

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

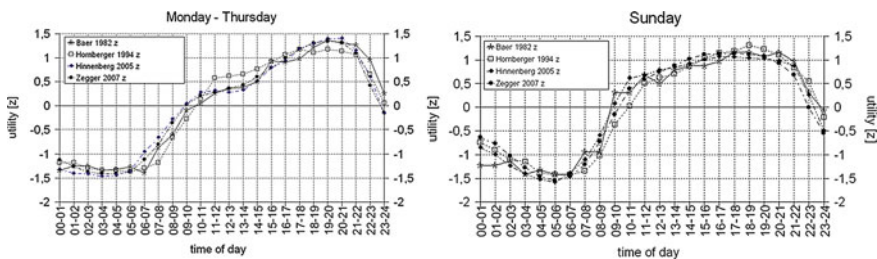


Fig. 1 Utility of free time as a function of the day and the time of the day in four studies from 1982 to 2007

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.

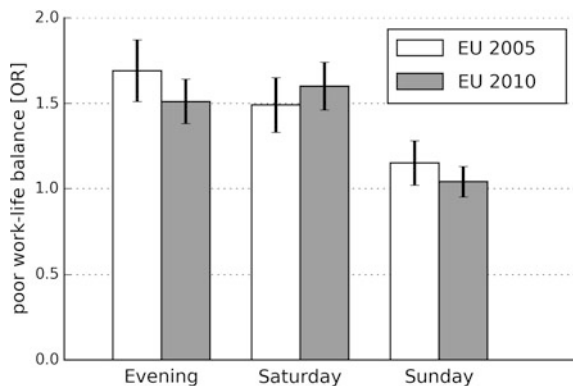
A recent cross-validation study by these authors (Greubel et al. submitted; see also Greubel et al. 2013) used the fourth and fifth European Working Conditions Surveys from 2005 (Parent-Thirion et al. 2007) and 2010 (Parent-Thirion et al. 2012) to investigate the risk of reporting a poor work-life balance 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

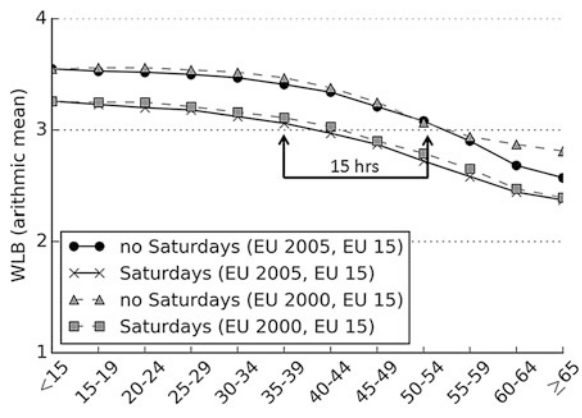
The evidence showing detrimental social effects of work on evenings and weekends is quite consistent and leads to the question of how workers should be adequately prevented from or at least be compensated for working these unusual and unsocial work hours, if they are necessary or unavoidable. Since the 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.

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