst, she was a spokeswoman, otherwise Orest and Cyril might have been able to reach an agreement (Dzielska 1996).

In the global population, a severe imbalance in women's and men's numbers exists: there are 60 million fewer women than men (Data World Bank 2015), partially due to selective abortion of female foetus and lower attention to female safety and growth in some parts of the world. The lack of social equity as well as female illiteracy in vast part of the world is one of the major obstacles to economic growth (Schwab et al. 2014). It also limits upward social mobility opportunities, erodes individual health over the life course and inhibits timely use of medical care (James 2009; Beer 2009; Marinacci et al. 2013; Veronesi 2012).

Accordingly, political choices are relevant to avoid gender inequalities in health: democracy, as a long term process, transparent politics, women's participation and dual-earner family models (Van der Lippe et al. 2010; Aryee and Luk 1996) make a significant contribution to increasing gender equality and health, even after controlling for the effects of modernization and development.

Today, the European preventive measures of stress at work need to take in account gender, age and origin of the workers and to promote their democratic participation in preventive procedures. However, behind the words gender, age and provenance there are no homogenous realities. In this chapter, a review is provided here to identify more practical indicators such as biological and social determinants of gender inequalities and health disparities. Some of these determinants are examined through different regulation and culture, in a historical perspective and different personal life stages. Work–life balance is then reviewed in relation with these determinants. Then, a retrospective analysis of previous studies carried out, with preventive purpose, on Italian workers exposed to psychosocial stressors at work is reported to verify the presence of gender issues.

2 Health Disparities and Their Determinants

The term "health disparities" refers to unnecessary, preventable and unfair group differences in health. Gender inequalities in health reflect the fact that women have a lower social gradient. Thus, they suffer more than men from disabling physical and mental illness (Lombardi 2011). Although women in the world are today

expected to live longer than men (women's life expectancy +6.6 years, male's life expectancy +5.8 years; Mather et al. 2014), generally they live longer but in poorer health conditions (Borrell et al. 2014).

Health determinants of health include biological, psychological, environmental and sociocultural factors. With respect to biological aspects, "sex" refers only to the classification of male or female according to reproductive organs and functions assigned by chromosomal complement, even if influenced by diverse race or ethnicity. For example, there is strong evidence of the influence of:

- menstrual cycle and its endocrine dynamics on cardio-metabolic biomarkers such as oxidative lipids, insulin sensitivity and systematic inflammation,
- pregnancy on cardiovascular health (for instance, cardiovascular disease in women shows strong associations with previous pregnancy complications, even if these are markers of latent high risk cardiovascular trajectories) (Rich-Edwards et al. 2013),
- ovulatory function on bone mineral density (Li et al. 2014). Progesterone, as well as estrogens, play an important role in osteoblast function, promoting ossification while anovulation potentially affects bone mineral density,
- hormonal changes in pre-menstrual period, pregnancy, postpartum, peri-menopause and menopause on mood, anxiety and exacerbation of psychiatric diseases.

There are also different prevalences of cancer types between females and males with specific rates of incidence along the course of life and dissimilar reaction to therapies. In addition, postmenopausal hormone therapy and obesity (BMI > 30) have also been evaluated for their association with breast cancer risk (Woods and Tsui 2014). For all these reasons, World Health Organization (2009) highlighted the need to examine women's risks for cardiovascular disease, breast, cervical or other reproductive organ cancer, diabetes, osteoporosis and mental depression.

Inevitably, sex interacts with the construct of gender that is based on culture-bound conventions, roles and behavior. The acquisition of gender roles and stereotypes starts early with socialization of girls and boys and continues throughout the life course. Even if biology plays a role in health differences, the higher burden of suffering is related mainly to social inequalities in power and in the unequal division of paid and unpaid work grounded in gender (Borrell et al. 2014).

Several epidemiologic studies showed that gender inequalities in health outcomes can be explained by inequalities between men and women in some key macro-social determinants of health like political power (representation), welfare state (equity in pension issue), social protection policies (family support as child care facilities and gender equitable use of time), economic and labor market policies (equal incomes, equal horizontal and vertical opportunities of career). These determinants act via an increase in stress, discrimination, violence, financial difficulties and poverty, double burden of work and time pressure, with consequence even on women's leisure and refresher time (Borrell et al. 2014).

3 Regulations, Culture, Persistence of Horizontal and Vertical Segregation

Already in the nineteenth century British legislation and later the ILO were aware of and addressed the issue of protecting women's and young persons' health (ILO Constitution 1919). Further on, during the years 1970–1990, a long debate took place about gender discrimination, especially because some equal opportunities and equal treatment could not be maintained due to biological, cultural or social differences. Recently, strategy plans (CEC 2007–2012) were arranged to cope with gender differences in safety and health at work, promoting equality. In nine years of measuring the Global Gender Gap Index, (based on hard data indicators from international organizations, it takes into account economic participation and opportunities, educational attainment, political empowerment, health and survival; World Economic Forum, 2006) the world has seen only a small improvement in equality for women in the workplace (Schwab et al. 2014). Nordic nations remain the most gender-equal societies in the world. In 2013, the leading four nations—Iceland (1), Finland (2), Norway (3) and Sweden (4)—were joined by Denmark, climbing from eighth to fifth place.

With particular regard to inequalities in working time, a "part time work" culture is also prevalent in the Netherlands. In Southern Europe women are much more likely to work full time although it is common for them to stop when they have children, while only Scandinavian countries have a culture in which both men and women are responsible for child care and both continue to work part time for more than 30 h a week.

Gender disparities are more evident in the labor market where men and women's roles, generally viewed as the base of traditional parental relationships, are also reasons for discrimination at work. In particular, where a male culture is prevalent men are required to be assertive, tough and geared towards material success while women should be modest, friendly and oriented towards quality of life. Male culture was dominant mainly in agricultural societies; medieval employers acted as father and owners and had relevant power over the employees' individual life and their families, endowing income, house, school and health assistance. At that time prevention was mainly an issue of physical capacity to avoid adverse effects due to some kind of exposure. Successive women's efforts to enter the labour market started without benefit of union, associative or political participations, therefore with role, income and reward inequalities. The first regulations to protect women and children at work, as powerless categories, had the main intent of limiting their entrance into the world of work. At that time, women's prevention mainly considered risks connected to motherhood and feeding, leaving out risk factors due to biology diversities or disparities in occupational organization (e.g., atypical jobs, shift work, temporary job etc.…) as well as company policies to promote and esteem women's roles.

Today, the changed construct of health and prevention in the International and European regulations is intended to fill this gap: health is seen as a process that

allows all people to obtain greater control of their wellbeing and the opportunities to improve it; while prevention is a global strategy that integrates gender as a dimension in the assessment of occupational risks (Mercadante and Citro 2014). The working world has really changed, but a substantially male culture is still prevalent, though an increasing number of countries are currently introducing various types of gender quotas, as well as preventive regulations and norms to check the presence of women in discriminatory positions. In fact, notwithstanding the possibility for women to exercise traditional male activities, the majority of women are still employed in care and domestic jobs especially in the health care, educational, hostelry or cleaning sectors. In practice, women themselves mostly choose employment that is compatible with their family responsibilities: home proximity, flexible time schedule, low level jobs, no long commuting time. Only egalitarian countries have a less traditional division of tasks. The result is that men and women are exposed to different risks because they are working in different occupations. For instance, due to horizontal segregation (Mercadante and Citro 2014):

- Women are affected by mesothelioma less than men (1:2.6), but, in Italy, their rate is higher in respect to other countries. During the years 1950–1960 many of these women were employed in textile factories where asbestos was used in brakes of all machines and in the building to counteract water vapors and noise (Bazzi 2015).
- Women suffer more from upper extremity cumulative trauma disorders due to repetitive movements in sewing, embroidery, ironing, cooking, washing, typing… while men suffer more from musculoskeletal disorders such as low back pain due to biomechanics overload.
- women, working mainly in light industry and exposed to low levels but disturbing noise, suffer from noise annoyance, hypertension and myocardial infarction, while men, working mainly in heavy industry, are exposed to higher noise levels and risk deafness if they do not use safety devices.
- Women, working mainly inside offices, laboratories and other close environments, have different biological responses than men to various substances and present increased sensitivity to specific chemical risks, major cutaneous absorption and different toxic kinetic of chemical agents, so they show effects from indoor air pollution 2–4 times more than men.
- Women in caring professions have a major exposure to psychosocial factors because they use more relational and emotional resources and must meet the difficulty of adapting to an environment that is organized and built on the male paradigm of work, whose unwritten rules and its shared, wide-spread stereotypes require women to make great efforts in order to adapt to and comply with this model. Considering specific cardiovascular consequences of stress in females, anxiety and anger due to chronic or relevant stress are responsible for Tako-Tsubo syndrome as well.

Women's accidents are also more frequent in specific sectors like family attendance, health care, social work and in itinere (on the journey to or from work).

Vertical segregation refers to the hierarchical structure of management and the paths of authority and responsibility. Globally, in January 2014, very few women served as Heads of Government and for the majority, women deputies remain under 30 % of the total ministers. They mainly head social sectors such as education and the family (Inter-Parliamentary Union, United Nations Entity for Gender Equality and the Empowerment of Women 2014). Sweden, Finland, France, Norway, the Netherlands, Denmark, Switzerland, Belgium, Germany and Spain were ranked highest in terms of the percentage of women in ministerial positions (>30 %) but there are still visible or invisible obstacles (glass ceiling) leading to a rarity of women in power and decision making positions in public organizations, enterprise, associations and unions. Moreover, men generally continue to have access to the best job conditions (income, prestige, job stability…) while women are more numerous in part time contracts, precarious work and lower paid occupations with fewer opportunities for career advancement and wellbeing (This is referred to as the "sticky floor."[2]).

Inequalities follow previous and present history of a country and its politics (cohort effects), life cycles with their different representations of social roles and individual life opportunities to develop skills and adequate coping strategies to improve one's own existence (Duxbury et al. 2011; Higgins et al. 1992). In this way, gender issues are strongly associated with age and historical period in terms of chances to choose a job, obtain social support, enrich one's own skills, autonomy and authoritativeness (Beutell 2013) and shape a common construct of "family". In the West, the generation, sometimes referred to as "Veterans" (1925–1945), was educated on traditional family role division and clearly marked division between work and family. Baby Boomers (1946–1964) grew up in an era of sexual liberation, the Women's Movement and increased divorce rate. Generation X (1963–1980) frequently had single-parent and extended families, working mothers, dual-career couples, and considered significant changes to the concept of "traditional" family; they were substantially latch-key children. Today, Millennials (1981–2000) have distinctly different behaviors, values and attitudes from previous generations as a response to technological implications of the Internet and to the dramatically increased rates of youth unemployment. They are characterized as having a strong desire for work-to-life balance, rapid career advancement and higher levels of interest in international travel exchanges.

At present, gender norms and policy vary across European countries. They can be characterized as: *Dual Earner model* in Denmark, Finland and Sweden, *General Family Support model* in Germany and the Netherlands, *Market Oriented model* in UK (low institutional support for work-family reconciliation), *Southern model* in Spain (strong familialism and weak institutional support for working mothers), and a *mix of the dual-earner model and general family support model* in the Central East European countries (CEE). These country-level models are mirrored in people's attitudes regarding work and care such as to reduce working hours, share division of caring and earning responsibilities or accept long parental leaves in

absence of childcare facilities and less institutional support for maternal employment (Fahlén 2012). Fahlén (2012) demonstrates that in all countries, work and home demands weaken the capability to achieve work–life balance, work demands are more linked to work-to-home conflict and home demands are more linked to home-to-work conflict. Men experience more work-to-home conflict and women more home-to-work conflict in countries with more traditional gender norms and weaker support for work-family reconciliation, such as Spain and the EEC countries. Men are subjected to longer and more unsocial working hours, and overtime at short notice, while women in general shoulder home responsibilities. Work-to-family conflict and home-to-work conflict are less separable for women, indicating that multiple roles entail a greater challenge for women to achieve work–life balance, especially when faced with care responsibilities, economic constraints, irregular work hours, no flexi-time and job insecurity.

4 Work to Family Conflict and Enrichment

Most individuals are confronted with the challenge of managing work and family responsibilities. Competing demands from work and family derive from the finite resources of time and energy as well as of behavioural suppleness.

The conservation of resources (COR) theory approach is widely applied in studies of work-to-home conflict because its perspective is to focus on people's capabilities to achieve valuable activities and improve one's own life situation (Hobfoll 1989).

Few empirical studies have investigated work/family interference among generational cohorts. Notwithstanding difficulties and limits, some evidence of relation exists in the studies by Beutell and Wittig-Berman (2008), Beutell (2013) and Sparks (2012) with proper implications for personnel management.

Otherwise, taking into consideration age, van der Heijden (2012) observed that individuals in early adulthood will experience high inter-role conflict and low facilitation due to high demands and low resources in both life domains, while individuals in late adulthood will experience the opposite pattern; that is, low conflict and high facilitation due to low demands and high resources in both domains. Individuals in middle adulthood will experience high work–family conflict but also high family–work facilitation due to the presence of high job demands and resources in both life domains. Hence, both directions of the conflict have to be taken into account (work may interfere with the family life or vice versa) as well as the hypotheses of negative (role strain) or positive spillover (role enhancement).

Other variables are recommended by Fahlén (2012) as sources of time, stress or behavioural forms of work-family interference, including age of youngest child in the household, partner in unpaid work, partner's work hours, hours of housework each week, economic constraints, division of housework, intra-household disagreement regarding time and money issues, paid working hours/week, shift work, unsocial work hours, overtime at short notice, inflexible working time, insecure employment, work intensity.

5 Studies Conducted at the University of Milan

Now, it is evident that research to enhance occupational prevention, taking into account gender-age specificity, should be approached on different levels (national, regional and local indexes of gender inequalities), a good knowledge of gender medicine, a proper theory and choice of parameters to identify the antecedent of diseases and stress at work. At present, the Ergonomics Unit of the Department of Clinical Science and Community of the University of Milan can only verify some effects of gender inequalities looking at the results of previous studies (Table 1). Most of them were carried out using the data of the Nurses Early Exit Study (NEXT Study: Hasselhorn et al. 2003) due to its multicultural approach, high number of participants, their representativeness and a follow-up design. The other studies were also on health care personnel or on call centres operators.

Gender inequalities were identified in many studies on work related stress, although "gender" was not the focus of authors' interest. First, the human resources were actually distributed in such a way that they support the existence of horizontal and vertical segregation. Then, testing the Italian nurses' mood with PANAS (NEXT Study: Hasselhorn et al. 2003), men proved to be more *excited*, *strong*, *guilty*, *hostile*, *enthusiastic*, *proud*, *alert*, *inspired*, *determined*, *attentive*, *active* at work than women. Another variable "Fear of making errors" was more common among female nurses under 45 years old who were employed in hospitals, than among male nurses in the same age range (38.8 vs. 29.7 %) (Camerino et al. 2008a).

This evidence was interpreted to reflect women's discomfort in typical female employment organized and managed with a male approach, since women's abilities in listening skills, empathy, care, intuition, flexibility, versatility were not recognized as behaviours to be rewarded. However, women are also known to display greater stress reactivity due to their tendency to perceive events as more stressful, to be more sensitive to interpersonal stress, and to use emotion regulation strategies (such as suppression, reappraisal and rumination) during and following acute stress more frequently than their male counterparts (Kelly et al. 2007). Females are more willing to disclose such issues and seek care too. It must be observed that Italy had a higher percentage of male nurses as compared with the other 10 countries of the NEXT study (25.9 vs. 7.6 %) due to the unemployment rate in southern Italy and Italian Nurses Association's preference, at that time (2002–2004), to include men to strengthen the profession.

Lifecycle stage was significantly associated with demands, overload, nurses' well-being and work-to-family conflict. Female nurses without children were better off in all aspects, while singles with children and women with both children care and elder care got worse (Hasselhorn et al. 2003; Simon et al. 2004; Camerino et al. 2007b). In that study, Italian nurses proved to perceive their working conditions as worse than their European colleagues. Differences among countries were recognized in the number of subjects that, in the cluster analysis, had defined their working conditions (Table 2) as "optimal" or "good but with low engagement" or "good but

Table 1 Studies conducted by the Ergonomics Uni, Department of Clinical Science and Community, University of Milan

Authors	Years	n.	Population	Design	Aims	Methods	Main results
Simon et al. NEXT-Study group	2004	27.603 out of 77.681 registered nurses	88.6 % Female nurses of 8 European countries	Cross-sectional study	To investigate predictors of the work-home conflict	Weekly working hours per week, work schedule, pressure to work overtime	WFC is higher than FWC, Italian nurses had the highest WFC mean scores (women WFC mean score significantly higher than men's mean score, younger nurses worse than older). WFC depends by quantitative demand and arrangement of working hours. WFC strongly impacts on the intention to leave the nurses 'profession
						Quantitative and emotional demand, quality of leadership Age, gender	
						(Work to Family Conflict scale by Netemeyer et al. 1996) *Intention to leave the profession*	
						Multiple linear regression analisyses	
Costa and Sartori	2007	1.449	39.75 % female 877 in health care works 186 in a chemical 386 in construction works	Cross-sectional study	monitoring ageing and functional working capacity with particular attention to gender, working hours and work activity	Age, Gender, Working sector, Working schedule	Strong inter-relation between job activity and perceived work ability
						Work Ability Index (Tuomi et al. 1998) Logistic regression analysis	Sex and working hours act concurrently in influencing work ability, particularly in association with more physically demanding jobs

(continued)

Table 1 (continued)

Authors	Years	n.	Population	Design	Aims	Methods	Main results
Camerino et al. NEXT Study group	2007a	3329	74.9 % female Italian registered nurses	Longitudinal study	To evaluate different reasons and different consequences from fear of making errors	Time pressure (*Copenhagen Psychosocial Questionnaire*)	Prevalence of fear of making errors was relevant among Italian nursing staff, particularly in female nurses under 45 years employed in hospitals (38.8 %)
						Emotional demand (De Jonge et al. 2000)	
						Role conflict and ambiguity, Decision latitude (Demand-Control Questionnaire)	
						Interpersonal Relationship (NEXT scale)	
						Career Reward (ERI-Q of Siegrist and Peter 1996)	Higher emotional demand and lower career rewards were predictive of higher fear of making errors in the younger
						Work to Family Conflict scale by Netemeyer et al. (1996)	
						Fear of making errors (*NEXT scale*)	
						Multiple linear regression	

(continued)

Table 1 (continued)

Authors	Years	n.	Population	Design	Aims	Methods	Main results
Camerino et al. NEXT-Study group	2008a	19099	86.9 % Female registered nurses of 8 European countries	Cross-sectional and Longitudinal study	To verify different working condition among countries	Copenhagen Psychosocial Questionnaire (Kristensen et al. 2005) Work to family conflict (Netemeyer et al. 1996) *Copenhagen Burnout Inventory, General Health e Work Ability Index* (Tuomi et al. 1998) *Cluster Analysis*	Differences among countries were justified by cultural, socioeconomic and organizational variety. Females have different affectivity at work in respect to men. Worse conditions are related to worse health outcomes
Van der Heijden et al. Next study group	2008	753 registered nurses out of 4018	94.4 % Dutch female nurses	Longitudinal study 1 year time interval	To test the mediating role of work to family conflict between work demand and health and check the loss spiral hypothesis (health problems lead to higher demand and more work to family conflict, over time).	Emotional, Quantitative and Physical demands Work to Family Conflict scale by Netemeyer et al. 1996 *General Health* (*COPSOQ scale by* Kristensen et al. 2005) Cross-lagged structural equation model approach	The higher nurses' job demands, the higher is their level of work-to-family conflict and the more likely is a general health deteriorization over time. The loss spiral hypothesis is confirmed

(continued)

Table 1 (continued)

Authors	Years	n.	Population	Design	Aims	Methods	Main results
Camerino et al. NEXT-Study group	2008b	7516 registered nurses (staff)	85.8 % Female nurses from 7 European countries	Longitudinal study	To examine whether favourable and rewarding work-related factors increased work ability	Work schedule	Work schedule did not show any impact on work ability, restorative sleep predict work ability as well as motivating and rewarding characteristics of the job
						Sleep quality and quantitative (NEXT scale)	
						Esteem and career reward (ERI-Q of Siegrist and Peter 1996)	
						Satisfaction with pay	
						Work Ability Index (Tuomi et al. 1998)	
						Hierarchical linear regression analysis	
Camerino et al. NEXT Study group	2009a	10.301	87 % Female nurses of 8 European countries	Longitudinal study	To test the sensitivity of the work ability index to poor sleep compared to burnout, job satisfaction and thinking of quitting	Sleep quality and quantitative (NEXT scale)	Shift work is a risk factor for disturbed sleep; poor sleep is associated to work-family conflict (WFC) and to exhaustion, poor sleep affects work ability in the time
						Emotional exhaustion (CBI of Borritz Kristensen et al. 2005)	
						Job dissatisfaction (Kristensen et al. 2005)	
						Thinking of quitting (NEXT scale)	
						(Work to Family Conflict scale by Netemeyer et al. 1996)	
						Work Ability Index (Tuomi et al. 1998)	
						Multivariate Logistic regression analysis	

(continued)

Table 1 (continued)

Authors	Years	n.	Population	Design	Aims	Methods	Main results
Camerino et al. NEXT-Study group	2009b	10.301	87.1 % Female registered nurses from 8 European countries	Cross-sectional	To assess whether disturbed sleep predict several psycho-physical work-related outcomes among European nurses	Work schedule	Poor sleep is associated with lower health and well-being irrespective of the shift pattern. Sleep problem are prevalent among young nurses (30–39 age group), probably for an increased conflict between work and family obligation in this life period
						Sleep quality and quantitative (NEXT scale)	
						Emotional exhaustion (*Copenhagen Burnout Inventory*)	
						Job dissatisfaction (*Copenhagen Psychosocial Questionnaire*)	
						(*NEXT item*)	
						Thinking of quitting (*NEXT scale*)	
						Work Ability Index (Tuomi et al. 1998)	
						Multiple logistic regression model	

(continued)

Table 1 (continued)

Authors	Years	n.	Population	Design	Aims	Methods	Main results
Camerino et al.	2009c	673 10 % at each structure	98.3 % Female nurses from Lazio (Italy)	Cross-sectional	To assess preventative measures in 6 healthcare institutions of the Lazio Region) and personnel wellbeing	Work schedule, family status	Poor influence at work, performing task do not belonging to own's profession, high FWC and WFC, low quantity and quality of preventive interventions are associated to emotional exhaustion, high percentage of poor and moderate work ability
						Occupational Health and Safety Prevention Index	
						Work to Family Conflict scale by Netemeyer et al. (1996)	
						Quantitative Demands, Quality of Leadership (COPSOQ by Kristensen et al. 2005)	
						Influence at work, Social Support (Demand-Control Questionnaire)	
						Interpersonal relationship (NEXT scale)	
						Emotional exhaustion (*Copenhagen Burnout Inventory*)	
						Work Ability Index (Tuomi et al. 1998)	
						Descriptive analysis	

(continued)

Table 1 (continued)

Authors	Years	n.	Population	Design	Aims	Methods	Main results
Camerino et al.	2010a	644	98.3 % z from Lazio (Italy)	Cross-sectional	To test the hypothesis that effective preventative measures at the workplace will promote better working time management, resulting in decreased work-family conflict and improved staff health and well-being	Work schedule, family status, n. of children <7 years of age	WFC is strongly associated to quantitative demand, work schedule and performing task not belonging to one's own profession. Functional communication and active participation in preventative measures modify these associations. WFC mediates the relationship between quantitative demand and burnout
						Index on occupational Safety and Health Prevention	
						Quantitative Demands, Quality of Leadership (COPSOQ by Kristensen et al. 2005)	
						Influence at work, Social Support (Demand-Control Questionnaire)	
						Interpersonal relationship (NEXT scale)	
						Sleep quality and quantitative (NEXT scale)	
						(*Work to Family Conflict scale by Netemeyer* et al. 1996)	
						Emotional exhaustion (*Copenhagen Burnout Inventory*)	
						Data mining techniques, Random Forest and Bayesan Networks	

(continued)

Table 1 (continued)

Authors	Years	n.	Population	Design	Aims	Methods	Main results
Genovese I.	2010	600	81.87 % male 33.5 % operatives, 59,9 offices workers 7.4 % executives in micro-electronic enterprise	Cross-sectional	Work-related stress assessment in preventivative interventions	Working sector, Working schedule Interviews HSE (2008) Cognitive load (COPSOC 2010) Work to Family Conflict scale by Netemeyer et al. (1996) *Gastrointestinal and cardiovascular diseases* (SSI by Barton et al. 1995) *Sleep quality and quantitative* (SSI by Barton et al. 1995) *Work Ability Index* (Tuomi et al. 1998) Descriptive and Logistic regression analysis	Female shift workers present more sleep disturbances, more gastrointestinal and cardiovascular diseases and lower work ability than men. Work-to-family conflict is associated with shift work, contract of employment (fulltime, low variability), title (executives) cognitive load and low authonomy

(continued)

Table 1 (continued)

Authors	Years	n.	Population	Design	Aims	Methods	Main results
Camerino et al.	2011a	3.949	74.32 % Italian female nurses (from NEXT study + nurses from 6 healthcare institutions of the Lazio Region)	Cross-sectional	To evaluate the association between work-related stress and work ability, considering the role of family status and work-family conflict	Work schedule, family status, n. of children <7 years of age, additional off-work caring responsibilities and age	All measures of the Effort reward Imbalance and Work Family Conflict scales are independently important predictive covariatees of work ability. Sub-items of WAI concerning health are worse in older female nurses. Only in female: the WAI scores is associated to WFC and to Overcommitment
						Effort Reward Imbalance (ERI-Q of Siegrist and Peter 1996)	
						Work to Family Conflict scale by Netemeyer et al. (1996)	
						Work Ability Index (Tuomi et al. 1998)	
						Random Forest Analysis nd General Linear Models	

(continued)

Table 1 (continued)

Authors	Years	n.	Population	Design	Aims	Methods	Main results
Conway et al.	2013	1106	Call center operator of two separate Italian companies characterized by outsourcing, unification, restructuration, downsizing, rationalization, delocalization. 76.5 % female (60 % inbound)	Multi center Cross-sectional	Assessment of work-related stress To test the interplay between Job Strain and Effort-Reward Imbalance models in the development of psychological symptoms	Gender, Age, Educational level, n. of children, Marital status, Body mass index, Personality, Seniority, Part-time/fulltime, Work Schedule, Flexibility	Work-to-family interference (III tertile) is significantly associated with General Health (adjusted Odds ratio 2.7, CI 95 % 1.8–4.2), Work Ability Index (adjusted OR 1.5, CI 95 % 0–2.2), Gastrointestinal diseases (adjusted OR 1.9, CI 95 % 1.3–2.9) and Cardiovascular diseases (adjusted OR 1.8, CI 95 % 1.2–2.7)
						Interviews	
						Job Demand (Karasek et al. 1998)	
						Effort Reward Imbalance (ERI-Q of Siegrist and Peter 1996)	
						Work-to-family interference	
						Job Satisfaction	
						GHQ-12 $\geq$ *4*	
						Work Ability Index (Tuomi et al. 1998)	
						Logistic multiple regression analysis with both stress models included	Flexibility odd ratio is significant only with job satisfaction (adjusted OR 1.6, CI 95 % 1.1–2.3)

Table 2 NEXT study dataset: classification of nurses into five sub-groups by means of cluster analysis based on their perceptions of working characteristics (Camerino et al. 2008a)

	Clusters				
	1	2	3	4	5
Psychosocial factors	Optimal	Low engagement	Low support	High load	Very bad
Possibility for development	H	l	m	h	L
Quality of the leadership	H	m	L	h	l
Work meaning	H	l	h	m	L
Social relationship	H	m	l	h	L
Social support	H	m	L	h	l
Influence at work	H	h	l	m	L
uncertainty	L	l	h	m	H
Work-family conflict	L	l	m	h	H
Institutional commitment	H	l	m	h	L
Professional commitment	H	l	h	m	L
Quantitative demand	L	l	m	h	H
Ratio E/R imbalance	L	l	h	h	H
Overcommitment	l	l	m	H	h

H = very high; h = high; L = very low; l = low; m = medium

with low support" or "good but with high load" or "as a whole—very bad". The observed differences among countries were justified by cultural, socio-economic and organizational variety. For example, in the Netherlands most nurses had a part-time employment contract and they manifested, above all, disappointment for low engagement in job, while their work-to-family conflict (Netemeyer et al. 1996) mean score was low. In Belgium, the good practices of some magnet hospitals resulted in a higher percentage of subjects that judged their conditions as "optimal", and their work to family conflict mean scores were very low. After only one year, the nurses that previously had declared "very bad conditions" reported worse health status (more emotional exhaustion, more disabilities, lower general health and lower feel of work ability) than the other groups (Camerino et al. 2008b). Among the personnel that reported "as a whole—very bad working conditions" (see in particular female Italian nurses under 40 years old) "work to family conflict" had a higher mean score. The variable was also significantly correlated with negative affectivity (PANAS). It must be considered, in this issue, that Italian women spent more time on household chores (on average, 21 h a week) than women living in other Western European countries. In a study of Dutch nurses, van der Heijden et al. (2008) also examined the mediating role of work-home interference in the relationship between working demands and health and found a reciprocal relationship too.

In a study of 664 nurses from Latium region using the NEXT questionnaire, the Random Forest Method identified the main antecedents of "work to family conflict" to be quantitative demand, type of work schedule (irregular day work and shift work including nights), number of weekends/month spent at work, satisfaction with working time with regard to wellbeing and private life, the quality of communication, and actions to prevent risk at work. The last dimensions mediated the effect of quantitative demand on work to family conflict (Camerino et al. 2010a); involvement in the development of preventative strategies allowed workers to find better ways to improve control over their work and life time and reduce quantitative job demands. Age was related with work to family conflict only among nurses who lived with a partner and children under 7 years old (Camerino et al. 2011a).

Work-to-family conflict was the most important predictor of job dissatisfaction, sleep disturbances, emotional exhaustion, poor work ability and thinking of quitting the profession (Hasselhorn et al. 2004; Camerino et al. 2008b, 2009a, b). In particular, after stress measures (Effort-Reward Imbalance, Overcommitment) and independently of them, work-to- family conflict appeared to be the most important predictive covariate of Work Ability Index scores, especially when associated with additional off-work caring responsibilities and age (Camerino et al. 2010b, 2011a). Inversely, one year later female nurses with poor work ability showed an increased work-to-family conflict and looked for ways to adapt their current job or working situation to better reconcile work and family life: shift versus day work, full time versus part-time work, overtime work versus regular working hours (Camerino et al. 2011b).

Work Ability Index scores are known to be lower in females than in males. This is due, probably, to lower tolerance for physical and cognitive loads, higher family responsibilities and lower support for career. In 2007, 1842 out of 2412 nurses from 7 public and private hospitals in Mantua completed the Work Ability Index, work related stress and shift work scales (Costa and Sartori 2007). 36.4 % of women and 21.1 % of men showed poor or moderate scores. The data confirmed the direction of the significant difference between female and males and highlighted a stronger progressive decrement of this index across age ranges, more pronounced in females. The most discriminant items of the Work Ability Index, between women and men were: "number of current diseases diagnosed by a physician", estimated "work impairment due to diseases and sick leave during the past year". Musculoskeletal disorders and mental distress were the more frequent diagnoses in females as compared with men.

The same antecedents and the same path "work-to-family conflict and health" were found in different occupational groups with diverse risk factors. For example, in the call centers, employees have monotonous and poor tasks, low control, low support, scarce opportunity of career, high job pressure, insufficient length of pauses, low flexibility and, in some companies, even low hours variability. These kinds of workers are generally younger and healthier than nurses, but even in this

case full time women had higher work-to-family conflict, lower general health, more musculoskeletal disorders, lower work ability and all these data were significantly associated with work to family conflict, even if not so robust as other more specific risk factors (Conway et al. 2013).

6 Discussion

Italy represents a *Southern European model* and a Mediterranean regime characterized by a masculine culture. Today, increased women's employment concerns only specific sectors of economic activities, but horizontal and vertical segregations persist in our case though males have entered the nursing profession which is considered typically feminine. Italian women are much more likely to work full time, but often they are forced to withdraw from the labour market during the childrearing years, the division of house-work remains unequal and women spend more time on household activities than men.

Italian nurses in the NEXT study and call centres operators demonstrate significant differences in work-family interference, with higher difficulties among younger females with children. Similarly, according to Fahlén's study, Spain and EEC countries where women are assumed to be the primary caregiver and men the primary earners, and where there is weaker policy supports for work-family reconciliation, females equally show the most gender differences. Organizational management was judged worse by Italian nurses, probably due to the changes occurring in these structures in companies instead of services. Adverse psychosocial factors and the lack of good practice in preventative measures result in a significantly worse load, lack of time to restore, work-family interference, worse health outcomes and lower work abilities. Female nurses' aging is worse than men's and the female perception of one's own abilities is low in response to contract fulfillments, this finding being mainly due to physical illness which increases along the different age bands. Stress and work-to-family conflict play a role in this health deterioration, probably as a consequence of neglected motivations, resources and needs at the different stages of one's life.

On the contrary daily interpersonal communication and actions to prevent risk at work proved to be effective to counteract time and stress base conflicts and diseases.

Negative affectivity turns out to be associated with gender and work family conflict beyond job characteristics, thus confirming the results by Tement and Korunka (2013) about the importance of trait affectivity in work-family research.

In conclusion, according to COR theory, Italian female workers have lower chances to arrange work and family demands with negative consequences on mood and health.

7 Conclusion

These results demonstrate the necessity to strengthen political priorities on health inequalities and to improve prevention at work taking into account gender issues. Usually, interventions fall into three main groups: initiatives addressing working time or working hours, collaborative actions focused on improving workplace equity and performance levels, and initiatives to embed work-life balance within organizational culture (Brough and Kalliath 2009).

Flexibility and control over working hours reduce the potential negative impact of long working hours and their effects on work to family conflict, poor recovery and consequent impaired well-being. Taking micro-pauses after strenuous work task helps to avoid excessive fatigue and changing from a slower "backward rotating shift schedule" to a quicker "forward rotating schedules", may have profound and positive effects on sleep patterns, psychomotor performance and general wellbeing of shift workers, especially among workers aged 45 years and over. Recovery after a single night shift is easier as compared with recovery after 3 consecutive night shifts, and an increased number of free weekends may have positive effects on the perceived wellbeing of female shift workers.

Effective health and safety programs favor employees' participation in supportive procedures intended to reduce the negative influence of job demands on private life over time, promote work life balance, reduce fatigue, improve networking opportunities, especially for women and improve equity in hiring, retention and advancement (Allen 2001). In this group of initiatives, an improvement is expected also for a more gender-specific protocol of health surveillance.

In the name of equality, institutions' efforts aim at "adding" women to the labor market, without fostering any changes in workplace culture, which is dominated by the male model of work. Women's differences and identity are neither protected nor valued, neither is any attempt in place to optimize women's qualities such as their ability to listen and to foster human relationships or their inclination to cooperate and to care. Female diversity is conformed to a male stereotyped system, thus diminishing the feminine with respect to the masculine. In other words, there is no attempt to modify work organization in order to value and use the biological and cultural differences between men and women. On the contrary there is an attempt to adjust the feminine to the dominant context.

> …For this reason, rather than forcing women to adjust to male models in male environments, it seems more appropriate to foster the development of paradigms and cultural representations able to create more varied and less stereotyped working environments, in which the differences between women and men might naturally and freely coexist and be useful (Cangiano et al. 2008).

Finally to create democratic participation, it will be better to invest even in "words", in job values, work culture and creativity to strengthen the enterprise, not only money. Words facilitate emotional regulation, buffering the strain response associated to stress exposure.

Note

1. Possibility for development, quality of the leadership, work meaning, social interaction, social support, influence at work, uncertainty, work-family conflict, institutional and professional commitment, and quantitative demand.
2. The term "sticky floor" is used to describe a discriminatory employment pattern that keeps a certain group of people at the bottom of the job scale. Most of the workers who experience the "sticky floor" are "pink collar workers," such as secretaries, nurses, or waitresses. Close to half of working women, as compared to one-sixth of working men, hold clerical or service jobs which are often associated with the "sticky floor." By comparison, the term "glass ceiling" is used to describe an artificial discriminatory barrier which blocks the advancement of women or colored people who already hold fairly good jobs, usually in middle management. Although women who run into the glass ceilings are more educated and privileged than those who experience the sticky floor, women in both situations have some similarities. Both have low mobility and find themselves unable to improve their situation. Also, most of these women are expected to work a "double day," where they are expected to do household work in addition to their wage labor.

References

Allen, T. D. (2001). Family supportive work environments: The role of organizational perceptions. *Journal of Vocational Behavior, 58*, 414–435. doi:10.1006/jvbe.2000.1774

Aryee, S., & Luk, V. (1996). Work and non-work influences on career satisfaction of dual-career couples. *Journal of Vocational Behavior, 49*(1), 38–52.

Barton, J., Spelten, E., Totterdell, P., Smith, L., Folkard, S., & Costa, G. (1995). The standard shiftwork index: a battery of questionnaires for assessing shiftwork-related problems. *Work & Stress, 9*(1), 4–30.

Bazzi, A. (2015). La terza era dei Danni da amianto. *Corriere della Sera*. Domenica 1 Marzo 2015.

Beer, C. (2009). Democracy and gender equality. *Studies in Comparative International Development, 44*, 212–227.

Beutell, N. J. (2013). Generational differences in work-family conflict and synergy. *International Journal of Environmental Research and Public Health, 10*, 2544–2559. doi:10.3390/ijerph10062544

Beutell, N. J., & Wittig-Berman, U. (2008). Work-family conflict and work-family synergy for generation X, baby boomers, and matures: Generational differences, predictors, and satisfaction outcomes. *Journal of Managerial Psychology, 23*, 507–523.

Borrell, C., Palència, L., Muntaner, C., Urquìa, M., Malmusi, D., & O'Campo, P. (2014). Influence of macrosocial policies on women's health and gender inequalities in health. *Epidemiologic Reviews, 36*, 31–48.

Brough, P., & Kalliath, T. (2009). Special Issue: Achieving Work-family balance: Theoretical and empirical advancements. *Journal of Organization Behavior*, *30*(5), 14–25.

Camerino, D. (2008). A Saúde do Trabalhador de Enfermagem: Impactos e Desafios. 2º Seminário Internacional sobre o Trabalho na Enfermagem – SITEN2: A Saúde do Trabalhador de Enfermagem: Impactos e Desafios. Curitiba (Brasile) Associação Brasileira de Enfermagem – ABEn e a Federação Nacional de Enfermeiros – FNE. 14–19 Aprile 2008.

Camerino, D., Conway, P. M., & Estryn-Béhar, M. (2007a). Fear of making errors in young and old Italian nurses. *Ergonomia, 29*, 211–217.

Camerino, D., Conway, P. M., & Costa, G. (2007b). Effects of disturbed sleep on health and well being among European nurses. *Sleep and Biological Rhythms, 5*(Supplement 1), 22–31.

Camerino, D., Sartori, S., Conway, P. M., & Costa, G. (2008a). *Nursing staff; shiftwork; disturbed sleep; emotional exhaustion; job dissatisfaction; work ability; thinking of quitting nursing*. CRC, London: ICOH.

Camerino, D., Conway, P. M., Sartori, S., Campanini, P., Estryn-Behar, M., van der Heijden, B. M. I. J., et al. (2008b). Factors affecting work ability in day and shift-working nurses M. *Chronobiology International, 25*, 425–442. doi:10.1080/07420520802118236

Camerino, D., Conway, P. M., Sartori, S., & Costa, G. (2009a). Effects of disturbed sleep on work ability and well-being among European nurses. In M. Kumashiro (Ed.), *Promotion of Work Ability towards Productive Aging*. London, UK: Taylor and Francis Group.

Camerino, D., Sandri, M., Sartori, S., Destrebecq, A. L., & Lusignani, M. (2009b). Prevenzione e benessere degli infermieri nelle strutture sanitarie del Lazio: problemi di genere e di età. *Giornale Italiano di Medicina del Lavoro ed Ergonomia*; XXXI, n. 3: pp. 342–343.

Camerino, D., Sartori, S., Sandri, M., Conway, P.M., Campanini, P., & Costa, G. (2009c). Working time satisfaction in aging nurses. In *Extending the Work Life*. Tallin, 2008, Tallinn: Tallinn School of Economics and Business Administration.

Camerino, D., Sandri, M., Sartori, S., Conway, P. M., Campanini, P., & Costa, G. (2010a). Shiftwork, work-family conflict among Italian nurses, and prevention efficacy. *Chronobiology International, 27*, 1105–1123. doi:10.3109/07420528.2010.490072

Camerino, D., Sandri, M., & Sartori, S. (2010b). Il Work Ability Index nelle donne che lavorano: la percezione della capacità lavorativa del personale infermieristico. In: La Medicina del Lavoro quale Elemento Migliorativo per la Tutela e la Sicurezza del Lavoratore e delle Attività dell'Impresa. SIMLII, Roma.

Camerino, D., Campanini, P. M., Conway, P. M., Fichera, G. P., Costa, G., & Sartori, S. (2011a). Effort-Reward Imbalance and Work Ability Index among Italian female nurses: The role of family status. In *Age Management during the Life Course. 4th symposium on Work Ability*. Finland: University of Tampere.

Camerino, D., Sandri, M., & Conway, M. P. (2011b). Influence of the Work Ability Index on changing working time and work family conflict. In *20th International Symposium on Shiftwork and Working time*, Stockholm, Sweden.

Cangiano, G., Guerra, G., Bentivenga, G., Pera, A., & Papaleo, B. (2008). Women and work from the viewpoint of Public institutions through a qualitative and quantitative analysis of documents on the web. *Prevention Today, 4*(2), 81–102.

CEC. (2007a). "Tackling the pay gap between women and men: Communication from The Commission to The Council, The European Parliament, The European Economic and Social Committee and The Committee Of The Regions", Commission of the European Communities. COM (2007).

CEC. (2007b). "Opinion on Gender Pay Gap", Advisory Committee on Equal Opportunities for Women and Men Adopted on 22 March 2007 Available at http://ec.europa.eu/social/BlobServlet?docId=3176&langId=en

CEC. (2008a). "Report on Equality Between Women and Men", Commission of the European Communities. Available at http://europa.eu/legislation_summaries/employment_and_social_policy/equality_between_men_and_women/c10167_en.htm

CEC. (2009a). Evaluation of the effectiveness of the current legal framework on equal pay for equal work or work of equal value in tackling the gender pay gap. The European Evaluation Consortium 2007 (version of 19th July 2009).

CEC. (2009b). Report from the Commission to the Council, The European Parliament, The European Economic and Social Committee and The Committee of The Regions: Equality Between Women And Men—2010. Brussels: Commission of the European Communities. COM(2009)694 final.

CEC. (2009c). Indicators for monitoring the Employment Guidelines including indicators for additional employment analysis:2009 compendium. Brussels Commission of the European Communities available at http://ec.europa.eu/social/main.jsp?catId=477&langId=en

CEC. (2009d). "Annex to the Roadmap For Equality between women and men implementation in 2008 and 2009–2010 forecasts" Commission of the European Communities Brussels, 31.7.2009 SEC(2009) 1113 final.

CEC. (2009e). "Joint Employment Report 2008/2009" Brussels: Commission of the European Communities, 11 March 2009; 7435/09.

CEC. (2009f). "Companion Document: Implementation of the Lisbon Strategy Structural Reforms in the context of the European Economic Recovery Plan—a more detailed overview of progress across the EU in the specific macro- and micro-economicas well as the employment areas" Brussels: 28.1.2009 COM(2009) 34 final Volume II.

CEC. (2009g). "The Role of NGOs and Trade Unions in Combating Discrimination" Brussels: Commission of the European Communities.

CEC. (2010). "Draft Joint Employment Report 2009/2010" Brussels, 6575/10, 19 February.

Costa, G., & Sartori, S. (2007). Ageing, working hours and work ability. *Ergonomics, 50*(11), 1914–1930.

Conway, P. M., Campanini, P., Punzi, S., Fichera, G. P., Camerino, D., Francioli, L., Neri, L., & Costa, G. (2013). Work stress, common mental disorders and Work Ability Index among call center workers of an italian company. *Epidemiologia e Prevenzione, 37*, 17–28.

de Jonge, J., Bosma, H., Peter, R., Siegrist, J. (2000). Job strain, effort-reward imbalance and employee well-being: a large-scale cross-sectional study. *Social Science & Medicine, 50*(9), 1317–1327.

Duxbury, L., Higgins, C., & Smart, R. (2011). Elder care and the impact of caregiver strain on the health of employed caregivers. *Work, 40*(1), 29–40.

Dzielska, M. (1996). *Hypatia of Alexandria. trans. F. Lyra*. Harvard University Press.

Fahlén, S. (2012). Does Gender Matter? A Capability Approach to Work-to-Home and Home-to-Work Conflict in a European Perspective. Working paper. Stockholm University Linnaeus Center on Social Policy and Family Dynamics in Europe, SPaDE

Genovese, I. (2010). Conseguenze sulla salute dell'interazione "turni-Conflitto casa Lavoro": una prospettiva di genere. Thesis of Specialization in Occupational Health: University of Milan.

Hasselhorn, H.-M., Tackenberg, P., & Müller, B. H. (Eds.). (2003). Working conditions and intent to leave the profession among nursing staff in Europe—Working Life Research in Europe, Report No 7:2003. Stockholm, Sweden: National Institute for Working Life.

Hasselhorn, H.-M., Tackenberg, P., Peter, R., et al. (2004). Effort–reward imbalance among nurses in stable countries and in countries intransition. *International Journal of Occupational and Environmental Health, 10*, 401–408.

Higgins, C. A., Duxbury, L. E., & Irving, R. H. (1992). Work-family conflict in the dual-career family. *Organizational Behavior and Human Decision Processes, 51*, 51–75.

Karasek, R., Brisson, C., Kawakami, N., Houtman, I., Bongers, P., & Amick, B. (1998). The Job Content Questionnaire (JCQ): An instrument for internationally comparative assessment of psychological job characteristics. *Journal of Occupational Health Psychology, 3*, 322–355.

Kelly, M. M., Tyrka, A. R, Anderson, G. M., Price, L. H., Carpenter, L. L. (2007). Sex differences in emotional and physiological responses to the Trier Social Stress Test. *Journal of behavior therapy and experimental psychiatry, 39*(1), 87–98.

Kristensen, T. S., Hannerz, H., Høgh, A., & Borg, V. (2005). The Copenhagen Psychosocial Questionnaire (COPSOQ): A tool for the assessment and improvement of the psychosocial work environment. *Scandinavian Journal of Work Environment Health, 31*, 438–449.

Hobfoll, S. E. (1989). Conservation of resources: A new attempt at conceptualizing stress. *American Psychologist, 44*, 513–524.

Inter-Parliamentary Union, United Nations Entity for Gender Equality and the Empowerment of Women. (2014). Women in Politics: 2014 Imprimerie Courand et Associeté. (ipu.org/pdf/publications/wmnmap14_en.pdf).

International Labour Organization (ILO) Constitution. (1919). In Annex: Declaration concerning the aim and purpose of the International Labour Organization Philadelphia.

James S. A. (2009). Epidemiologic research on health disparities: Some thoughts on history and current developments. *Epidemiologic Reviews, 31*(1), 1–6. First published online October 11, 2009 doi:10.1093/epirev/mxp010

Li, D., Hitchcock, C. L., Barr, S. I., Yu, T., & Prior, J. C. (2014). Negative spinal bone mineral density changes and subclinical ovulatory disturbances—prospective data in healthy premenopausal women with regular menstrual cycles. *Epidemiologic Reviews, 36*(1), 137–147. doi:10.1093/epirev/mxt012

Lombardi, R. (2011). Disuguaglianze di salute e disuguaglianze sociali: una prospettiva di genere, in Pullini A, Disuguaglianze sociali e di salute. Procedure di record-linkage tra fonti di dati diverse, Quaderni ISMU, n. 3, Fondazione ISMU.

Marinacci, C., Grippo, F., Pappagallo, M., Sebastiani, G., Demaria, M., Vittori, P., et al. (2013). Social inequalities in total and cause-specific mortality of a sample of the Italian population, from 1999 to 2007. *European Journal of Public Health, 23*(4), 582–587.

Mather, C. D., Stevens, G. A., & Boerma, T. (2014). Causes of international increases in older age life expectancy. The Lancet, Early Online Publication, 6 November 2014. doi:10.1016/S0140-6736(14)60569-9

Mercadante, L., & Citro, A. (2014). Un nuovo approccio culturale con l'"ottica di genere". *I monografici di Ambiente & Sicurezza, 20*, 15–43.

Netemeyer, R. G., Boles, J. S., & McMurrian, R. (1996). Development and validation of work–family conflict and family–work conflict scales. *Journal of Applied Psychology, 81*(4), 400–410.

Rich-Edwards, J. W., Fraser, A., Lawlor, D. A., & Catov, J. M. (2013). Pregnancy characteristics and women's future cardiovascular health: an underused opportunity to improve women's health? *Epidemiologic Reviews,* 2014 *36*(1), 57–70. doi:10.1093/epirev/mxt006.

Schwab, K., Eide, E. B., Zahidi, S., Bekhouche, Y., Ugarte, P. P., Camus, M., et al. (2014). The Global Gender Gap Index 2014. World Economic Forum, Harvard University and the University of California, Berkeley. http://reports.weforum.org/global-gender-gap-report-2014/part-1/

Siegrist, J., & Peter, R. (1996). Measuring Effort-Reward Imbalance at Work: Guidelines. Institut für Medizinische Soziologie. Düsseldorf.

Simon, M., Kummerling, A., Hasselhorn, H. M., & the Next-Study Group (2004). Work-home conflict in the European nursing profession. *International Journal of Occupational Environmental Health, 10*, 384–391.

Sparks, A. M. (2012). Psychological Empowerment and Job satisfaction between Baby Bomer and Generation X nurses. *Journal of Nursing Management, 20*, 451–460.

Tement, S., & Korunka, C. (2013). Does trait affectivity predict work-to-family conflict and enrichment beyond job characteristics? *Journal of Psychology, 47*(2), 197–216.

Tuomi, K., Ilmarinen, J., Jahkola, A., Katajarinne, L., & Tulkki, A. (1998). Work Ability Index. 2nd revised edn. Helsinki: Finnish Institute of Occupational Health.

van der Heijden, B. M. I. J. (2012). Work-family interface from a life and career stage perspective: The role of demands and resources. *International Journal of Psychology, 47*(4), 241–258. doi:10.1080/00207594.2012.699055

van der Heijden, B. I., Demerouti, E., Bakker, A. B., NEXT Study Group coordinated by Hans-Martin Hasselhorn. (2008). Work-home interference among nurses: Reciprocal relationships with job demands and health. *Journal of Advanced Nursing, 62*(5), 572–584.

Van der Lippe, T., de Ruijter, J., de Ruijter, E., & Raub, W. (2010). Persistent inequalities in time use between men and women: a detailed look at the influence of economic circumstances, policies and culture. *European Sociological Review, 27*, 164–179.

Veronesi, U. (2012). Longevità. I sampietrini n. 2 Bollati Boringhieri, p. 94.

World Health Organization. (2009). Women and health: Today's evidence, tomorrow's agenda, Geneva. Available at: http://whqlibdoc.who.int/publications/2009/9789241563857_eng.pdf
Woods, N. F., Tsui, A. O. (2014). Editorial: Epidemiologic approaches to women's health. *Epidemiologic Reviews, 36*(1), 1–4. First published online December 16, 2013 doi:10.1093/epirev/mxt013

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http://data.worldbank.org/indicator/SP.POP.TOTL.FE.ZS/countries/1W?display=default

Individual Differences in Circadian Rhythm Parameters and Work-Family Spillover in Shift Workers

Irena Iskra-Golec

Abstract This chapter, after a review of the existing evidence on the moderating role of individual differences on work-family relationship concentrates on the role of individual differences in circadian rhythm characteristics on this relationship. The aim of the study was to examine whether morningness and circadian type traits (flexibility of sleeping habits and inability to overcome drowsiness), which have been found to be related to tolerance to shift work, can moderate conflict and facilitation between work and family in shift workers. Regression analyses were performed on the results of Work/family Spillover Questionnaire, Circadian Type Questionnaire and Morningness/eveningness Questionnaire completed by 229 male shift workers. The models of regression analyses were significant and showed a predictive power of inability to overcome drowsiness and eveningness in regard to work-family conflict accounting for 22.9 % of variance explained and in regard to family-work conflict accounting for 16.7 % of variance explained. Work-family facilitation was predicted by age and flexibility of sleeping habits accounting for 6.4 % of variance explained. Although, conflict and facilitation between work and family is related to structural factors of both life domains, the findings of this research indicated that conflict and facilitation in shift working population are related to circadian type traits and morningness. Implications for work/family theory and tolerance to shift work are discussed.

1 Work-Family Linkages—the Basic Notions and Theoretical Models of Negative and Positive Work-Family Relationship

Moderating effect of individual difference variables associated with circadian rhythmicity on work-family positive and negative spillover is considered in this chapter. Spillover is defined as the effect of work and family on one another that

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generate similarities between them (Edwards and Rothbard 2000). These similarities concern work and family affect, values, skills, and behavior. Grzywacz et al. (2002) defined spillover as the extent to which participation in one domain impacts participation in another domain. They differentiated between two relatively distinct sets of concepts reflected by the term. One set of concepts concerns negative spillover (both directions, from family to work and from work to family) named also as interference or conflict (Greenhaus and Beutell 1985). Negative spillover refers to the extent in which participation in one domain (e.g., work) negatively impacts participation in another domain (e.g., family) (Frone 2003). The second set of concepts refers to positive spillover between work and family. The other terms used to name positive spillover were resource enhancement (Kirchmayer 1993), work-family success or balance (Milkie and Peltola 1999), and more recently facilitation (Frone 2003). Work-family facilitation is defined as "..the extent to which participation at work (or home) is made easier by virtue of the experiences, skills, and opportunities gained or developed at home (or work) (Frone 2003). Both, positive and negative spillover are two dimensional i.e. from work to family and from family to work. Both directions of spillover are related but distinct as well as both forms of spillover (positive and negative) (Grzywacz and Marks 2000).

The first theoretical models of work and family relationship concerned mainly conflict and structure of the work and family situation. They contained three core components: (1) antecedents of work and family relation, which lead to (2) a combination of work domain, family domain and life outcomes mediated by (3) a work-family relationship construct (conflict). A complex multivariate model of the work family interface developed by Frone et al. (1992) assumes existence of predictors (or antecedents) of the conflict relationship between work and family which include job stressors, family stressors, job involvement and family involvement (psychological importance of work and family roles). Job stressors and job involvement are positively related to frequency of work-to-family conflict while family stressors and family involvement are positively related to frequency of family-to-work conflict. Work-to-family conflict was assumed to be directly and positively related to its outcomes like family distress while family-to-work conflict to be directly and positively related to its outcomes like job distress. Both job- as well as family-related distress are positively related to depression understood as an indicator of overall psychological life distress.

The other model of work and family conflict relationship (Carlson and Kacmar 2000) includes as antecedents domain role ambiguity and time demands and the outcomes include job (job dissatisfaction), family (family dissatisfaction), and life outcomes (life dissatisfaction, depression). These models are regarded to be mainly structural and not assuming existence of moderators of the relationships between their three core components antecedents, work-family relationship and outcomes. Some researchers (Michel and Clark 2009) are of the opinion that this was one of the reasons of a neglect of the moderating effect of individual differences on work-family relationship in the early research.

Another work-family linkages models developed later went beyond structure of the work and family situation concentrating more on the mechanisms and modifiers

of the work-family relationship. The model developed by Greenhaus and Beutell (2006) concerns a positive work-family relationship (work-family enrichment) and consists of three groups of components. The first component consists of five types of work and family resources (skills and resources, psychological and physiological resources, social-capital resources, flexibility, material resources) that can promote work-family enrichment. The second component includes two mechanisms or paths (instrumental and affective) by which these resources can promote work-family enrichment. The third one contains several moderator variables (the salience of a given role, the perceived relevance of the resource to a given role, and the consistency of the resource with the requirements and norms of that role) that determine which resources in one role are most likely to enrich the quality of life in the other role.

A model developed by Wayne et al. (2007) based on research and theory from Ecological Systems Theory (Bronfenbrenner 1989), Conservation of Resources Theory (Hobfoll 1989) and Positive Organizational Scholarship (Cameron et al. 2003) provided theoretical context to explain mechanism of facilitation between work and family. Facilitation is understood by the authors as '..the extent to which an individual's engagement in one life domain (i.e., work/family) provides gains (i.e., developmental, affective, capital, or efficiency) which contribute to enhanced functioning of another life domain (i.e., family/work)' (p. 65, Wayne et al. 2007). The authors identify primary antecedents, consequences, and moderators of facilitation. The basic premise of the theoretical perspective they adopted is that individuals have natural tendencies to grow and obtain the highest levels of functioning at the individual and at the system level (family, work). They assume that the factors which enable facilitation are personal characteristics (e.g. positive affectivity, self-efficacy) and environmental resources (e.g. objects, conditions, energies). The more of any single resource an individual has, the greater the potential for facilitation.

The models described above reflect the state of knowledge of the times they were developed and at the same time are an inspiration for the future research as well. The models of enrichment and facilitation, which were developed later than models of conflict, concentrate on mechanisms and moderators rather than on the structure of the work and family situation. These inspire more comprehensive research approach in work-family research area including individual and system moderators of the relationship between both domains of human life.

2 Work-Family Interface and Individual Differences—an Overview of the Existing Research

The role of individual differences in work-family relation has not been intensively studied for a long time. First theoretical models of work-family linkages have not included individual difference variables focusing primarily on situational demands

(e.g., Frone et al. 1992). Thus, as a consequence the studies—for decades—have concentrated on situational factors like work environment factors (e.g. work demands) and family characteristics (e.g. number of children) in relation to perceptions and experiences of work–family relationship and its outcomes. In the last decades however, there is an increasing number of cross-sectional research, meta-analytic investigations (Allen et al. 2012; Michel et al. 2011) and longitudinal studies on work-family interface incorporating individual difference variables.

2.1 Theoretical Context of the Relationship Between Work-Family Interface and Individual Difference Variables

The authors of more recent studies considering the role of individual differences in work-family relation represent at least three approaches to this problem. Some of them complain about an absence of a broader theoretical framework to analyze linkages between individual difference variables and work-family interface (e.g. Allen et al. 2012; Michel and Clark 2013) and apply different strategies to manage this problem. Michel and Clark (2013), for instance, argue that personality theory in general may provide a framework for understanding the relationship between work-family interface and individual difference variables. Personality theories propose that organizations of mental structures and coordinated mental processes determine an individual's emotional and behavioral adjustments to the environment (e.g. Allport 1937, 1961). These individual patterns of behavior, thoughts and feelings lead to a relatively consistent way of behavior, thinking and feeling across time and situations what may result in differences in perceptions and experiences of work-family relation.

The other authors choose as a theoretical support a specific personality theory (e.g. Michel et al. 2011) or the other dispositional variables theory (e.g. Biggart et al. 2010). Biggart et al. (2010), for example, choose Lazarus and Folkman's (1984) cognitive appraisal theory in order to explain how emotional intelligence and negative affect, are likely to influence self-reporting on situations like work–family conflict. They hypothesized, for instance, that individuals with higher levels of emotional intelligence should experience less threat and conflict due to their belief of their good emotional coping resources.

Grandey and Cropanzano (1999) were the first to apply the Hobfoll's (1989) Conservation of Resources Theory (COR) to the work–family research area because of its potential for developing specific hypotheses about relationships between work-family linkages and a range of their outcomes, and for predictions about a moderating role of individual difference variables in work–family linkages. The COR theory, as a resource-oriented stress model assumes that individuals have a deeply rooted motivation to obtain and maintain what they value, referred to as resources. Resources are defined as those objects, personal characteristics,

conditions, or energies that are valued by the individual or that serve as means to attain resources (Hobfoll 1989). Stress is a reaction to an environment in which there is a threat of a loss of resources, an actual loss of resources, or lack of an expected acquisition of resources after investing resources possessed. Personal characteristics are resources which are regarded as buffering one against stress. The differences in the levels of these resources may affect how individuals react to stress making some of them better able to minimize their losses.

The other solution applied by some authors considering the role of individual differences in work-family relation was to include individual differences to already existing conceptual framework in the work family literature (division into antecedents, work-family relation, and outcomes). Blanchard et al. (2009), for instance, incorporated individual difference variables into antecedents of work-family interface next to situational factors concerning work and family.

2.2 *Individual Difference Measures and Negative Side of Work-Family Relationship*

The early research on the role of individual difference variables in the work-family linkages concentrated mainly on a negative side of work-family relationship (conflict) and some of them only on its one direction (work-to-family) (Noor 2002) and on a narrow scope of personality traits (negative affect, neuroticism, and type A behavior).

Negative affect (in contrast to positive affect) is understood as a general tendency, a predisposition to feel anxious, angry and upset (Watson and Clark 1992). The early research have found that higher levels of negative affect were associated with greater work-family conflict (e.g., Stoeva et al. 2002). Carlson (1999) searching for the relationship between negative affectivity, type A behavior, and all three forms of work-family conflict (time-, strain-, and behavior-based) found that negative affectivity explained significant amount of variance in all forms of work–family conflict. This has been explained by the way how negative affect shapes the individuals' perception of their work and family environment.

The early studies concerning the relation between Type A behavior and work-family interface provided inconsistent results. Type A behavior manifests itself in high ambition, competitiveness, impatience, and aggression or hostility in opposite to Type B behavior (Spence et al. 1987). Type A individuals experience time urgency, are more likely to be involved in conflict with coworkers, more overloaded at work, and more likely to be overcommitted than Type B individuals. Burke (1988) found a significant relationship between Type A and work-family conflict among married police officers (individuals with higher levels of Type A behavior more often experienced work-family conflict). On the contrary, Carlson (1999) found that Type A was related significantly only to behavior-based conflict. Additionally, the relationship was in the opposite direction to that expected (the

more Type A an individual was, the less behavior-based conflict reported). The author concluded that certain aspects of Type A might be more predictive to work-family conflict than others. There is an increasing evidence on the multidimensionality of the construct (e.g. Greenglass and Burke 1991) and thus, the global measure used by them may not be measuring all of the nuances in Type A behavior.

Neuroticism in opposition to emotional stability was associated with lower control of impulses and lower ability to cope with stressful situations (Costa and McCrae 1992). The earlier research showed the relationship between higher level of neuroticism with greater work-to-family and family-to-work conflict. These was explained that poor emotional adjustment and greater stress, anxiety and depression of neurotic individuals (Costa and McCrae 1992; Goldberg 1990) may make them more vulnerable to work-family conflict in both directions.

Noor (2002) examined three possible mechanisms (direct, moderator and mediator effects) by which locus of control moderated the relationship between work-to-family conflict and well-being in a sample of 310 married Malaysian women. Locus of control is understood as a stable personality trait concerning the individual's generalized belief on the extent to which outcomes depend on internal (e.g. personal efforts and abilities) rather than external variables (e.g. chance, efforts of others) (Rotter 1966). The research provided support for all three ways by which locus of control influence the relationship between work-to-family conflict and well-being. However, in case of work-to-family conflict determinants, it was found that the individuals with high control were more vulnerable to this conflict (experiencing at the same time higher levels of job satisfaction) than women with low control beliefs. The author concluded that although internal locus of control was usually associated with positive outcomes it could be counterproductive when situation was outside of control of the individuals and then internal locus of control was not helpful.

Thus, the early studies on individual differences and work-family interface focused—like majority of research in this area at that time—on a negative aspect of work-family linkages and on individual difference variables which were supposed to determine that aspect of work-family relationship.

2.3 The Big Five and Work-Family Interface

In the first decade of the 21 century the studies searching for the relationship between work-family interface and individual difference variables concentrated on the five-factor model of personality (The Big Five) (e.g. Kinnunen et al. 2003; Bruck and Allen 2003; Wayne et al. 2004). Moreover, the positive side of work/family relation was more frequently than in the early studies included in these research as well as both directions of the work-family relation.

The Big-five is a hierarchical organization of five orthogonal personality dimensions including Extraversion, Agreeableness, Consciousness, Neuroticism, and Openess to Experience (McCrae and John 1992). Extraversion refers to the

quantity and intensity of interpersonal interaction and activity. Individuals who score high on extraversion, in contrast to those scoring low, are cheerful, energetic, and optimistic and exhibit characteristics of sociability, assertiveness, talkativeness and high activity. The individuals high on agreeableness in contrast to individuals low on agreeableness are helpful, sympathetic to others, soft-hearted, cooperative, and good-natured. The individuals high on consciousness dimension are more purposeful, determined, punctual, reliable, well-organized, strong-willed, and usually attain academic or organizational success than individuals low on this dimension. Individuals high on the openness to experience dimension have an active imagination, aesthetic sensitivity, intellectual curiosity, preference for variety, and independence of judgment in contrast to individuals low on this dimension.

It was found that The Big Five moderated experience of work-family conflict and its well-being outcomes among fathers taking part in the national family research project in the Netherlands (Kinnunen et al. 2003). Emotional stability was found to moderate the relationship between work-to-family conflict and job exhaustion and between work-to-family conflict and depression. Agreeableness was shown to moderate the relationship between family-to-work conflict and marital satisfaction. The authors concluded that emotionally stable individuals were protected from negative effect of work-to-family conflict on well-being at work (exhaustion) and more general well-being (depression) while agreeable individuals were protected from negative effect of family-to-work conflict on marital satisfaction.

Bruck and Allen (2003) studied the relationship between work-family conflict, work-family facilitation, Type A behavior, negative affectivity and the Big-Five personality traits. They found neuroticism to be related to work-to-family conflict (especially strain-based) as well as the impatience–irritability component of Type A behavior (but not achievement striving component). Moreover, negative relations between work-to-family conflict and agreeableness were found indicating that less agreeable workers were more likely to experience time-based conflict. Consciousness was related to family-to-work conflict indicating that more conscientious individuals experienced less family interferences with work. This was explained that more conscientious individuals were found to be more effective at managing their time, responsibilities, tasks, and conflicts that arise between the work and home domains.

The American authors (Wayne et al. 2004) included the positive side of the work-family interface and studied the relationship between personality traits (the Big Five) and both work-family conflict and facilitation (and their outcomes) in the American national random sample. They found that neuroticism was related to both directions of work-family conflict and not related to facilitation. Consciousness was related to both direction of conflict i.e. the higher consciousness the lower work-to-family and family-to-work conflict. Agreeableness was negatively related to work-to-family conflict. Extraversion was related to both directions of facilitation but not to conflict. Consciousness and agreeableness were positively related to family-to-work facilitation but not to work-to-family facilitation. Openness to

experience—on the contrary—was positively related to work-to-family facilitation but unrelated to family-to-work facilitation.

A longitudinal approach to study on the role of personality traits in work-family conflict was applied by Rantanen et al. (2005). A sample of 80 women and of 75 men completed NEO Personality Inventory at age 33 years, and work-family conflict and psychological distress scales at age 36 years. Neuroticism was positively related to both directions of work-family conflict and psychological distress in men and women. Neuroticism was also a moderator which strengthened the link between work-family conflict both directions and psychological distress in women. Openness to Experience was positively linked to work-to-family conflict in men, and Agreeableness was negatively linked to psychological distress in both genders.

Summing up, the studies from the beginning of the 21 century on the work-family relationship and individual differences included the Big Five personality theory apart from the individual difference measures frequently studied in earlier research (e.g. type A behavior). Additionally, these studies concerning both directions of work-family relationship (from work-to-family and from family-to-work) and both valences of this relation (positive and negative) were more and more frequent.

2.4 Last Decade Studies—Longitudinal and Meta-Analytic Approaches in Search of a Moderating Role of Dispositional Variables on Work-Family Interface

More recent studies (around the last decade) take into consideration both positive and negative side of work-family relationships (e.g., work-family conflict, facilitation and enrichment), continue searching for the effect of the Big Five on work/family interface (e.g. Michel and Clark 2013), and take into account a wider scope of other individual difference measures (e.g. performance based self esteem). Additionally, apart from cross-sectional studies the longitudinal (e.g. Innstrand et al. 2010) and meta-analytic ones appeared as well.

A meta-analytic review by Michel et al. (2011) examined the relationships between the Five Factor Model (FFM) of personality and negative and positive forms of work–family spillover (e.g., work-family conflict and work-family facilitation). They found that personality variables were predictive of both work-to-family and family-to-work spillover. Meta-analytic structural equation modeling indicated that extraversion, agreeableness, and conscientiousness were negatively but neuroticism positively related to negative work–family spillover (conflict). Extraversion, agreeableness, conscientiousness, and openness to experience were related to positive work–family spillover (facilitation). The strongest predictor of negative work-family spillover was neuroticism while the strongest predictors of work-family positive spillover were extraversion and openness to experience.

Another meta-analytic study summarized the results of 68 studies on the relationship between dispositional and demographic variables (positive affect, locus of control The Big Five) and work-family conflict (Allen et al. 2012). They found strong relations of negative affect and neuroticism with work-family conflict and suggested that negative affect and neuroticism were the factors which predisposed individuals to work-family conflict. On the contrary, positive affect, internal locus of control, and optimism helped individuals to manage work and family demands. Agreeableness and conscientiousness were negatively related to both directions of work-family conflict. The authors concluded that agreeableness may help finding social resources to deal with work-family conflict while conscientiousness determining high performance helps managing multiple role responsibilities.

Michel and Clark (2013) searched for the relative importance of personality traits in the prediction of positive and negative side of work-family interface. They found that conscientiousness, neuroticism, negative affect and core self-evaluations were related to both directions of work–family conflict, whereas agreeableness predicted significant variance in family-to-work conflict only. Positive affect and core self-evaluations were related to both directions of work–family facilitation. Negative affect and neuroticism were found to be the strongest predictors of work-family conflict whereas positive affect and core self-evaluations were found to be the strongest predictors of work-family facilitation.

The effect of job performance-based self-esteem on work-family conflict and facilitation in the sample of around 3500 professionals was examined in a Norwegian longitudinal study (Innstrand et al. 2010). Performance based self-esteem refers to the person's perception of his/her performance at work (Hallsten 2005). The individuals with high on job performance-based self-esteem tend to put work above their personal needs and for example to bring work home, to attend work when they are sick (Hallsten 2005). Strong job performance-based self-esteem was found to be a vulnerability factor increasing work-home conflict. Job performance-based self-esteem and work-family facilitation were only weakly related.

Biggart et al. (2010) investigated emotional intelligence and work-family conflict in a sample of British fathers. Emotional intelligence is a dispositional characteristic defined as an ability to understand, accurately perceive, express, and regulate emotions (Mayer and Salovey 1997). They applied a "trait model" assuming that emotional intelligence is a constellation of emotional self-perceptions consisting of four factors (Self-control, Emotionality, Sociability and Well-being) (Petrides et al. 2007). Total emotional intelligence was negatively related to work-to-family and family-to-work conflict. More specifically, self-control which is one of four factors of emotional intelligence was associated with lower levels of work-family conflict of both directions. Individuals who were able to regulate their emotions experienced less work–family conflict. Neither of the remaining emotional intelligence factors significantly predicted work-to-family and family-to-work conflict.

Cohen (2009) examined the relationship between individual values and the work-family conflict of both directions, and coping strategies. Schwartz's theory (Sagiv and Schwartz 2000) of ten types of basic human values which are defined as desirable, trans-situational goals, varying in importance, that serve as guiding

principles in people's lives, was applied. They found that power (understood as control or dominance over people and resources) was positively related to work-family conflict of both directions. The authors concluded that those individuals who value power are more inclined to be involved in conflicts in general and between work and family roles in particular.

Canadian authors (Blanchard et al. 2009) searched for a role of work environment factors and individual time management and global self-determination on work-family conflict in a random sample of nursing staff. Time management is a construct comprising both attitudes and behaviors that determine the effective use of one's time (Macan et al. 1990). Self-determination is understood as the degree of volition or perceived autonomy a person experiences toward a certain behavior (Deci and Ryan 1985). The results provided evidence that the global self-determination was a predictor of work-to-family and to family-to-work conflict what suggests that individuals who feel self-determined toward their life in general, experience less interference between work and family domains in both directions. The time management did not significantly contribute to the prediction of work-to-family and family-to-work conflict.

The role of locus of control and situational control (job autonomy) on the experience of work-family conflict and work-family facilitation among nationally representative sample of employed adults (n = 3504) was examined by Andreassi and Thompson (2007). In contrast to earlier findings (Noor 2002) internal locus of control was negatively related to both directions of work-family conflict and positively related to work-family facilitation. Individuals who had an internal locus of control were more likely to have lower levels of work-family conflict (both directions) and higher levels of work-family facilitation.

The Slovenian study (Mihelič and Tekavčič 2014) examined whether negative and positive affectivity can predict different forms of work-to-family conflict (time-, strain-, and behavior based) and enrichment (development, affect and capital aspects) beyond job characteristics (workload, autonomy, variety, workplace support) in a large sample of Slovenian employees from various organizations and occupations. Negative affectivity significantly predicted work-family conflict beyond work situational antecedents. The authors concluded that high negative affectivity individuals may seek out more negative events when managing the work–family interface or may create stressful situations. They may perceive their work–family interface as even more taxing and they may not have sufficient coping skills to deal with work–family issues. Positive affectivity was found to increase all forms of work-family enrichment. The authors suggested that enthusiasm and energy may help to shape perceptions of the work–family interface in an enriching way.

In sum, the most recent studies continued searching for the relationship between the Big Five and work-family interface. Additionally, they incorporated into consideration dispositional variables that were not investigated in earlier studies. Looking from the point of view of methodology they included apart from cross-sectional studies longitudinal and meta analytic ones as well.

3 Do Individual Differences in Circadian Rhythm Parameters Associated with Shift Work Tolerance Moderate Work-Family Relationship in Shift Workers?

3.1 Shift Work Stress

Shift work is defined as any system of fixed working hours, about 8 h in length, most of which falls outside the standard day work period (between 08.00 and 17.00 h) (Tepas 1985). Shift work is regarded a stressor due to its working time arrangements including night work. Working nights and evenings disturbs both biological rhythms and social routines what results in impaired sleep, increased incidence of cardiovascular disease, gastrointestinal disease, and family and social life problems (described in detail in Chapter "Introduction to Problems of Shift Work" of this book).

There have been developed theoretical models explaining associations between shift work and its effects on well-being (Taylor et al. 1997). The conceptualization of the relationship between shift work and its well-being effects was based on stress theories from linear stress-strain models (e.g. Rutenfranz et al. 1981) through chronobiological ones (e.g. Monk 1988) to multidirectional, psychological conceptualizations (e.g. Olsson et al. 1990) understanding shift work as any other workplace stressor.

The shift work stress model based on more developed occupational stress interactional models may serve as a theoretical framework for considering the relationship between the work-family interface and individual differences in shift workers. The model assumes that shift systems because of their parameters (e.g. night work, duration of shits) require individuals to adjust their sleep-wake cycle to timing of work and rest (Barton et al. 1995). This may result in interrelated disruptions of biological rhythms, sleep as well as family and social life. The effects of these disruptions are modified by individual (e.g. age, personality, chronotype) and situational variables (e.g. domestic and work circumstances). Disturbances in biological rhythms, sleep and family/social life lead to acute effects on well-being (e.g. general feeling of malaise, chronic fatigue) and performance. Over the course of exposure to shift work the chronic effects of shift work on well-being (e.g. cardiovascular diseases, gastro-intestinal diseases) and performance build up which are moderated by individual differences and differences in coping strategies.

3.2 Individual Differences Associated with the Circadian Rhythms Parameters and Tolerance to Shift Work

There have been found factors moderating shift work effects on well-being that make people more or less tolerant to shift work (e.g. Harma 1993; Nachreiner 1998). Shift work tolerance is understood as an ability to adapt to shift work

without adverse consequences (e.g. digestive troubles, persistent fatigue/unusual nervousness, and sleep alterations) (Andlauer et al. 1979). Several groups of shift work tolerance factors have been identified. Here, individual factors which have the potential to moderate tolerance to shift work (including morningness, languidity and flexibility) will be considered as moderating work-family relationships (conflict and facilitation) in shift workers. These individual factors are regarded as associated with parameters of circadian rhythms (Folkard and Monk 1985). Morningness is regarded to be associated with the circadian rhythm phase (timing of the maximum value within a cycle) (Horne and Ostberg 1976). Morning people differ from evening people with regard to timing of sleep and different activities during the day. Morning people—in contrast to evening people—feel more alert during the day, get up early in the morning, choose morning hours as the best time for different activities and fall asleep earlier in the evening. The majority of earlier and more recent studies have documented that evening individuals in comparison to morning ones are better able to adapt to changing work schedules (e.g. Monk 1988), report better shift work tolerance (Steele et al. 2000; Takahashi et al. 2005), better work performance (Burch et al. 2009) and higher satisfaction with shift work (Korompeli et al. 2009). One of the recently published reviews of studies on individual difference variables and shift work tolerance (Saksvik et al. 2011) showed that out of sixteen studies carried out between the years 1998 and 2009, nine provided support that low scores on morningness were associated with high shift work tolerance (e.g. Furnham and Hughes 1999; Seo et al. 2000). The opposite was true in three studies (e.g. Willis et al. 2008). The other four studies reported no significant relationship between morningness and shift work tolerance (e.g. Axelsson et al. 2006).

Languidity and flexibility are defined as associated with the circadian rhythm amplitude (the difference between the maximum value and the average value over the complete cycle) and stability of the rhythm from one cycle to the other cycles, respectively (Di Milia et al. 2005). Languid types in opposition to vigorous types are regarded to have lower amplitude of the circadian rhythm which makes them experience more difficulties in overcoming drowsiness and be more sensitive to sleep loss.

The flexibility/rigidity dimension concerns the stability of a subject's sleeping habits. A flexible type—compared to a rigid type—is easily able to sleep and work well at unusual times of the day. Earlier (e.g. Folkard et al. 1979; Costa et al. 1989; Iskra-Golec et al. 1995) and more recent studies (a review by Saksvik et al. 2011) have provided evidence that high levels of flexibility and low levels of languidity (e.g. Di Milia et al. 2005) are positively related to shift work tolerance.

It is assumed here that if evening individuals, flexible individuals and individuals who are better able to overcome drowsiness tolerate shift work well (they suffer less from shift work related impairment of well-being) they will also be better able to manage work and home obligations and experience less work-to-family and family-to-work conflict. Suffering less from well-being impairment they will be better able to experience facilitation between work and family both directions as well.

The earlier research findings showing that individual differences can moderate work-family relationships provided the premises to the following hypotheses examined in this study:

Hypothesis 1. Variables associated positively with shift work tolerance (eveningness, flexibity, and vigorousness) are negatively related to work-family conflict in both directions.

Hypothesis 2. Variables associated positively with shift work tolerance (eveningness, flexibity, and vigorousness) are positively related to work-family facilitation in both directions.

3.3 Method

Participants

A convenience sample of 260 male workers employed in maintenance workshops of two transportation companies of two large towns in southern Poland completed self-report questionnaires. Thirty one participants were excluded from the sample because they did not meet the inclusion criteria (i.e. being married and having at least one child). The final sample included 229 male blue collar shift workers. They were middle aged, had medium work experience, and the average age of their youngest child was 12.25 years (Table 1). They all worked a weekly rotating three-shift (morning, afternoon, night) schedule with 48 h off after each of 5 days shift blocks. The timing of shifts was as follows: morning 06.00–14.00 h; afternoon 14.00–22.00 h, and night 22.00–06.00 h.

Measures

The four dimensions of work-family spillover were measured using Polish translation of the four sets of questions developed for the Midus survey (Grzywacz and Marks 2000). The items belonging to negative spillover (conflict) scales concerned the extent to which time pressures and strain in one role interfered with performance in the other role. The items measuring work-to-family conflict included "(1) Your job reduces the effort you can give to activities at home. (2) Stress at work makes you irritable at home. (3) Your job makes you feel too tired to do things that need attention at home. (4) Job worries or problems distract you when you are at home." Family-to-work conflict was assessed using the following items: "(1) Responsibilities at home reduce the effort you can devote to your job. (2) Personal or family worries and problems distract you when you are at work.

Table 1 Means and standard deviations of the participants age, work experience, number of children and age of the youngest child

Age		Work experience		Number of children		The youngest child age	
Mean	SD	Mean	SD	Mean	SD	Mean	SD
40.57	6.77	18.22	4.39	1.89	0.82	12.25	5.53

(3) Activities and chores at home prevent you from getting the amount of sleep you need to do your job well. (4) Stress at home makes you irritable at work". The items of sets on positive spillover (enhancement, facilitation) between work and family concerned the extent to which skills, behaviors, and positive mood from one domain positively influenced one's performance in other domain. The work-to-family positive spillover (facilitation) was assessed by application of the following items: "(1) The things you do at work help you deal with personal and practical issues at home. (2) The things you do at work make you a more interesting person at home. (3) The skills you use on your job are useful for things you have to do at home." The items evaluating the family-to-work facilitation were as follows: "(1) Talking with someone at home helps you deal with problems at work. (2) the love and respect you get at home makes you feel confident about yourself at work. (3) Your home life helps you relax and feel ready for the next day's work". Each set of questions was preceded by a question "How often have you experienced each of the following in the past year?". Participants were asked to indicate the frequency of experiencing each work-family situation using five-point frequency based scale (1 = All the time, 5 = Never). Higher scores reflected higher levels of a given work-to-family or family-to-work conflict or facilitation.

The Morningness–Eveningness Questionnaire (MEQ, Horne and Ostberg 1976) applied to measure morningness consists of 19 items asking about preferences concerning timing of sleep and different activities during the day. Five items were provided with a time-scale to position the individuals preferences on. The other items were provided with 4 options Likert-type scales. A sample item is "Considering only your "feeling best" rhythm, at what time would you go to bed if you were entirely free to plan your evening?". A higher score means a higher level of morningness. The validity of the original version of the questionnaire was based on the daily course of the body temperature rhythm.

The eleven item version of the Circadian Type Inventory (CTI) consisting of two scales concerning daily habits, and preferences was applied (Folkard et al. 1979; Di Milia et al. 2004). One scale concerns flexibility/rigidity of sleeping and other daily habits. A sample item from the flexibility/rigidity scale is "Would you be just as happy to do something in the middle of the night as during the day?" Individuals scoring high on flexibility scale have flexible daily habits concerning timing of sleep and different activities. The second scale languidity/vigor concerns ability to overcome drowsiness. A sample item from this scale is "If you have to get up very early one morning do you tend to feel tired all day?" High scorers on the languidity scale have difficulties with overcoming drowsiness and need more sleep than individuals scoring lower on this scale. All questions are provided with 5-point Likert-type scale of answering from 1 (almost never) to 5 (almost always). Test–retest reliability in a group of students after three months was 0.72 and 0.75 for the LV and FR scales respectively. In a sample of shift workers and day workers Cronbach's alpha was 0.72 (LV) and 0.79 (FR) (Di Milia et al. 2005).

3.4 Results

Regression analyses (step wise method) were performed on the data as well as descriptive statistics and correlation analyses (Table 2).

Morningness was found to be significantly negatively correlated, while languidity was significantly positively correlated, with conflict between work and family of both directions. Flexibility was significantly positively correlated with family-to-work facilitation. There was a high significant correlation between morningness and languidity.

In order to test the hypotheses multiple regression analyses (step wise method) were conducted with the four dimensions of work and family linkages as dependent variables, age and three individual difference variables as independent variables (predictors: age, morningness, languidity, flexibility).

The model predicting work-to-family conflict was significant and explained 22.9 % of the variance (Table 3). In the first step languidity entered the equation and explained 19.2 % of variance and in the second step languidity together with morningness (ß = −0.233) accounted for 22.9 % of variance explained. The effect of languidity was strong and positive and the effect of morningness was weak and negative. The more languid and the more evening an individual is, the more work-to-family conflict is experienced. This result confirms a part of hypothesis 1.

Table 2 Variables under the study—descriptive statistics and Pearson's correlation coefficients

Variable	Mean	SD	Flexibility	Languidity	Morningness
WFC	10.17	6.49	−0.012	0.457**	−0.380**
FWC	9.63	3.11	0.075	0.394**	−0.343**
WFF	11.75	2.92	0.047	0.055	−0.052
FWF	13.82	3.12	0.179**	0.082	0.002
Morningness	62.88	6.49	−0.019	−0.443**	–
Languidity	16.05	4.41	0.150*	–	–
Flexibility	14.59	3.58	–	–	–

* = p ≤ .05
** = p ≤ .001

Table 3 Predictors of work-to-family conflict—results of multiple regression analysis (step wise method)

Dependent variables and R^2	Individual difference variables	B	β	t	p
Work-to-family conflict	–	–	–	–	–
Step 1. (Constant)	–	5.237	–	7.664	0.000
R^2 = 19.6 %	Languidity	0.299	0.442	7.248	0.000
Corrected R^2 = 19.2 %	–	−0.098	0.442	–	–
Step 2. (Constant)	–	13.202	–	5.374	0.000
R^2 = 23.6 %	Languidity	0.220	0.324	4.690	0.000
Corrected R^2 = 22.9 %	Morningness	−0.106	−0.233	−3.369	0.001

Table 4 Predictors of family-to-work conflict—results of multiple regression analysis (step wise method)

Dependent variables and R^2	Individual difference variables	B	β	t	p
Family-to-work conflict	–	–	–	–	–
Step 1. (Constant)	–	5.387	–	7.444	0.000
R^2 = 13.5 %	Languidity	0.254	0.368	5.816	0.000
Corrected R^2 = 13.1 %	–	–	–	–	–
Step 2. (Constant)	–	13.437	–	5.156	0.000
–	–	–	–	–	0.000
R^2 = 17.5 %	Languidity	0.173	0.251	3.495	0.001
Corrected R^2 = 16.7 %	Morningness	−0.107	−0.231	−3.211	0.002

The model predicting family-to-work conflict was also significant and accounted for 16.7 % of the variance explained (Table 4). Languidity explained 13.1 % of variance in the first step and in the second step languidity together with morningness (ß = −0.231) accounted for 16.7 % of the variance explained.

Languidity itself explained a larger amount of variance than morningness. The effect of languidity was positive while that of morningness was negative. Higher levels of languidity and lower levels of morningness are associated with more conflict between work and family in both directions. This confirms a part of hypothesis 1.

The next model predicting work-to-family facilitation was significant as well but explained much less variance (6.4 %) than the previous two models (Table 5). Finally, the last model concerning family-to-work facilitation was not significant.

Age and flexibility explained a small but significant amount of variance in work-to-family facilitation. The effect of age was stronger than the effect of flexibility. The effect of age was negative and the effect of flexibility was positive. Younger workers and higher levels of flexibility were associated with more work-to-family facilitation. This result confirms a part of hypothesis 2.

Table 5 Predictors of work-to-family facilitation—results of multiple regression analysis (step wise method)

Dependent variables and R^2	Individual difference variables	B	β	t	p
Work-to-family facilitation	–	–	–	–	–
Step 1. (Constant)	–	13.952	–	20.628	0.000
R^2 = 5.4 %	Age	−0.076	−0.233	−3.516	0.000
Corrected R^2 = 5.0 %	–	–	–	–	–
Step 2. (Constant)	–	12.241	–	11.550	0.000
R^2 = 7.3 %	Age	−0.071	−0.218	−3.293	0.001
Corrected R^2 = 6.4 %	Flexibility	0.107	0.138	2.086	0.038

3.5 Discussion

The hypotheses of the study reported in this chapter assumed that individual differences in tolerance to shift work associated with the circadian rhythm parameters (morningness, languidity, flexibility) had a potential of moderating work-family relationship in shift workers. The findings of this study indicated that individual differences associated with circadian rhythm parameters and tolerance to shift work can moderate to different extents the work-family relationship in blue collar, male shift workers.

Languidity and to a smaller degree morningness were related to both directions of conflict but generally not related to facilitation. Moreover, languidity was found to be the strongest predictor of work-to-family and family-to-work conflict. This is consistent with a part of the first hypothesis. The ability to overcome drowsiness (vigor) in contrast to languidity seems to be a resource preventing against work-to-family and family-to-work conflict. Individuals able to overcome drowsiness might be better able to perform home and work duties late during the day or at night without feeling drowsy despite the sleep deficit. This may help manage responsibilities of both roles. Additionally, as demonstrated by numerous studies—they are better able—than languid individuals - to tolerate shift work (e.g. Folkard et al. 1979; Costa et al. 1989; a review by Saksvik et al. 2011; Di Milia et al. 2005). Suffering less from shift work related sleep and health consequences may prevent vigorous types in opposite to languid types from strain based work-family conflict both directions.

Morningness together with languidity was found to predict negatively conflict between work and family of both directions. The more evening individual the bigger conflict between work and family in both directions. This is opposite to what was hypothesized (hypothesis 1). Thus, this may suggest that morningness may not moderate work-family relationship via shift work tolerance. However, the research findings on morningness and tolerance to shift work were not highly consistent. Only 56 % of studies carried out in the last decade provided support for negative relationship between morningness and shift work tolerance (Saksvik et al. 2011).

Morning individuals, in contrast to evening ones, prefer and are better able to act and feel better during earlier hours of the day what is in accordance with the sleep/activity pattern of the rest of the society including their families. This may facilitate performance on family roles and prevent conflict. Additionally, morningness was found to correlate positively with consciousness (Randler 2008; Tonetti et al. 2009) and negatively with neuroticism (DeYoung et al. 2007). It has been found in numerous studies on the relationship between the Big Five and work-family relation that consciousness was negatively and neuroticism positively related to work-family conflict both directions (Michel et al. 2011; Allen et al. 2012).

Flexibility (together with age) predicted work-to-family facilitation (explaining a limited amount of variance) but was not related to conflict between work and family. Flexible individuals are better able than rigid ones to do different activities

and sleep at odd times of the day. This may prevent them from having a deficit of sleep resulting from night work, which in turn may help them to manage their work and family roles. Moreover, being flexible may help to adjust to changing hours of work and to use them to perform better home and child care duties.

The findings of this study indicated that conflict and facilitation between work and family in shift working population might be related to individual differences associated with the circadian rhythm parameters (chronotype and circadian type dimensions). These add new knowledge about the role of not-as-yet investigated individual difference variables in moderating the relationship between work and family in shift working individuals. This finding however, needs to be treated as a signal of a potential relationship and confirmed in a larger samples from various organizations and occupations. Additionally, the cross-sectional design of this study makes also possible alternative interpretations. Thus, longitudinal studies are needed to confirm relationships found in this study.

Languidity together with morningness were found to be predictors of work/family conflict but not of facilitation. Flexibility—on the contrary—was found to be a predictor of facilitation (work-to-family) but not of conflict. This adds some knowledge to the nature of conflict and facilitation. These results are consistent with the other research findings on individual differences and work-family interface (e.g. Wayne et al. 2004) demonstrating that conflict is not merely an opposite of facilitation but that they both are the separate constructs having their own determinants and correlates.

A limitation of this study is a relatively small sample size and its homogeneity with regard to age, gender and profession, which do not allow for wider generalization of the results. Homogeneity of the sample however, enabling for firm conclusions might be regarded at the same time as a strong point of this study. Another limitation is that the data were all self-report so the method bias cannot be excluded. However large and variable correlations in predicted directions may say against the method bias as the only explanation of the results.

This research raises several questions regarding the mechanisms of the relationship between languidity, morningness and flexibility and work-family interface that could be addressed in the future research. For instance, are there the same relations of chronotype and circadian type traits with work-family interface in day working populations? What is the mechanism underlying the positive relationship between chronotype and circadian type traits (languidity and morningness) with work-family conflict of both directions? Is it (and to what extent) the higher level of shift work strain which contributes to work-to-family and family-to-work conflict in the evening and languid people in comparison to the vigorous and morning types or is it their style of life only (sleep/wake habits)?

In sum, this study advances the knowledge about the work-family interface by providing new insight concerning its correlates. This study shows that conflict and facilitation between work and family is related not only to individual differences in personality but to individual differences in behavior styles associated with circadian rhythm parameters as well, at least among shift workers.

References

Allen, T. D., Johnson, R. C., Saboe, K. N., Cho, E., Dumani, S., & Evans, S. (2012). Dispositional variables and work–family conflict: A meta-analysis. *Journal of Vocational Behavior*, *80*, 17–26.

Allport, G. W. (1937). *Personality: A psychological interpretation*. New York: Holt.

Allport, G. (1961). *Pattern and growth in personality*. New York: Holt, Rinehart, & Winston.

Andlauer, P., Reinberg, A., Fourre, L., Battle, W., & Duverneuil, G. (1979). Amplitude of the oral-temperature circadian-rhythm and the tolerance to shift work. *Journal of Developmental Physiology, 75*, 507–512.

Andreassi, J. K., & Thompson, C. A. (2007). Dispositional and situational sources of control. Relative impact on work-family conflict and positive spillover. *Journal of Managerial Psychology, 22*, 722–740.

Axelsson, J., Lowden, A., & Kecklund, G. (2006). Recovery after shift work: relation to coronary risk factors in women. *Chronobiology International, 23*, 1115–1124.

Barton, J., Spelten, E., Totterdell, P., Smith, L., Folkard, S. & Costa, G. (1995). The standard shiftwork index: A battery of questionnaires for assessing shiftwork-related problems. *Work and Stress, 9*(1), 30–44.

Biggart, L., Corr, P., O'Brien, M., & Cooper, N. (2010). Trait emotional intelligence and work–family conflict in fathers. *Personality and Individual Differences, 48*, 911–916.

Blanch, A., & Aluia, A. (2009). Work, family and personality: A study of work–family conflict. *Personality and Individual Differences, 46*, 520–524.

Blanchard, C. M., Tremblay, M. A., Mask, L., & Perras, M. G. M. (2009). A combination of work environment factors and individual difference variables in work interfering with family. *International Journal of Workplace Health Management, 2*, 63–90.

Bruck, C. S., & Allen, T. D. (2003). The relationship between big five traits, negative affectivity, type A behavior, and work-family conflict. *Vocational Behavior, 63*, 457–472.

Bronfenbrenner, U. (1989). Ecological systems theory. In R. Vasta (Ed.), *Six theories of child development. Annals of child development: A research annual* (Vol. 6, pp. 187–249). Greenwich, CT: JAI Press.

Burch, J. B., Tom, J., Zhai, Y. S., Criswell, L., Leo, E., & Ogoussan, K. (2009). Shift work impacts and adaptation among health care workers. *Occupational Medicine-Oxford, 59*, 59–66.

Burke, R. J. (1988). Some antecedents and consequences of work-family conflict. *Journal of Social Behavior and Personality, 3*, 287–302.

Cameron, K. S., Dutton, J. E., Quinn, R. E., & Wrzesniewski, A. (2003). Developing a discipline of positive organizational scholarship. In K. S. Cameron, J. E. Dutton, & R. E. Quinn (Eds.), *Positive organizational scholarship: Foundations of a new discipline*. San Francisco: Berrett-Koehler.

Carlson, D. S. (1999). Personality and role variables as predictors of three forms of work–family conflict. *Journal of Vocational Behavior, 55*, 236–253.

Carlson, D. S., & Kacmar, K. M. (2000). Work-family conflict in the organization: Do life role values make a difference? *Journal of Management, 26*(5), 1031–1054.

Cohen, A. (2009). Individual values and the work/family interface. An examination of high tech employees in Israel. *Journal of Managerial Psychology, 24*(8), 814–832.

Costa, P. T., Jr., & McCrae, R. R. (1992). *Revised NEO personality inventory (NEO-PI-R) and NEO five-factor inventory (NEO-FFI) professional manual*. Odessa, FL: PAR.

Costa, G., Lievore, F., Casaletti, G., Gaffuri, E., & Folkard, S. (1989). Circadian characteristics influencing inter-individual differences in tolerance and adjustment to shift work. *Ergonomics, 32*(4), 373–385.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

DeYoung, C. G., Hasher, L., Djikic, M., Criger, B., & Peterson, J. B. (2007). Morning people are stable people. Circadian rhythm and the higher-order factors of the Big Five. *Personality and Individual Differences, 43*, 267–276.

Di Milia, L., Smith, P. A., & Folkard, S. (2004). Refining the psychometric properties of the circadian type inventory. *Personality and Individual Differences, 36*, 1953–1964.

Di Milia, L., Smith, P. A., & Folkard, S. (2005). A validation of the revised circadian type inventory in a working sample. *Personality and Individual Differences, 39*, 1293–1305.

Edwards, J., & Rothbard, N. P. (2000). Mechanisms linking work and family: Clarifying the relationship between work and family constructs. *The Academy of Management Review, 25*(1), 178–199.

Folkard, S., Monk, T. H., & Lobban, M. C. (1979). Towards a predictive test of adjustment to shiftwork. *Ergonomics, 22*(1), 79–91.

Folkard, S., Monk, T.H. (1985). *Hours of Work*. Temporal Factors in Work Scheduling. Chichester: Wiley.

Frone, M. R. (2003). Work—family balance. In J. C. Quick & L. E. Tetrick (Eds.), *Handbook of occupational health psychology* (pp. 143–162). Washington, DC: American Psychological Association.

Frone, M. R., Russell, M., & Cooper, M. L. (1992). Antecedents and outcomes of work–family conflict: Testing a model of the work–family interface. *Journal of Applied Psychology, 77*, 65–68.

Furnham, A., & Hughes, K. (1999). Individual difference correlates of night work and shift work rotation. *Personality and Individual Differences, 26*, 941–959.

Goldberg, L. R. (1990). An alternative "description of personality": The Big-Five factor structure. *Journal of Personality and Social Psychology, 59*, 1216–1229.

Grandey, A. A., & Cropanzano, R. (1999). The conservation of resources model applied to work–family conflict and strain. *Journal of Vocational Behavior, 54*, 350–370.

Greenglass, E., & Burke, R. J. (1991). The relationship between stress and coping among Type As. In P. L. Perrew (Ed.), *Handbook of Job Stress*.

Greenhaus, J. H., & Beutell, N. J. (1985). Sources of conflict between work and family roles. *Academy of Management Review, 10*, 76–88.

Greenhaus, J. H., & Beutell, N. J. (2006). When work and family are allies: A theory of work-family enrichment. *Academy of Management Review, 31*(1), 72–92.

Grzywacz, J. G., & Marks, N. F. (2000). Reconceptualizing the work-family interface: An ecological perspective on the correlates of positive and negative spillover between work and family. *Journal of Occupational Health Psychology, 5*(1), 111–126.

Grzywacz, J. G., Almeida, D. M., & McDonald, D. A. (2002). Work-family spillover and daily reports of work and family stress in the adult labor force. *Family Relations, 51*(1), 28–36.

Hallsten, L. (2005). Burnout and wornout—concepts and data from a national survey. In A.-S. G. Antoniou & C. L. Cooper (Eds.), *Research companion to organizational health psychology* (pp. 516–536). Cheltenham: Elgar Publishing.

Härmä, M. (1993). Individual-differences in tolerance to shift work—a review. *Ergonomics, 36*, 01–109.

Hobfoll, S. E. (1989). Conservation of resources: A new attempt at conceptualizing stress. *American Psychologist, 44*(3), 513–524.

Horne, J. A., & Ostberg, O. (1976). A self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms. *International Journal of Chronobiology, 4*(2), 97–110.

Innstrand, S. T., Langballe, E. M., Espnes, G. A., Aasland, O., & Falkum, E. (2010). Personal vulnerability and work-home interaction: The effect of job performance-based self-esteem on work/home conflict and facilitation. *Scandinavian Journal of Psychology, 51*(6), 480–487.

Iskra-Golec, I., Marek T., & Noworol, C. (1995). Interactive effect of individual factors on shift working nurses' health and sleep. *Work and Stress, 9*(2/3), 256–261.

Kirchmeyer, C. (1993). Nonwork-to-work spillover: A more balanced view of the experiences and coping of professional women and men. *Sex Roles, 28*, 531–552.

Kinnunen, U., Vermulst, A., Gerris, J., & Makikangas, A. (2003). Work–family conflict and its relation to well-being: The role of personality as a moderating factor. *Personality and Individual Differences, 35*, 1669–1683.

Korompeli, A., Sourtzi, P., Tzavara, C., et al. (2009). Rotating shift-related changes in hormone levels in intensive care unit nurses. *Journal of Advanced Nursing, 65*(6), 1274–1282.

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal and coping*. NY, USA: Springer Publishing Company Inc.

Macan, T. M., Shahani, C., Dipboye, R. L., & Phillips, A. P. (1990). College students' time management: Correlations with academic performance and stress. *Journal of Educational Psychology, 82*, 760–768.

McCrae, R. R., & John, O. P. (1992). An introduction to the five-factor model and its applications. *Journal of Personality, 60*, 175.

Mayer, J. D., & Salovey, P. (1997). What is emotional intelligence? In P. Salovey & D. Sluyter (Eds.), *Emotional development and emotional intelligence: Educational implications* (pp. 3–31). New York: Basic Books.

Michel, J. S., & Clark, M. A. (2009). Has it been affect all along? A test of work-to-family and family-to-work models of conflict, enrichment, and satisfaction. *Personality and Individual Differences, 47*, 163–168.

Michel, J. S., Clark, M. A., & Jaramillo, D. (2011). The role of the Five Factor Model of personality in the perceptions of negative and positive forms of work–nonwork spillover: A meta-analytic review. *Journal of Vocational Behavior, 79*, 191–203.

Michel, J. S., Clark, M. A. (2013). Investigating the relative importance of individual differences on the work-family interface and the moderating role of boundary preference for segmentation. *Stress Health, 29*(4), 324-336.

Mihelič, K., & Tekavčič, M. (2014). Work-family conflict: A review of antecedents and outcomes international journal of management and information systems—first quarter, *18*(1).

Milkie, M. A., & Peltola, P. (1999). Playing all the roles: Gender and the work-family balancing act. *Journal of Marriage and the Family, 61*, 476–490.

Monk, T. H. (1988). Coping with the stress of shiftwork. *Work and Stress, 2*, 169–172.

Nachreiner, F. (1998). Individual and social determinants of shift work tolerance. *Scandinavian Journal of Work and Environmental Health, 24*, 35–42.

Noor, N. M. (2002). Work–family conflict, locus of control, and women's well-being: Tests of alternative pathways. *The Journal of Social Psychology, 142*, 645–662.

Ognianova, V. M., Dalbokova, D. L., & Stanchev V. (1998). Stress states, alertness and individual differences under 12-hour shiftwork. *International Journal of Industrial Ergonomics, 21*, 283–291.

Olsson, K., Kandolin, I., & Kauppinen-Toropainen, K. (1990). Stress and coping strategies in three-shift workers. *La Travail Humain, 53*, 175–188.

Petrides, K. V., Pita, R., & Kokkinaki, F. (2007). The location of trait emotional intelligence in personality factor space. *British Journal of Psychology, 98*, 273–289.

Randler, C. (2008). Morningness-eveningness, sleep-wake variables and big five personality factors. *Personality and Individual Differences, 45*, 191–196.

Rantanen, J., Pulkkinen, L., & Kinnunen, U. (2005). The big five personality dimensions, work–family conflict, and psychological distress. *Journal of Individual Differences, 26*, 155–166.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control reinforcement. *Psychological Monographs: General and Applied, 80*, 1–28.

Rutenfranz, J., Knauth, P., & Angersbach, D. (1981). Shift work research issues. In L. C. Johnson, D. I. B. Saksvik, B. Bjorvatn, H. Hetland, G. M. Sandal, & S. Pallesen (2011). Individual differences in shift work tolerance. A systematic review. *Sleep Medicine Reviews, 15*, 221–235.

Sagiv, L., & Schwartz, S. H. (2000). Value priorities and subjective well-being: direct relations and congruity effects. *European Journal of Social Psychology, 30*, 177–198.

Seo, Y. J., Matsumoto, K., Park, Y. M., Shinkoda, H., & Noh, T. J. (2000). The relationship between sleep and shift system, age and chronotype in shift workers. *Biological Rhythm Research, 31*, 559–579.

Spence, J. T., Helmreich, R. L., & Pred, R. S. (1987). Impatience versus achievement strivings in the Type A pattern: Differential effects on students' health and academic achievement. *Journal of Applied Psychology, 72*, 522–528.

Steele, M. T., Ma, J., Watson, W. A., & Thomas, H. A. (2000). Emergency medicine residents' shiftwork tolerance and preference. *Academic Emergency Medicine, 7*, 670–673.

Stoeva, A. Z., Chiu, R. K., & Greenhaus, J. H. (2002). Negative affectivity, role stress, and work–family conflict. *Journal of Vocational Behavior, 60*, 1–16.

Tamagawa, R., Lobb, B., & Booth, R. (2007). Tolerance of shift work. *Applied Ergonomics, 38*, 635–642.

Takahashi, M., Taningawa, T., Tachibana, N., Mutou, K., Kage, Y., Smith, L., et al. (2005). Modifying effects of perceived adaption to shift work on health, wellbeing, and alertness on the job among nuclear power plant operators. *Industrial Health, 43*, 171–178.

Taylor, E., Briner, R. B., & Folkard, S. (1997). Models of shift work and health: An examination of the influence of stress on shiftwork theory. *Human Factors, 39*(1), 67–82.

Tement, S., & Korunka, C. (2013). Does trait affectivity predict work-to-family conflict and enrichment beyond job characteristics? *The Journal of Psychology, 147*(2), 197–216.

Tepas, D. (1985). Flexitime, compressed workweeks, and other alternative work schedules. In S. Folkard & T. Monk (Eds.), *Hours of work. Temporal factors of work scheduling* (pp. 147–163). Chichester: John Wiley & Sons.

Tepas, D., Colquhoun, P., & Colligan, M. (Eds.). (1981). *Biological rhythms, sleep, and shift work* (pp. 165–195). New York: Medical and Scientific Books.

Tonetti, L., Fabbri, M., & Natale, V. (2009). Relationship between circadian typology and big five personality domains. *Chronobiology International, 26*, 337–347.

Watson, D., & Clark, L. A. (1992). On traits and temperament: General and specific factors of emotional experience and their relation to the five-factor model. *Journal of Personality, 60*, 441–476.

Wayne, J. H., Musisca, N., & Fleeson, W. (2004). Considering the role of personality in the work–family experience: Relationships of the big five to work–family conflict and facilitation. *Journal of Vocational Behavior, 64*, 108–130.

Wayne, J. H., Grzywacz, J. G., Carlson, D. S., Kacmar, K. M. (2007). Work-family facilitation: A theoretical explanation and model of primary antecedents and consequences. *Human Resource Management Review, 17*, 63–76.

Willis, T. A., O'Connor, D. B., & Smith, L. (2008). Investigating effort-reward imbalance and work-family conflict in relation to morningness/eveningness and shift work. *Work Stress, 22*, 125–137.