Behavior Modification

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Synonyms

Behavior change; Behavioral change

Definition

Behavior modification means the change of a current behavior by adopting a new behavior or by increasing or decreasing the current behavior.

Understanding, predicting, and evoking behavior modification is a key topic in all areas of psychology. It is a crucial means to reaching personal, organizational, and societal goals across the lifespan, including the major goal to stay healthy and well. With chronic disease on the rise, partly due to an increasing aging population, promoting and stabilizing health and well-being is more topical than ever (cf. Scholz et al. 2015). Behavior modification is a major factor to prevent and manage chronic diseases, such as diabetes and cardiovascular diseases (e.g., Ornish et al. 1998), be it, for example, to normalize blood pressure levels by exercising or eating more healthily or by better adherence to medication regimes; behavior modification and long-term maintenance are crucial at any time during the lifespan, even though the goal of behavior modification may differ depending on age. Whereas increasing health and well-being or preventing disease may be more achievable goals for younger persons, stabilization is often the more realistic goal in older age. Irrespective of this, however, behavior modification is usually a prerequisite. The following sections introduce the key principles of behavior modification. An overview is given of the behavioral determinants, the techniques by which behavior modification can be engendered, and how these can be selected for interventions. The entry ends with concluding remarks and directions for future research.

A Social Cognitive Approach to Behavior Modification

Before the cognitive revolution in the second part of the twentieth century, behavior modification was mostly understood as the learning process termed operant conditioning (learning by reinforcement or punishment), which is associated most notably with the works of behaviorist B.F. Skinner. The processes by which behavior modification occurs were considered a "black box," as they were deemed unobservable and could therefore not be empirically studied. The cognitive revolution changed this understanding

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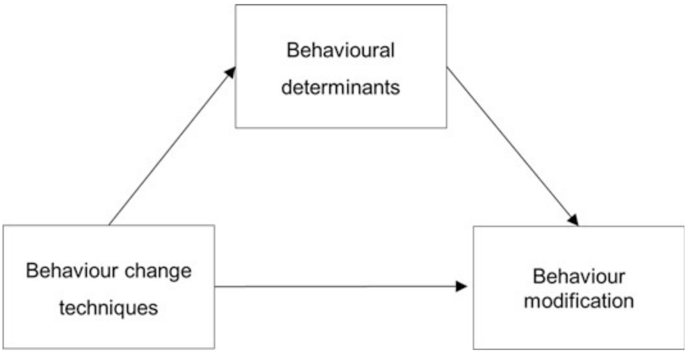

Behavior Modification, Fig. 1 Schematic display of the principles of behavior modification (Adapted from Michie et al. (2008))

and led to the social cognitive approach to behavior modification.

In contrast to the simplistic stimulus–response view of behaviorists, social cognitive theories of behavior modification assume "that social behaviour is best understood as a function of people's perceptions of reality, rather than as a function of an objective description of the stimulus environment" (Conner and Norman 2005, p. 5). To illustrate this, imagine elderly persons who have difficulties to walk. The objective description would predict that these difficulties will impair them from getting enough physical activity. The social cognitive approach, in turn, would assume that whether or not these persons find a way to overcome this barrier and engage in physical activity despite their walking impairments (e.g., by doing yoga exercises at home) depends on the persons' perception of this barrier, for example, on their motivation to exercise and on their belief that they can exercise, even when this is difficult (a behavioral determinant known as self-efficacy, Bandura 1999). Various theories have developed from this social cognitive approach. These theories have identified several behavioral determinants, with the theory of planned behavior (Ajzen 1991) and the health action process approach (Schwarzer 2008) as a classic and a more recent example, respectively.

A further principle of the approach is that the behavioral determinants (or causal processes) are modifiable and that they can be specifically tackled with behavior change techniques (BCTs, Michie et al. 2008). Behavior change techniques are "…an observable, replicable, and irreducible component of an intervention designed to alter or redirect causal processes that regulate behaviour" (Michie et al. 2013, p. 82). There are a great number of BCTs with which researchers and practitioners aim at modifying behavioral determinants and behavior. Recent efforts have been directed at standardizing definitions of BCTs in order to accumulate evidence on their efficacy (Michie et al. 2008, 2013) and to link BCTs to specific behavioral determinants (Abraham 2012). Figure 1 summarizes the elements of theory-based behavior modification.

Determinants of Behavior Modification

There are essentially two types of social cognitive theories that have been proposed to understand and predict behavior modification: continuum theories and stage theories. Continuum theories assume that persons can be characterized on a continuum from action readiness to actual behavior modification (Abraham 2012). Stage theories, on the other hand, assume that the process of behavior change comprises a discrete number of stages an individual has to pass through to modify a behavior from adoption to long-term behavioral maintenance. A representative of each type of behavior theory is presented next.

A classic continuum model is the theory of planned behavior (Ajzen 1991). At the theory's core are behavioral intentions. They reflect "… people's decisions to perform particular actions" (Sheeran 2002, p. 2). The theory of planned behavior predicts that when people form an intention to perform a behavior, they are more likely to carry out this behavior. Behavioral intentions, in turn, are predicted by attitudes toward the behavior (i.e., persons' valuations of the behavior and its consequences and the expected likelihood that these will occur), the subjective norm (i.e., beliefs about others' expectations regarding the behavior and a person's willingness to comply with these), and perceived behavioral control (i.e., beliefs about facilitating and hindering factors and their subjective power to impede behavior performance). The latter is also assumed to have direct effects on behavior (Ajzen 1991). In summary, the theory of planned behavior predicts that persons are most likely to perform or modify a behavior when they are highly motivated (i.e., have strong intentions as determined by their attitudes, subjective norms, and perceived behavioral control) and have high perceived behavioral control. The TPB has been widely researched and proven useful to explain and predict several health behaviors (Conner and Sparks 2005). However, a major criticism is the finding that while intentions are usually well explained by its predictors, behavior is not. This phenomenon is commonly referred to as the intention–behavior gap and indicates that, contrary to many behavior theories' assumptions, people who have stronger intentions than others are only moderately more likely to perform a specific behavior than others (Sheeran 2002). This has led to fruitful research on self-regulatory (or volitional) factors that may explain how intentions translate into actions (Schwarzer 2008) and how to overcome the gap (Sheeran 2002). Timely health behavior models have incorporated these factors to mediate intention–behavior relations. The health action process approach (HAPA, Schwarzer 2008), for example, includes volitional mediators such as action planning, coping planning, and action control (Sniehotta et al. 2005). According to Schwarzer, the HAPA is a hybrid model, meaning that it can be applied as both a continuum model and a stage theory.

Stage theories have traditionally put more emphasis on factors that can translate intentions into actions than continuum theories. As mentioned above, stage theories assume that the behavior change process can be divided into a fixed sequence of qualitatively distinct stages (or phases). At the core of these theories are transitional variables (e.g., the decision to take action) that "move" persons from one stage into the next (e.g., from the pre-action to the action stage, cf. Schwarzer 2008). Each stage transition is predicted by a specific set of stage determinants that are causally related in some theories (e.g., the HAPA, Schwarzer 2008). Stage theories are commonly considered more comprehensive than continuum theories, but also more complex. One of the earlier and possibly the most prominent stage theory is the transtheoretical model of behavior change (Prochaska and DiClemente 1983). In its most frequently used version, the transtheoretical model proposes five stages of change: precontemplation, contemplation, preparation, action, and maintenance. Stage progression is specified by decisional balance (pros and cons of behavior), self-efficacy (confidence and temptation), and ten processes of change: five cognitive (e.g., consciousness raising) and five behavioral (e.g., stimulus control). While the idea of separating the behavior change process into distinct phases may seem appealing, empirical tests of the transtheoretical model and other stage theories have generally yielded mixed evidence for the distinction of stages (e.g., Sutton 2005). Nevertheless, they remain particularly popular among practitioners, perhaps because of their clear-cut directions for intervention development that is a consequence of the stage assumption: if persons in different stages of behavior change are qualitatively distinct, they would require different BCTs to promote their transitions between the stages. This point will be further touched upon in a subsequent section. But, first, an overview of BCTs is given.

Behavior Change Techniques (BCTs)

There are a vast number of techniques that have been proposed and applied to modify behavior, with the abovementioned operant conditioning being one of the first of what is now termed a BCT. A major challenge in behavior modification research is the fact that the same BCTs are often termed differently by behavior change professionals from different fields. Or the same term is used, but different techniques are meant by it. This consequently limits the potential of intervention research to produce evidence on the effectiveness of specific BCTs. In an effort to address this issue, several research groups have recently focused on creating taxonomies of BCTs with standardized definitions. This work is crucial to building a cumulative science of behavior modification. The most widely accepted, systematic, and comprehensive taxonomy that has emerged from these efforts is the BCT taxonomy v1 by Michie and colleagues (2013). In its first version, the taxonomy comprises 93 distinct BCTs that were collected through extensive reviews of the scientific and applied behavior modification literature from various fields, such as clinical psychology, social psychology, and health psychology. The BCTs are grouped into 16 clusters. These include clusters of social–psychological BCTs, e.g., goals and planning, which comprise BCTs such as problem solving and action planning, or the BCT cluster feedback and monitoring. Other clusters contain BCTs to foster social support, making contextual changes of antecedents (e.g., BCTs restructuring the physical environment and adding objects to the environment) or providing reward and threats.

The taxonomy should potentially be applicable to behavior modification in any field of interest, from clinical to health psychology and pro-environmental behavior modification to changing workplace behavior. There are, however, also behavior-specific taxonomies that may be helpful in providing a subset of these BCTs, as not all of the abovementioned techniques are relevant to all behaviors. This can be especially useful when such taxonomies also include information on the effectiveness of the BCTs for modifying a particular behavior.

The BCT taxonomy v1 was a vital first step toward standardization of BCT research and practice. Still, it can be expected that this taxonomy will further develop in the coming years, as it will be refined by researchers in psychology and other fields as well as practitioners. Another topic that also needs to be addressed is the mapping of BCTs onto specific behavioral determinants, i.e., what BCTs can modify which behavioral determinant. This will help selecting specific BCTs to target behavioral determinants that are particularly important to change a specific behavior.

Selecting BCTs

Social cognitive theories and empirical evidence provide guidance which determinants to focus on to achieve behavior modification. BCT taxonomies and empirical research provide an overview of techniques available to modify behaviors. But behavior change researchers and practitioners also need knowledge about the link of BCTs and behavioral determinants, so BCTs can be specifically selected to tackle the intended determinants. Also, when evaluating behavior change interventions, the mechanisms of the intervention can be ascertained by assessing the behavioral determinants assumed to be modified by the administered BCTs and performing mediation analysis. This not only offers a tool to test social cognitive behavioral theories but can also deliver important information as to why an intervention was successful (what were its active ingredients?) or not (did the intervention fail to enhance the behavioral determinants?). For example, in an intervention study on physical exercise in cardiac rehabilitation patients, two intervention groups were compared to a standard-treatment control group (Scholz et al. 2007). The first intervention group received an action planning intervention, that is, participants were asked to plan when, where, and how to implement their physical exercise. The second intervention group received a combined action plus coping planning intervention. The coping planning part comprised asking participants to think about barriers to their physical exercise and to subsequently form detailed plans, when, where, and how they will overcome these barriers. Two months later, the combined planning group was the most successful in increasing their physical exercise levels. This effect was independent of the age of participants. However, a closer look at the behavioral determinants revealed age-differential effects: older individuals reported the highest levels of coping planning already at the baseline assessment compared to young and middle-aged participants. The latter two age groups increased their coping planning after the intervention whereas the older participants reported relative stability of coping planning across the two months. Self-reported action planning in contrast was not changed by the intervention, nor were there age-differential effects over time (Scholz et al. 2007). Thus, not only analyzing the direct effects of BCTs on behavior modification but also examining the effects on the behavioral determinants provides important information on what the active ingredient of an intervention is and whether or not this applies, for example, to people of all ages.

Unfortunately, with few exceptions (Mosler 2012), behavior theories provide little guidance on which BCTs can modify which behavioral determinants, and empirical research on the BCT–behavioral determinant–behavior link is still rare. There are, however, some expert groups that have proposed links (Michie et al. 2008; Abraham 2012) or are currently working on this. Abraham (2012), for example, provided a menu of 40 BCTs linked to behavioral determinants. In any case, much empirical research is needed to test these proposed links.

When planning an intervention, another question is which behavioral determinant to target. On the one hand, this depends on the goal of the endeavor, e.g., testing a particular theory or the more applied goal of evoking greatest possible behavior modification. It also depends on the theory that the intervention is based on. Continuum theories and stage theories have different implications for selecting behavioral determinants for interventions. As discussed above, continuum theories assume that their behavioral determinants increase the likelihood of people's behavior performance. This implies that behavior can be modified by changing any of the behavioral determinants of the theory and that this holds for all individuals, wherefore this approach is sometimes termed "one size fits all." If it is a causal theory, the most distal behavioral determinants should be targeted, as it is assumed that they will work their way through to behavior change by modifying the more proximal behavioral determinants of the theory (Sutton 2008). Alternatively, one could "jump into the causal chain" (Sutton 2008, p. 73) and aim at directly altering proximal determinants. In addition, some approaches, such as intervention mapping (Bartholomew et al. 2011) or the RANAS (Risk, Attitude, Norms, Ability, Self-Regulation) approach (Mosler 2012), suggest procedures to target behavioral determinants that are of particular importance to the target population and context (Mosler 2012; Bartholomew et al. 2011). In the intervention mapping approach, this step is referred to as needs assessment (Bartholomew et al. 2011). It entails a detailed literature review and survey in the target population to carefully adapt the intervention to the context.

A criticism of the one-size-fits-all approach is that individual particularities are not taken into account. Tailored interventions seek to overcome this. They are defined as "...any combination of strategies and information intended to reach one specific person, based on characteristics that are unique to that person, related to the outcome of interest, and derived from an individual assessment" (Kreuter et al. 2000, p. 277). One form of tailoring is stage tailoring. As discussed above, stage theories assume qualitatively distinct behavior change stages. Consequently, different interventions result for persons who are in different stages of change. Following a stage theory approach, the stage of change of each person needs to be assessed beforehand, and everyone receives the intervention that is tailored to their current stage. By stage theories' rationale, interventions matching individuals' present stage of change should allow transition to the next stage, whereas mismatched interventions should have nil or possibly adverse effects. The prerequisite to perform stage-tailored intervention is a staging algorithm that can reliably assess individuals' stage of change prior to the intervention. The transtheoretical model, for example, assumes time-based criteria to determine individuals' stage of change. This has been frequently criticized, because the time criteria seem arbitrary. More recent theories, such as the HAPA, therefore developed psychological staging algorithms that characterize persons regarding their current intentions and behavior.

An advantage of stage-tailored interventions should be that they take into account the characteristics of the target persons and may therefore be potentially more effective than not-tailored interventions. However, evidence on this is mixed, which may be due to the lack of reliable staging algorithms, and the lack of clear definitions of and evidence for the predictors of each stage transition. In particular, it has been criticized that stage-tailored interventions usually only use few behavioral determinants for assessing stages (Abraham 2008). The menu-based approach, in contrast, considers many social cognitive factors, possibly from a compilation of behavioral theories (Abraham 2008). Each individual's characteristics are considered, wherefore this approach may lead to a menu of as many BCTs as behavioral determinants that were considered. A disadvantage of this approach is the increased effort and complexity for developing and implementing the great number of interventions required to meet the needs of all participants.

Conclusions and Outlook

In summary, behavior modification is related to behavioral determinants that can be modified by BCTs. In the health behavior modification field, which is of particular importance to the aging population, theory and research on the behavioral determinant–behavior modification link is much advanced. Despite an ongoing discussion whether behavior modification is best understood as a continual process or as divided into discrete stages, the behavioral determinants of importance are now, in principal, understood. A behavior change theory that elegantly incorporates both the continuum and the stages of change approach, and may therefore have gained popularity fast, is the HAPA model (Schwarzer 2008). It specifies causal pathways to behavior change, similar to the theory of planned behavior, but it extends the latter by volitional factors (action planning and coping planning, phase-specific self-efficacy, and action control) in an effort to overcome the intention–behavior gap. Yet, to plan and implement interventions, the HAPA can also be divided into at least three stages: pre-intention/motivation, pre-action/volition, and action.

In contrast to the behavioral determinant–behavior change link, BCTs and their mechanisms to modify behavior require much further research. Important groundwork has been done by producing standardized definitions of the BCTs (Michie et al. 2013) and by hypothesizing their links to behavioral determinants (Abraham 2012). Now, these definitions require large-scale adoption by researchers and practitioners, and empirical investigations need to test the mechanisms by which their BCTs modify behavior.

Regarding environmental factors, the social cognitive approach makes the argument that their influence on behavior is mediated through individuals' perceptions thereof. However, other fields of research, e.g., environmental psychology, suggest that behavior is best understood as an interaction of person by environment. Following this viewpoint, it could be helpful to consider environmental factors that may hinder or facilitate behavior modification.

Finally, a further line of future behavior change research concerns the mode of delivery of interventions. Whether an intervention is delivered personally (e.g., by a health professional), by mass media (e.g., leaflets or television), and by the Internet or smartphone should make a difference in its efficacy. But little is known on this subject yet. Also, the ideal mode of the delivery could differ for different populations, e.g., for different age groups.

Cross-References

- ▶ Behavioral Analysis
- ▶ Cognitive Behavioural Therapy
- ▶ Cognitive Control and Self-Regulation
- ▶ Decision Making
- ▶ Environmental Influences on Aging and Behavior, Theories of
- ▶ Health Promotion
- ▶ Prospective Memory, New Perspectives for Geropsychological Research
- ▶ Psychological Theories on Health and Aging

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Behavioral Analysis

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Synonyms

Applied behavior analysis; Behavior modification; Behavior therapy; Behavioral health; Classical conditioning; Learning theory; Operant conditioning

Theoretical Foundations of Behavior Analysis

Behavior analysis involves the systematic application of learning theory to explain why behavior is occurring. Within this model *behavior* encompasses everything a person does including observable behavior as well as what the person thinks and feels (Ramnero and Torneke 2008). Learning theory posits that an individual's behavioral repertoire is a product of their genetic and learning histories (Skinner 1938/1991). The significant heterogeneity of psychological functioning within the population of older adults is both predicted and explained by the model's assumption that each human being is unique by virtue of their idiosyncratic genetic and learning histories. The utility of behavior analysis for explaining behavior in late life and prescribing interventions to promote behavioral health is significant as the majority of evidence-based behavioral health interventions share roots in learning theory.

Within learning theory *genetic history* encompasses factors that influence the individual's physiology and is reflected in the individual's current physiological status (e.g., health status, sensory functioning, physical conditioning) as well as in responses that are natural, biologically driven, and not learned (e.g., salivating at the smell of food, blinking at a bright light). Behavior that is the product of an individual's *learning history* encompasses responses that are influenced by environmental experience.

Learning is conceptualized as occurring within two processes: *operant conditioning* and *respondent conditioning*. Behavior analysis assumes that to the extent that behavior, including both developmentally "normal" and dysfunctional behaviors, is learned it can be unlearned (Krasner and Ullman 1965). The assumption of behavioral plasticity is the *raison d' etre* for the systematic application of learning principles to produce behavior change at any point in the life span (Bijou 1961/1995; Baltes and Barton 1977).

Operant conditioning and functional relations. The unit of analysis within operant conditioning is *behavior in context*. Context includes both historical and current physiological, cultural, and social conditions. In order to understand *why* a particular behavior is occurring, a behavior analyst attempts to identify patterns in the conditions and events that surround the behavior, i.e., whether events or stimuli (called *antecedents*) reliably precede and follow (called *consequences*) the occurrence of the behavior. The continuous interaction of antecedent, behavior, and consequence over time is called the *operant contingency* (Skinner 1938/1991). A *contingent* relationship between antecedents and consequences is said to occur if systematic observation of behavior reveals that an antecedent reliably increases the probability that a behavior will be emitted and the occurrence of the behavior increases the probability that a consequence will be delivered. Antecedents are environmental events or stimuli that are reliably present in the setting in which a behavior occurs. Antecedents can be verbal or nonverbal. Verbal antecedents may be either the verbal behavior of another person or the individual's own verbal behavior, for instance, "I know how to do this" or "This isn't safe." When an antecedent gains the property of signaling the availability of reinforcement for certain behaviors, the behaviors are said to be under *stimulus control* in that the presence of the antecedent stimulus increases the probability of the behaviors occurring.

Within the operant model, consequences are defined based on their effect on behavior, i.e., whether the consequence results in an increase or decrease in the probability that the behavior will be emitted in the presence of similar antecedents. If it is determined that the probability of a behavior occurring over time has increased, i.e., its frequency increased, the consequence is labeled a "reinforcer"; if it is observed that the probability of the behavior decreased over time, then the consequence is considered a "punisher." The adjectives "positive" and "negative" distinguish different types of reinforcers: if a behavior results in *access* to a stimulus (e.g., smiling is reliably followed by a hug from a friend), the reinforcer is considered "positive." If behavior is followed by a reduction in the quantity of a consequence (e.g., the intensity of painful emotion declines immediately following suicidal ideation;

physical pain is reduced following the ingestion of an analgesic), the consequence is considered a "negative" reinforcer. Reinforcement *contingencies* are identified based on their *effect on the quantity of behavior*, i.e., whether behavior frequency increases, is stable, or decreases over time.

The identification of the reinforcement contingencies controlling a behavior is a central goal of behavior analysis and directly informs the identification of interventions that would be effective for increasing or decreasing the behavior. Points of intervention to *break the contingency* may include: (1) altering the antecedent stimuli to prevent or increase the probability of the occurrence of behavior (e.g., removing electronic devices and reading material from a bedroom to promote sleep, placing medicine containers by the coffee pot to increase the probability medication will be taken in the morning as prescribed, camouflaging a door to prevent a person with dementia from trying to exit) or (2) discontinuing the reinforcement of a behavior (known as *extinction*) (e.g., discontinuing negative reinforcement of escape from emotionally painful private events through in vivo exposure, instructing family members to stop attending to maladaptive "sick" role behaviors), delivering a reinforcer contingent on behavior that is incompatible with a dysfunctional behavior, or both (Ramnero and Torneke 2008; Skinner 1938/1991). Examples of differential reinforcement of behavior include praising a client's problem solving when emotionally distressed rather than his engaging in escape of avoidance behavior or praising a caregiver of a person with dementia for engaging in empathic verbal responses rather than corrective feedback with their family member.

Within the behavior-analytic model, it is assumed that a behavior may serve more than one function or purpose. For example, complaining about poor health or pain may result in an individual escaping from household tasks (i.e., the behavior is negatively reinforced in that it results in the removal of aversive stimuli) and also being consistently followed by hugs and comforting statements by family members (i.e., the behavior is positively reinforced in that it is consistently followed by social attention). It is important to determine if a behavior serves more than one function in order to design an intervention that will effectively address all functions of the problem behavior.

The function of a behavior is determined through a variety of assessment methods:

(a) *Experimental functional analysis* during which hypothesized controlling variables, specifically the antecedents and consequences, are directly manipulated while the behavior analyst carefully monitors whether there are changes in frequency of the behavior (Skinner 1938/1991; Bijou 1961/1995). Experimental functional analysis is the most direct and accurate method of identifying the function of a behavior.

(b) *Descriptive analysis* or assessment involves less direct, but often more practical methods for generating but not directly testing hypotheses about the function of a behavior. Descriptive assessment can involve a variety of methods, such as direct observation, self-report methods involving interviews, or paper and pencil questionnaires. Descriptive analysis can also include a variety of sources of information from clients or collateral sources, for instance, a client monitoring and recording the environmental and private events that precede and follow the problem behavior, having the client or an informant (e.g., a caregiver) complete a paper and pencil questionnaire designed to assess the contextual variables reliably associated with the behavior, or having an informant directly observe and record the problem behavior and events or stimuli that precede and follow the behavior (Haynes and O'Brien 2000).

Classical Conditioning

Classical or respondent conditioning involves learning by association. Classical conditioning has been applied to explain the development of many physiological and emotional responses including conditioned fear, sexual arousal, trauma-related anxiety, and responses associated with substance abuse. For example, an individual who has experienced a traumatic event may later experience anxiety when they have contact with environmental stimuli, such as the smells, images, or sounds similar to those present during the initial traumatic event.

Classical conditioning provides the theoretical foundation for several evidence-based therapies such as exposure therapy for anxiety. Classical conditioning was first described by the Russian physiologist Ivan Pavlov (1849–1936). In studying the salivary and gastric secretions of dogs, Pavlov would place a bowl of meat powder in front of a dog and measure the amount of secretions naturally produced. During his studies Pavlov observed that over time the dogs would start salivating when he entered the room, regardless of whether meat powder was presented. Pavlov's serendipitous, yet astute, observation of this phenomenon led to a series of experiments in which he systematically manipulated the presentation of a neutral stimulus, the sound of a bell or tuning fork, prior to presenting meat powder in order to better understand this learning by association. Pavlov observed that by repeatedly pairing the sound, a neutral stimulus, with the presentation of the meat powder, an unconditioned stimulus because it naturally elicited a response, the dogs would start to salivate at the sound of the neutral stimulus, demonstrating that the neutral stimulus had obtained functional properties similar to the food. The bell had become a *conditioned stimulus* (CS) in that it elicited a learned reaction or *conditioned response* similar to the natural reaction or *unconditioned response* of salivating to the food (an *unconditioned stimulus*).

Behavior analysis of functioning in late life. Behavior-analytic strategies have been applied to promote the health and quality of life of older adults in a variety of ways. Treatment goals have ranged from increasing health-related behaviors such as exercise, sleep, nutrition, and medication adherence to decreasing behaviors that restrict or prevent access to positive and valued outcomes, (for instance, social withdrawal and isolation, substance abuse, and suicidal behaviors). Examples of behavior-analytic conceptualizations of health-interfering and health-promoting behaviors are described below.

Depression. The behavior-analytic model of depression considers the interaction of the person's repertoire within its historical and current environmental context. The model posits that the risk of depression increases when individuals experience low rates of positive reinforcement, high rates of aversive events (punishment), or both in their lives (Ferster 1973). Further, the model assumes that an individual's repertoire, which may include high-frequency negative self-statements, low frequency of eye contact or smiling during interactions, or evidence of a low frequency of instrumental problem-solving skills, may further limit their access to positive reinforcement in day-to-day life or increase the probability of experiencing aversive consequences (Ferster 1973; Lewinsohn and Graf 1973). In addition, behaviors commonly exhibited by persons who meet diagnostic criteria for depression, such as excessive sleeping, social withdrawal and isolation, and alcohol consumption, may be negatively reinforced by escape from or avoidance of potentially aversive consequences such as feeling anxious, ashamed, lonely, or rejected (Martell et al. 2001). The low rates of behavior commonly observed when an individual behaves in a manner typically described as "depressed," in turn, further limit opportunities for the person to contact pleasant experiences that would elevate his mood. More stable behaviors in the person's repertoire, such as social skill deficits involving low rates of eye contact or smiling and high rates of vocalizing negative and pessimistic statements during social interactions, may increase the likelihood of contact with aversive consequences, which could include negative affect and withdrawal by others. In addition, these social skill deficits could further limit opportunities for contacting pleasant experiences and hence increase the likelihood of continued depressed mood. Behavioral approaches to the treatment of depression typically target both the depressogenic repertoire and contextual factors.

In regard to age-associated considerations, sensory changes, medical conditions that result in chronic pain or fatigue, and medication side effects may reduce or altogether preclude pleasure during activities that had been historically preferred. Further, a large proportion of elderly persons judged to be depressed are prescribed antidepressant medication although over 50% of older adults who meet criteria for major depressive disorder do not respond to first-line treatment with antidepressant medication (Joel et al. 2014). In many cases, pharmacological intervention for depression may be contraindicated as polypharmacy increases the risk of adverse medication effects (American Geriatrics Society 2015). In contrast, evidence-based non-pharmacological treatments for depression including behavioral activation (BA) (Martell et al. 2001) and cognitive behavior therapy (CBT) have been found to be highly effective for the treatment of depression in older adults (Gallagher-Thompson et al. 1990; Ayers et al. 2007) and have no side effects.

BA is designed to improve mood by targeting the individual's inactivity, avoidance, and withdrawal behaviors. Specifically, the BA treatment process involves three main steps: *activity monitoring* (monitoring the actions that preclude and follow depressive behaviors), *activity scheduling* (replacing prior maladaptive behaviors with positive, productive behaviors that increase contact with pleasant consequences), and *modifying activities based on client feedback* (continually adjusting the treatment plan until the desired outcome is reached) (Martell et al. 2001). During treatment it is important to consider how an individual's skill repertoire, sensory functioning, and health may influence their experience of activities, for example, individuals with sensory deficits may prefer activities that involve fewer sensory challenges. It is also important to consider an individual's socialization history when identifying potentially gratifying experiences. For example, an individual with a history of enjoying solitary activity may find physical activities more rewarding than those involving social interaction. Further, while it is commonly suggested that depressed clients increase social contact by attending community or other organized events, socializing with strangers may be less preferred by older adults who have a history of experiencing the emotion regulation benefits of intimate interactions with close friends and family (Carstensen 1992).

Suicide

Globally, the elderly are at higher risk of suicide than any other age group, with elderly men accounting for the largest proportion of suicides. Older adults tend to use lethal means and are less likely to report suicidal ideation prior to attempting suicide (World Health Organization 2014). Further, the current cohort of older adults is more likely to report somatic symptoms rather than emotional distress when experiencing depressed mood or anxiety (Hinton et al. 2006). A behavior-analytic conceptualization of suicidality considers suicidal thoughts and actions to be learned behaviors that function to allow the individual to avoid or escape overwhelmingly distressing and aversive feelings (Chiles and Strosahl 2005; Linehan 1993). Experiencing physical or emotional pain is a normative event at some point in the course of a long life but the ways in which individuals cope with physical pain and distressing emotions vary significantly. For individuals with a limited repertoire for coping with painful private events and weak social attachments, suicidal thoughts and actions may provide an immediate escape from or avoidance of physical pain and distressing feelings of loss, loneliness, or emptiness.

A behavior-analytic conceptualization of suicidality focuses on the context of suicidal behaviors, both private thoughts and emotions and overt actions, including the circumstances that tend to precede the occurrence of the behaviors and the consequences that reliably follow the suicidal behavior. To illustrate, suicidal ideation would be conceptualized as being negatively reinforced if it produces the consequence of temporarily alleviating painful emotion *and* the frequency of suicidal ideation following painful emotions has increased or is maintained over time. Alternatively, suicidal behavior would be conceptualized as being positively reinforced if it is consistently followed by a consequence such as access to social attention and comfort from friends and family and the frequency of the behavior increases over time.

Dialectical behavior therapy (DBT), developed by Marsha Linehan (1993) as a treatment for chronically suicidal individuals, focuses on replacing harmful behavior patterns (including thought patterns) with skillful alternatives. A behavior-analytic interpretation of the therapeutic process within DBT considers the contingency between suicidality, private events (e.g., distressing thoughts of abandonment), and environmental events (e.g., attention from or rejection by others). This contingency is broken by building a repertoire of behaviors (e.g., emotion regulation skills, distress tolerance skills, interpersonal skills) that are incompatible with suicidality. Although the primary population Linehan studied when developing DBT was young and female, the behavioral principles underlying the treatment are applicable throughout the life span. DBT has been found to be effective with older adults (Lynch et al. 2006).

Neurocognitive Disorders

Neurocognitive disorders such as Alzheimer's disease and vascular dementia are among the most debilitating conditions affecting older adults. Behavior analysis has been applied to both support the maintenance of adaptive behaviors (e.g., activities of daily living, speech, etc.) and prevent, decrease, or reverse *excess* disability and promote the behavioral health of elderly persons with neurocognitive disorders (Buchanan et al. 2011; Fisher et al. 2007). Within this population, excess disability is said to occur when a person is more disabled than expected based on the underlying neurodegeneration (Fisher et al. 2007). Within the behavior-analytic model, excess disability in persons with neurocognitive disorders is evident in the premature decline of functional behaviors that will eventually be lost due to neurodegeneration. Designing environments that support functional behaviors is a fundamental goal of behavior-analytic approaches to enhancing the health and quality of life of persons with neurocognitive disorders (Buchanan et al. 2011; Fisher et al. 2007; Hussian 1981).

The behavior-analytic or "contextual" model of neurocognitive disorders assumes that a person who is experiencing progressive cognitive decline will develop strategies to compensate for the impairment (Hussian 1981) and that the context in which they are experiencing the neurological changes can have a profound effect on their and their family members' behavioral health and quality of life (Schulz and Sherwood 2008). In this regard, the contextual model treats the interactions between affected persons and their family as essential to well-being.

An important implication of the age-associated risk of neurocognitive disorders is that they affect the functioning of individuals with decades-long genetic and learning histories and hence highly complex verbal, emotional, and interpersonal repertoires. Given the current lack of treatments for these disorders, behavior-analytic approaches to the support of persons with neurocognitive disorders tend to focus on three primary goals: (1) preserving functional repertoires, (2) preventing excess disability, and (3) preventing behaviors that lead to negative outcomes for persons and their families (commonly referred to as "noncognitive neuropsychiatric symptoms," "behavioral disturbances," or "challenging behaviors"). The behavior of family and professional caregivers is considered to be a critical feature of the context in which persons with neurocognitive experience changes and therefore the responding of caregivers is commonly targeted within behavior-analytic support services. *Support of caregivers* tends to focus on (1) increasing caregivers' knowledge of neurocognitive disorders and the effects of neurological changes on behavior in order to promote perspective taking rather than pathologizing behavior, make the behavior of care recipients predictable, and reduce the likelihood that caregivers will respond to the care recipient with negative consequences, such as negative affect and corrective feedback that may inadvertently or intentionally punish behaviors within the already vulnerable repertoire of the care recipient; (2) promoting the ability of caregivers to cope with the emotional and instrumental challenges that commonly emerge when caring for someone with a neurocognitive disorder; and (3) assisting families in preserving the meaningful and rewarding qualities of their relationship with their family member (Fisher et al. 2007; Nichols et al. 2011).

Persons with dementia experience an array of neurological changes that impact their ability to perform activities of daily life such as personal care and more complex tasks such as managing finances and medications and driving. The behavior changes that accompany neurocognitive disorders are often experienced as confusing, “out of character,” or “intentional” and aversive by family members. In addition, declines in verbal abilities increasingly lead to communication problems within relationships that involve behaviors that have been under powerful stimulus control, for example, responses that have reliably followed an antecedent stimulus – such as a family member’s request or effort to initiate a conversation by inquiring about how the family member is doing – and were reliably reinforced for decades. The confluence of communication deficits and perceived intentional and unpredictable behavior changes (i.e., reflecting the breakdown in the stimulus control of behavior) that occur during the course of neurodegenerative diseases typically lead to high rates of conflict between affected persons and their family members (Fisher et al. 2007). From a behavior-analytic perspective, intrafamilial conflicts may be due, in part, to the discontinuation of reinforcement contingencies (i.e., “extinction”) which is typically experienced as emotionally painful by family members.

Within the behavior-analytic or contextual model, the behavior changes that accompany neuropathology represent a natural response to increasingly overwhelming environmental demands (Hussian 1981). Declines in verbal abilities, including the ability to verbally label and respond to private events (e.g., pain, discomfort, fear, boredom, etc.), are a leading risk factor for excess disability in persons with neurocognitive disorders. This is due to the fact that the lack of ability to label, report, and respond to private events such as pain or discomfort increases the likelihood of the emergence of behavior changes that are misattributed to neurodegeneration. The default attribution of behavior change to neuropathology is a leading threat to the behavior health and quality of life of persons with neurocognitive disorders. Knowledge of the distinction between normal or expected behavior change or decline versus unusual behavior changes and careful examination of the context in which behavior changes occurred are critical for understanding the behavioral health of an individual who has a neurocognitive disorder and detecting adverse medical or environmental events. Because neurodegenerative disorders inevitably produce significant declines in behavioral repertoires, there is a risk that all observed behavior changes will be attributed to neurodegeneration, including behaviors that are a response to acute, treatable conditions such as pain, infection, or medication side effects. Through education and guided practice, family and professional caregivers can learn to understand and better predict the behavior of persons with neurocognitive disorders and hence respond in a more empathic and supportive manner (Nichols et al. 2011).

Given the current lack of a cure or effective treatment for neurocognitive disorders, geriatric healthcare advocacy groups have identified the development of support services that promote the quality of life of affected persons and their families as a priority (Odenheimer et al. 2014). The variable nature of the symptom presentation and trajectory of these disorders can limit the utility of traditional medical population-based approaches to disease management. In contrast, the idiographic nature of behavior analysis can readily accommodate the heterogeneous symptom presentation and the influence of idiosyncratic personal histories and contextual factors on the functioning of persons with neurocognitive disorders. An increasing body of literature demonstrates that behavior-analytic strategies are effective for both preventing and reducing excess disability and what are commonly described as noncognitive psychiatric symptoms, including resistance to care, wandering, and disruptive vocalizations exhibited by persons with dementia (Fisher et al. 2007; Hussian 1981).

Behavior Analysis of Health-Related Behaviors

Chronic illness and disability disproportionately affect older adults relative to other age groups. Numerous studies have documented the effectiveness of behavior-analytic strategies for promoting behavioral health and adaptive functioning in order to prevent or delay the onset of morbidity in healthy adults and prevent excess disability in persons with chronic illnesses. Domains targeted have included lifestyle factors that are known risk factors for chronic illnesses including exercise, diet, and smoking (LeBlanc et al. 2011; Roane et al. 2015). The following discussion focuses on how the principles of behavior analysis have been applied to foster health-promoting behaviors.

Behavior analysis of health-related behaviors considers the complex interaction of an individual's repertoire and contextual variables (antecedent and consequent stimuli) that promote or interfere with the occurrence of desired behavior(s). Analysis of the temporal relationship between a behavior (e.g., eating calorie-dense food or sedentary watching of television) and its consequence(s) (e.g., immediate access to pleasurable sensation or escape from physical discomfort vs. delay of benefits) is particularly important for understanding the probability of the occurrence of health-promoting versus health-interfering behaviors. The more powerful effect of immediate reinforcement relative to delayed consequences can be a significant barrier to behavior change. Further, many health-interfering behaviors are maintained by *primary* reinforcers (i.e., stimuli that do not require conditioning to function as a reinforcer such as food or the reduction of pain or discomfort) while health-promoting behaviors are often maintained by delayed consequences and/or *secondary* (i.e., conditioned) reinforcers such as praise, a number appearing on a scale, or fitting into smaller-size clothing. The inherent delay in the consequences of many health-promoting behaviors can limit the effectiveness of setting long-term and abstract verbal goals such as "losing weight" or "getting in shape." Behavior-analytic strategies of health promotion tend to address the differential effects of immediate versus delayed reinforcement by incorporating goal setting that focuses on increasing specific, concrete behaviors that are achievable in a short amount of time (Roane et al. 2015; King 2001). Consideration of age-associated barriers that may interfere with goal attainment is also important. Potential barriers may include chronic pain conditions, access to transportation and resources such as affordable nutritious food and fitness facilities and equipment, and reduced mobility or endurance.

Self-monitoring of specific behaviors is incorporated within many behavior-analytic health promotion programs as it allows the individual to assess the occurrence of desired behaviors, competing health-interfering behaviors, and progress toward goals in real time. Self-monitoring also enables individuals to identify barriers that require manipulation by providing detailed information about antecedents in instances when the individual deviated from their goals or lapsed. Social support in the form of praise for health behavior adherence has also been found to be effective in promoting health-promoting behaviors in older adults as it can function as an immediate, secondary reinforcement of behaviors that compete with maladaptive behaviors that have been historically maintained by powerful primary reinforcers including food or escape from discomfort by stopping exercise (Roane et al. 2015; King 2001; Penedo and Dahn 2005; Killgore et al. 2013).

Stimulus control or antecedent-based strategies involve arranging the individual's environment in order to increase the probability that a health-promoting behavior will occur while reduce the probability of the occurrence of health-interfering behaviors. Strategies include removing antecedents for undesired behavior while increasing the salience of antecedents associated with the health-promoting behavior. For example, in promoting physical activity, an antecedent-based intervention might involve placing exercise shoes by the front door, laying out exercise clothes on the bed, or installing a stand-up desk in an office. The promotion of nutritious eating might involve removing unhealthy foods from the home and following a structured meal plan with restricted choices. In the case of smoking cessation, an antecedent-based strategy might be avoiding settings or behaviors associated with smoking, for example, bars or having cigarettes in the home, and involves replacing smoking behavior with an alternative, incompatible adaptive behavior, such as chewing gum or holding a cigarette-shaped object (LeBlanc et al. 2011; Roane et al. 2015).

Behavior-analytic relapse prevention training involves normalizing deviation from goals when attempting behavior change, for instance, missing a scheduled walk or consuming calorie-dense food, and orienting the client to the identification of antecedents or triggers for lapses as well as behavioral skill training like problem solving or relaxation exercises to promote adaptive responding if relapses occur (LeBlanc et al. 2011; Roane et al. 2015; King 2001; Penedo and Dahn 2005; Killgore et al. 2013). For example, an individual who is striving to adhere to a nutritious diet might be instructed to consume high-volume but low-calorie foods prior to social gatherings in order to prevent hunger and reduce the reinforcement value of high-calorie foods.

Sedentary lifestyle, poor diet, medication non-adherence, and smoking are well-established risk factors for an array of preventable, chronic illnesses prevalent within the elderly population including cardiovascular disease, stroke, osteoporosis, many cancers, and type 2 diabetes. Relatedly, there is also vast evidence that even small changes in lifestyle factors such as increasing physical activity can decrease the morbidity and mortality due to cardiovascular disease (King 2001; Penedo and Dahn 2005; Killgore et al. 2013; Chapman et al. 2013). In addition, recent research indicates physical activity can buffer age-related cognitive decline. That is, older adults who are physically active are less likely to demonstrate cognitive decline relative to their more sedentary counterparts (Chapman et al. 2013). Thus, the promotion of adaptive functioning in older adults via behavior-analytic strategies has the potential to contribute to both improved quality of life and the prevention of chronic disease and disability.

Cross-References

- ▶ Alzheimer's Disease, Advances in Clinical Diagnosis and Treatment
- ▶ Anxiety and Cognition
- ▶ Anxiety Disorders in Later Life
- ▶ Behavioral and Psychological Symptoms of Dementia
- ▶ Dementia and Neurocognitive Disorders
- ▶ Depression and Cognition
- ▶ Depression in Later Life
- ▶ Lifestyle Factors on Depression, Effects of
- ▶ Suicide in Late Life
- ▶ Vascular and Mixed Dementia

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Behavioral and Psychological Symptoms of Dementia

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Definition

The term "Behavioral and Psychological Symptoms of Dementia" (BPSD) was coined in 1999, being defined as "symptoms of disturbed perception, thought content, mood or behaviour that frequently occur in patients with dementia" (Draper et al. 2012a). BPSD is not a unitary concept but rather an umbrella term that encompasses a number of symptom groups or syndromes; currently, there is limited agreement about syndrome composition, although "agitation," "moods." and "psychosis" feature prominently. It is likely that BPSD syndromes have a different prevalence, etiological factors (biological, psychosocial, environmental), prognosis, and hence management implications.

Introduction

In the historical descriptions of dementia by Esquirol in 1838 and by Alzheimer in 1907, behavioral and psychological symptoms were recognized as features of the dementia syndrome (Draper et al. 2012a). For example, Alzheimer's description of his patient Auguste Deter included symptoms of paranoia, delusions, vocal disruption, and hallucinations in addition to cognitive impairment. Despite this, for many years the focus of clinical dementia research was on the cognitive features, and it was only in the 1980s that an increase in research into the noncognitive symptoms occurred (Draper et al. 2012a).

One of the difficulties in establishing BPSD syndromes has been the term "agitation," which has been used in a variety of ways by clinicians and researchers. An Agitation Definition Working Group recently used a survey and consensus process to form an agitation definition for dementia and cognitive impairment that has four components: the behavior is consistent with emotional distress; there is excessive motor activity, verbal or physical aggression; the behaviors cause excess disability; and the behaviors are not solely attributable to another disorder (Cummings et al. 2015).

Another difficulty in establishing BPSD syndromes has been the lack of consensus about measurement. Numerous rating scales have been developed to measure BPSD, and there is no single gold standard, with one recent overview article listing 35 scales (Ford 2014). Some of the more commonly used scales are the Neuropsychiatric Inventory (NPI), the Cohen-Mansfield Agitation Inventory (CMAI), and the Behavioral Pathology in Alzheimer's disease rating scale (BEHAVE-AD). Each relies on the observations of a person who has been in close contact with the person with dementia over the previous 2–4 weeks (depending on the scale used). The NPI and BEHAVE-AD have a neuropsychiatric focus with symptoms being rated in clusters such as delusions, hallucinations, mood disturbance, and sleep disturbance, while the CMAI is more descriptive of individual behaviors such as biting, scratching, screaming, and pacing. Hence, the choice of rating scale might depend on the purpose. There is also a scale that focuses specifically on depression, the Cornell Scale for Depression in Dementia (CSDD).

BPSD occur in almost all people with dementia, with the community-based Cache County Study reporting a 97% 5-year prevalence of any type of BPSD as measured by the NPI. Many types of BPSD tend to persist, with 18-month follow-ups in the Cache County Study reporting that delusions persisted in 66% of individuals, depression in 58%, and aberrant motor behavior in 56%. However, it is noteworthy that population-based studies of BPSD have shown variability of types of BPSD in different countries; for example, apathy is less prevalent in China and Nigeria than in Japan, the United States, Spain, and the UK (Wang et al. 2012). BPSD are particularly common in nursing homes with the point prevalence ranging from 69% to 92% in studies from Australia, Norway, the Netherlands, and the United States (Draper et al. 2012a).

There has been a paucity of research that has explored the relative prevalence of BPSD in different types of dementia (Ford 2014). However, high rates of hallucinations and disinhibition have been reported in Lewy body dementia, consistent with visual hallucinations being one of the core diagnostic criteria for the disorder. Similarly, early behavioral disinhibition is a diagnostic criterion for frontotemporal dementia, which is distinguished from other types of dementia in most studies by the presence of disinhibition, apathy, and aberrant motor behavior. Comparisons of vascular dementia and Alzheimer's disease have had inconsistent findings, with some studies reporting few differences and others showing higher rates of apathy, depression, and emotional lability in vascular dementia and higher rates of psychosis (most commonly delusions) in Alzheimer's disease. Depression is more strongly associated with Parkinson's dementia than Alzheimer's disease.

Etiology of BPSD

Research into the etiology of BPSD is in its infancy and has mainly focused on Alzheimer's disease. There is a growing body of research, but much of it is unreplicated. Current models suggest an interaction of a broad range of factors including neurobiological substrates (such as genetic polymorphisms, neurotransmitter changes, neuropathology, medical comorbidity), premorbid personality, psychological reactions, and social aspects including caregiver and environmental issues (Draper et al. 2012b).

There are three main explanatory models of how caregiver interactions might contribute to BPSD. The "stress threshold" model is based on the observation that people with dementia have a lower threshold to coping with stress, with behavioral disturbances occurring when this threshold is exceeded. The "learning theory model" emphasizes the importance of inadvertent reinforcement of inappropriate behaviors; for example, caregivers might only respond to a noisy person when they are calling out and not when they are quiet. The "unmet needs model" recognizes that people with more severe dementia cannot always communicate their needs, such as social interaction, pain relief, hunger, or physical activity; hence, caregivers have the challenge of working out what unmet needs the behavior might represent. The models are not mutually exclusive; it is likely that elements of each might operate simultaneously with the individual circumstances of the person with dementia perhaps indicating which factors might be more relevant in their situation (Draper et al. 2012b).

It is likely that the relative contribution of each of these etiological factors varies according to the specific behavior and type of dementia. Here, we cover some of the more prominent types of BPSD and outline the key etiological factors that have been identified for each.

Psychosis (Delusions and Hallucinations)

In general, psychosis is mainly associated with neurobiological substrates. This includes medical comorbidity, such as infection, hypoxia, or drug toxicity, which may result in delirium with associated acute psychosis, particularly visual hallucinations and paranoid ideation, which develops over a few days. There are often features of agitation present. From a clinical perspective, this is a critically important diagnosis to make due to the high morbidity and mortality associated with delirium.

Psychosis otherwise has a more gradual onset and is more common in females, declining cognition and increasing severity of neuropathology in Alzheimer's disease. There is preferential involvement of the frontal lobe and/or limbic regions, although visual hallucinations tend to involve the occipital lobes (Draper et al. 2012b). On functional imaging, psychosis is associated with hypoperfusion in frontal and temporal lobes. Some delusions may be explained by memory deficits (e.g., misplacing items and interpreting this as theft) and misidentification of people and place. Although inappropriate caregiver strategies are also reported to be associated with delusions, it is unclear whether these are etiological or reactive to the psychosis.

There is an increased familial risk of psychosis in Alzheimer's disease as suggested in a study involving the combination of samples from the United States and the UK that found a significant association between proband psychosis status and the occurrence of psychosis in Alzheimer's disease in siblings with linkage peaks occurring on chromosomes 7 and 15. A meta-analysis of serotonergic system genes concluded that the HTR2A T102C polymorphism is a significant risk factor for psychosis in Alzheimer's disease. These receptors may also modulate antipsychotic response. Polymorphisms in dopamine receptors have also been associated with psychosis in most studies, particularly D3 genes, where two studies found homozygous (i.e., having identical pairs of genes) carriers of the 1 allele to be at increased risk (Draper et al. 2012b).

In Lewy body dementia, in contrast to Alzheimer's disease, visual hallucinations, but not delusions, are associated with less tangle burden but more cortical Lewy body pathology and may be related to cholinergic deficits in the temporal cortex. Further, visual hallucinations are associated with hypometabolism in visual association areas rather than the primary visual cortex. However, delusions in Lewy body dementia have a similar substrate to psychosis in Alzheimer's disease.

Aggression and Agitation

Aggression and agitation are often associated with other frontal symptoms such as disinhibition and may be a reflection of executive dysfunction. Aggression is more common in males and vocally disruptive agitated behavior more common in females. The etiology may be complex, multifactorial, and include medical comorbidities, history of head injury, alcohol and substance misuse, neurobiological substrates of dementia, and social, psychological, or environmental factors. Premorbid personality may also interact with these factors. Verbal and physical aggression may be secondary to pain, physical discomforts (e.g., constipation, thirst, overheating), depression, and other health issues. These behaviors are often best interpreted as a form of communication of distress. Consequently, patients with agitation and aggression have diverse reactions to caregiver intrusion into their personal space, with some improving and others worsening depending on the type of interaction, indicating a need for training of caregivers and tailored interventions.

Neurobiological substrates of aggression and agitation in Alzheimer's disease are multiple and complex. Genetic factors include polymorphic variations in serotonergic and dopaminergic genes. Dopaminergic, cholinergic, serotonergic, and noradrenergic neurotransmitter changes have been reported in the brain. For example, in Alzheimer's disease, aggression is linked with choline acyltransferase (ChAT) activity in the frontal and temporal cortices, with reduced ratios of ChAT activity to dopamine D1 receptor binding and dopamine concentration in the temporal cortex. Consistent with this is the finding that on functional neuroimaging, aggression is associated with hypoperfusion of the temporal cortex. Further, dopamine-blocking agents improve aggressive behavior in dementia. Aggression in Alzheimer's disease is also associated with an increased postsynaptic sensitivity to noradrenaline with a lower concentration of noradrenaline producing an amplified effect. Locus coeruleus neuronal loss, upregulated expression levels of tyrosine hydroxylase mRNA, and an increase in noradrenaline synthetic capacity in residual cells may account for the increased postsynaptic sensitivity to noradrenaline. The dopaminergic system has also been implicated in aggression and agitation in frontotemporal dementia, a type of dementia that has frontal and temporal lobe neurodegeneration, with increased activity and altered serotonergic modulation of dopamine neurotransmission (Ford 2014; Draper et al. 2012b).

Depression

Depression tends to occur earlier in the course of dementia, and for many, it can be the presenting problem. In some individuals, this represents a psychological reaction to self-awareness of early cognitive decline, while in others it appears to be associated with neurobiological changes associated with the evolving dementia, with frontal symptoms such as apathy being associated with more severe depression. Depression is more common in young-onset dementia with some evidence of an increased risk of suicide in the 3 months post diagnosis. A history of depression is also a risk factor for dementia, and so in many there is likely to be a predisposition to further depressive episodes and, as in cognitively intact people, those with dementia may become depressed in the context of stressful life events such as the death of a partner, admission into institutional care, pain, and other physical discomforts. Frustration from impaired communication skills, particularly in those with aphasia disproportionate to impairment in other cognitive domains, can also precipitate depression.

Neurobiological substrates to depression include abnormalities in the serotonergic neurotransmitter system including polymorphisms of serotonergic genes, reduced noradrenaline levels, and polymorphisms in dopaminergic genes. Neuroimaging studies show hypoperfusion (i.e., decreased cerebral blood flow) in frontal, temporal, and parietal lobes to be associated with depression in Alzheimer's disease (Ford 2014; Draper et al. 2012b).

Apathy

In the absence of depression, apathy is generally a reflection of neurobiological changes. Apathy is associated with frontal-subcortical dysfunction irrespective of the type of dementia. In Alzheimer's disease, neuroimaging studies show hypoperfusion in frontosubcortical structures, especially the anterior cingulate, while in frontotemporal dementia there is disruption of cortical-basal ganglia circuits. Neurotransmitter changes in Alzheimer's disease include cholinergic deficiency and a blunted dopaminergic brain reward system (Ford 2014; Draper et al. 2012b).

Clinical Features of BPSD

The hallmarks of dementia are deterioration in aspects of cognition and social and physical functioning. The term BPSD is not a diagnosis in itself but refers broadly to various clinical presentations seen in people with dementia. BPSD is an important development in a person with dementia as it is associated with longer hospital admissions and more complications, more disability, greater likelihood of placement in a residential aged care home, more rapid rate of decline, greater financial costs, reduced quality of life, greater mortality, and significant stress for carers and staff in residential facilities (Draper et al. 2012a). From a clinical perspective, BPSD can be subdivided into behavioral and psychological symptoms.

Behavioral Symptoms

Aggression and Agitation (Verbal or Physical)

Agitation is common in people with dementia, and the prevalence increases with the progression of cognitive impairment. Agitated behaviors may be divided into four subtypes, aggressive, nonaggressive, verbal, or physical. Aggressive behaviors include swearing, screaming, scratching, pushing, grabbing, hitting, kicking, and biting. Nonaggressive behaviors include calling out/repeated requests for attention, being verbally demanding, complaining, excessive/unrealistic anxiety, repetitive questions, phrases, concerns, or sounds, pacing and wandering, rummaging, restlessness or purposeless activity, repetitive movements or mannerisms, hiding things, and inappropriate dressing or disrobing. People with poor social relationships are more likely to be aggressive. Unsurprisingly, aggression and agitation are associated with admission to residential care.

Disorders of Sexual Expression

Sexual disinhibition may be verbal or physical and directed at self or others. These behaviors may be particularly confronting for caregivers and pose logistical problems in residential care. Sexually inappropriate behaviors may range from requests for unnecessary assistance in changing/bathing and genital care to suggestive gestures, disrobing, exposing, or masturbating in public, sexually explicit language, remarks or recounts of sexual experiences, and unwanted physical contact (e.g., kissing, inappropriate touching/fondling/grabbing, sexual advances, and attempts to have intercourse without consent).

These behaviors may relate to lack of an intimate partner, lack of privacy, misinterpretation of cues (e.g., caregivers touching them when assisting with personal care), an unfamiliar or understimulating environment, predementia sexual behavior, medication (e.g., dopaminergic drugs), mood disorders, or psychotic symptoms (Royal Australian and New Zealand College of Psychiatrists 2013).

Sleep Dysfunction

Disturbed circadian rhythm may complicate the progression of dementia and cause considerable carer stress. In dementia with Lewy bodies (a type of dementia characterized by fluctuation in mental state and intermittent confusion, parkinsonism, visual hallucinations, and falls), REM sleep behavioral disorder (which involves the person acting out their vivid dreams while asleep) may occur early and even precede the formal diagnosis of dementia. Sundowning is a term for the onset or worsening of BPSD symptoms in the afternoon or evening. It may also relate to disturbed circadian rhythms. Sleep dysfunction may also relate to comorbid medical conditions (e.g., sleep apnea, congestive cardiac failure, pain, depression), environmental conditions (e.g., room temperature, lighting, changes in the environment), and medication (e.g., diuretics).

Wandering

Wandering is a symptom particularly burdensome for carers, which may lead to placement in residential care. It may include exit seeking and repeated attempts to leave home and aimless walking. Under stimulation, boredom, anxiety, and cognitive deficits in navigation may be contributory.

Psychological Symptoms

Psychosis

Delusions Persecutory or paranoid delusions are the most widespread type in dementia. Common delusional beliefs include theft, that a spouse/caregiver has been replaced by an impostor (Capgras syndrome), that the person's residence is not their home, infidelity, and abandonment (Grossberg et al. 2012). Delusions may also be distressing for caregivers and increase the risk of violence toward them, particularly with delusions of infidelity and of impostors. Delusions in dementia are a risk factor for physical aggression.

Hallucinations Visual hallucinations are the most common type in dementia, followed by auditory hallucinations, with other sensory modalities rare. A common hallucination is of phantom boarders, where the person sees people in the home who are not actually there. Visual misperceptions also occur, when there is a visual stimulus but it is misinterpreted. This may relate to visual agnosias (impaired recognition of items presented visually) or problems with contrast sensitivity.

Misidentification External stimuli may be misinterpreted leading to misperceptions, which may be held with delusional intensity. The common types of misidentifications are of self (not recognizing one's own image), phantom boarders (people being in the person's home), of other people (e.g., a spouse or family member), and of events on television being interpreted as occurring in real time around them. Misidentification includes the defined syndromes Capgras, Fregoli (i.e., believing that a person is someone else in disguise), and intermetamorphosis (i.e., believing that familiar people in their lives have switched identities).

Anxiety Anxiety may occur on its own or in conjunction with another type of BPSD. Themes may relate to health, the future, finances, and activities or events not previously considered stressful. A common anxious cognition in dementia is fear of being left alone, which may reach phobic proportions. Godot syndrome may also occur, where the person repeatedly asks questions about an upcoming event.

Depression The spectrum of depressive symptoms is common in dementia, with depressed mood being most common (40–50%), followed by subsyndromal depression and major depression (10–20%) (Grossberg et al. 2012). It can be difficult to diagnose depression due to the overlap with somatic symptoms of dementia (such as weight loss, agitation, apathy, disturbed sleep) and the increasing communication and language difficulties as dementia progresses. A depressive illness should be considered if there is a rapid deterioration in cognition, a family or personal history of depression, pervasive low mood and anhedonia, unexplained acute behavioral change, or if the family is concerned about depression.

Apathy Apathy is a lack of interest, interactivity, emotion, concern, motivation, and initiation of activities. It is a common symptom, which may occur in up to 50% of patients with mild to moderate dementia. Symptoms of apathy and major depression may overlap, including reduced interest, lack of energy, psychomotor slowing, and poor motivation. Apathy may be distinguished from a depressive illness when amotivation occurs without the somatic and mood symptoms of depression (sadness and psychological distress). The following case demonstrates how a carer may interpret apathy in a loved one with dementia and the commonality with features of depression.

Case 1 Sidney is a 91-year-old man living at home with his wife. He was diagnosed with mixed vascular/Alzheimer's dementia 6 years ago. His wife refers him for assessment of depression. She complains that for the last year he just sits in his chair and stares at the wall. He no longer waters the plants and even seems to have lost interest in cricket as he does not even turn on the television when sitting in front of it. She is frustrated by how "lazy" he is and that he no longer even helps with the gardening. He does not strike up conversation with her but responds if she talks to him. When their great-grandchildren visit, he smiles and watches them play.

This case is illustrative of apathy with profound lack of motivation, self-initiated activities, and indifference but the retention of warmth and reactivity when caregivers take the initiative to provide enjoyable activities and interactions.

Principles of Management

BPSD may arise for numerous reasons, thus there is no single approach to management. The environmental, biological, psychological, and interpersonal factors should be considered when assessing someone. BPSD may be considered a form of communication, whereby unmet needs are expressed through behavior (Royal Australian and New Zealand College of Psychiatrists 2013). Aspects of the individual's personality, culture, and personal experiences may also influence their presentation. The first step is to have a clear description of the behavior and to evaluate whether intervention is needed. It may help to have caregivers/residential care staff keep a behavior diary prior to formal assessment. The ABC (antecedent, behavior, consequences) approach may be used to comprehensively describe behavioral problems. Using this method, the clinician records the antecedent events leading to the behavior (the context and any precipitant), the particular behavior, and the consequences of the behavior (for the patient, staff, others).

Delirium must first be excluded in a person with dementia who has an acute change in mental state or behavior. Dementia is a strong risk factor for delirium. The hallmarks of delirium are sudden onset of or new confusion, fluctuation in cognition and level of consciousness, and inattention. The etiology may be multifactorial and include medications, pain, and physical illness. Anesthetics, drug intoxication or withdrawal, and drug interactions, adverse effects, and polypharmacy may be relevant. Drugs of particular concern include psychotropics and those with cholinergic properties. Pain is a prevalent symptom in people with dementia but often unrecognized and undertreated. Common causes of pain include wounds, fractures, urinary retention, poor dentition, constipation, and surgery. Any acute medical illness may precipitate a delirium, so broad potential causes should be considered and treated accordingly. It may take days to several weeks for delirium to resolve, even after the underlying cause is treated.

Nonpharmacological

Nonpharmacological interventions are first-line treatment for BPSD. A person-centered approach emphasizes the importance of understanding the individual- what their interests, past experiences, and preferences are- and how this may inform the management of their BPSD (Royal Australian and New Zealand College of Psychiatrists 2013). For example, past negative experiences of institutionalization may be unwittingly reenacted in residential care, or knowledge of a person's hobbies may be used to divert them from the behavior or to address unmet needs for stimulation and social contact.

Environment

Environmental factors may contribute to BPSD. A change to the environment, including the interpersonal mix of residents or staff at a facility, may precipitate BPSD. It is important to evaluate whether there are extremes of temperature, lighting, stimulation, noise, or clutter. There is good evidence for unobtrusive safety features improving resident well-being and depression (Fleming et al. 2009). Exit seeking may be reduced by minimizing the number of locked doors or obscuring door handles, so as not to attract attention, and

Behavioral and Psychological Symptoms of Dementia, Table 1 Effective non-pharmacological treatments for BPSD

Treatment	Outcome
Essential oils: lavender and lemon balm	Limited evidence for reducing agitation when used as a sprayed mist and in facial/arm massage, respectively. Lemon balm also improves social engagement and constructive activity
Recordings of family voices (15 min)	Reduced agitated behaviours when audiotape of a family member talking was played through headphones. However, low level of evidence
Music: matched to person's taste Soothing sounds of water (ocean, stream)	Reduced agitated behaviours more than generic classical music. When used during baths reduced rates of physical and verbal aggression Reduced verbally disruptive behaviour
One-to-one interaction with a clinician (active engagement in conversation, sensory kit, gentle exercise, or manual activities matched to their skills and interests)	Reduced verbally disruptive behaviours
Daily physical activity (30-min)	Improved mood more effectively than a gentle walking group or conversation group
Sleep hygiene program (encouraging daytime activity, set-personalised bedtime routine, minimising interruptions at night, minimal light and noise at night)	Major reduction in time spent sleeping during the day and minor reduction in the time spent awake at night
Snoezelen room (multisensory stimulation)	Moderate evidence for reducing depression, aggressive behaviour and apathy and improves wellbeing during morning care, but benefits only apparent for a short time after the session
Animal-assisted therapy (pets)	Promotes social behaviour, improves nutrition, and reduces agitation and/or aggression
Therapeutic activities (a heterogeneous group including stimulation, cooking, Montessori methods, behavioural elements, creative activities)	Some benefit for apathy, especially if individually tailored (Brodaty and Burns 2012)

when doors do not have glass panels. An environment that provides a variety of spaces may reduce depression and anxiety, improve social interaction, and help the person find their way around. Single rooms are also beneficial in residential care. Optimization of levels of stimulation is effective, by both reducing unhelpful stimulation (e.g., noise or busy doors) and increasing lighting (e.g., good visual access to toilets). A homelike environment reduces aggression, but it is not possible to disentangle the effects of small unit size, staff skills, and care philosophy or familiar physical environment (Fleming et al. 2009). Similarly, there is moderate evidence for providing opportunities to engage in ordinary activities of daily living (ADLs), but the effects are hard to distinguish from staff factors and the contribution of the environment (Fleming et al. 2009). The provision of outside space is only beneficial if combined with staff interaction. A number of other nonpharmacological treatments may confer benefit in BPSD (O'Connor et al. 2012, see Table 1).

Sensory impairment is associated with BPSD and may be reversible. A thorough visual or auditory examination should be part of the assessment of hallucinations and the environment optimized to improve visual contrast and lighting. Inability to speak the local language may act as a sensory impairment by impeding communication. Interpreters should be used to optimize the likelihood of effective communication.

Psychological Approaches

Psychoeducation for caregivers about how to manage BPSD is an effective strategy, with benefits lasting months (Livingston et al. 2005).

There is also evidence for behavioral management strategies, which target behaviors of the individual or caregiver. Individual sessions are more effective than groups (Livingston et al. 2005).

There are a few types of psychotherapy, which have been evaluated in people with dementia. Any intervention should be based upon a person-centered framework, which incorporates the unique experiences and preferences of the individual. Overall, evidence is poor, and the methodological quality of studies is weak (Livingston et al. 2005). Cognitive stimulation therapy uses information processing rather than knowledge of facts to stimulate and engage people with mild to moderate dementia in an optimal learning environment. It may reduce depression and improve quality of life, during treatment and for some months afterward. A small pilot randomized controlled trial of a cognitive behavioral therapy-based intervention for people with dementia and anxiety, Peaceful Mind, showed short-term benefits in terms of improved quality of life and reduced anxiety in participants as well as reduced related distress in carers (Stanley et al. 2013).

A number of other psychotherapeutic approaches have been studied but have low or no evidence (Livingston et al. 2005). Validation therapy emphasizes a person's current feelings as real regardless of the reality of the situation. It encourages and validates expression of feelings. For example, if a person is agitated because they cannot be with a loved one, the therapist using a validation approach will acknowledge their feelings and engage them in a discussion about the relationship. Reminiscence therapy focuses on stimulating memory as it relates to an individual's life history, e.g., past significant events. Materials such as old newspapers or personal items may be used to stimulate memories and enable sharing of their experiences. Reality orientation therapy involves presenting information about place, time, and important others using visual prompts (e.g., calendars, clocks, personal items, regular family visits, lighting appropriate to time of day). The rationale is that reminders, which improve orientation, improve functioning. This therapy also has low-level evidence.

Pharmacological

Overall, there is only modest evidence for the use of pharmacotherapy in BPSD and risk of clinically significant adverse effects (Royal Australian and New Zealand College of Psychiatrists 2013). Most pharmacotherapy trials, although methodologically sound, are often limited by their short duration and follow-up period and exclusion of non-Alzheimer's dementias. Nonetheless, medication may be indicated in conjunction with nonpharmacological measures when the BPSD is moderate to severe, poses safety concerns, nonpharmacological interventions have failed, or the BPSD is affecting function or the quality of life of the patient or carer. Informed consent from the patient and their substitute decision-maker is essential.

Key issues to be considered before initiating a trial of pharmacotherapy for BPSD are whether drug treatment is warranted and why; whether the particular target symptom is likely to respond to medication; which class of drug is most appropriate/evidence based; adverse effects of the drug; the duration of drug treatment, and planned review and monitoring of response and adverse effects. Other general principles of prescribing include slow and careful titration from a low dose, consideration of the individual's medical comorbidities, which may affect drug metabolism and excretion, and avoiding polypharmacy. Particular care must be taken with people with dementia with Lewy bodies or Parkinson's disease, who have greater sensitivity to antipsychotic medication.

Pharmacological Cognitive Enhancers

Cholinesterase inhibitors are not currently indicated for BPSD. Meta-analyses of cholinesterase inhibitors in BPSD have found statistically significant differences in global neuropsychiatric scores compared to placebo, but clinical significance is doubtful (Campbell et al. 2008). Subgroup analyses show cholinesterase inhibitors may be useful when targeting specific BPSD symptoms, including apathy and indifference, hallucinations and delusions, anxiety and depression, and aberrant motor behavior (Setz and Lawlor 2012). Rivastigmine is significantly beneficial in dementia with Lewy bodies, particularly for agitation and visual hallucinations. Withdrawal of cholinesterase inhibitors may lead to worsening of BPSD within 6 weeks. Adverse effects such as diarrhea, gastrointestinal upset, agitation, bradyarrhythmia, and anorexia may limit use.

Memantine, an NMDA glutamate receptor antagonist may be useful for BPSD. Although it was found to modestly reduce scores on the neuropsychiatric inventory, the clinical significance is uncertain. It may be most useful for target behaviors such as agitation, aggression, delusions, hallucinations, and irritability. It may delay the emergence of agitation in people with dementia. Side effects include dizziness, drowsiness, constipation, hypertension, anorexia, headache, anxiety, delirium, and psychosis (in dementia with Lewy bodies).

Antidepressants

Evidence is lacking for the use of antidepressants in depression with dementia. Nonpharmacological strategies should be used first and antidepressants reserved for when these are unsuccessful or in more severe cases with suicidal ideation. Selective serotonin reuptake inhibitors are first-line agents. Tricyclic antidepressants should be avoided due to the risk of delirium conferred by the high anticholinergic burden. Citalopram, a selective serotonin reuptake inhibitor, may be effective for agitation/aggression and comparable in efficacy to risperidone and more effective than perphenazine (an antipsychotic). Adverse effects may include gastrointestinal symptoms, hyponatremia, falls, and, in citalopram, prolonged QTc interval (an abnormality on electrocardiograph which may predispose to cardiac arrhythmias) at doses 40 mg or greater.

The following case demonstrates the assessment and multimodal management of verbal agitation due to an untreated anxiety disorder.

Case 2 Mary is an 83-year-old nursing home resident with advanced Alzheimer's dementia and a history of anxiety. She is unable to walk and stays in her room. The staff ask for assistance to manage her constantly calling out "help." The vocalization has been present for years but has become more frequent and associated with distress in recent months. The general practitioner started risperidone (2 mg nocte), with little effect.

The staff complete a behavioral diary which shows that the calling out is greatest in the evenings and does not occur during bathing or meal times (when she is fed). Sometimes, she grabs at her throat and looks distressed. When her son sits holding her hand, the vocalization reduces. There are no abnormalities on physical examination or pathology tests. The staff have moved her to a room near their station so they can reassure her frequently. This works for a brief time, then she calls out again when they leave. During the assessment, Mary has no spontaneous speech other than calling out "help." She does not maintain eye contact. Tone is mildly increased in her arms. Her affect is fearful. She nods in agreement when asked about feeling worried and later about breathlessness. The vocalization becomes louder and more frequent as the psychiatrist leaves. Further discussion with staff reveals she used to feed the pet rabbits and sit out in the garden area but has not done so in several weeks due to short staffing. She now shares a room with a non-English-speaking resident. Mary's son confirms a history of significant anxiety and depression, with several hospitalizations.

The psychiatrist concludes that Mary has a relapse of her anxiety disorder with probable panic attacks. She is likely to be understimulated and lonely. Following discussions with staff, efforts are made to bring her into the dayroom beside English-speaking residents and for her to resume her role of feeding the rabbits. The risperidone is stopped due to lack of efficacy. With consent from Mary's son, she is recommenced on sertraline, which she responded to previously. The vocalizations reduce over a few weeks; she smiles occasionally at staff and appears less worried. Further review is scheduled to monitor progress.

This vignette demonstrates the importance of comprehensively describing the behavior using the ABC approach while taking into account individual historical factors, the environment, and nonverbal communication. Psychotropic medication may be indicated and useful but should be ceased if ineffective.

Antipsychotics

There is modest evidence for the use of either haloperidol or risperidone for aggression but limited evidence for other agitated behaviors in dementia (Schneider et al. 2006). Aripiprazole may be useful for agitation and aggression in Alzheimer's disease. Risperidone also confers modest benefit for psychosis in Alzheimer's disease (Schneider et al. 2006). Quetiapine has been shown not to be of benefit in studies of agitation in dementia with Lewy bodies and Alzheimer's and may be associated with greater cognitive decline in Alzheimer's (Royal Australian and New Zealand College of Psychiatrists 2013).

Antipsychotics are associated with several risks warranting consideration. There is an elevated risk of stroke, neurological symptoms (e.g., headache, dizziness, transient ischemic attacks), and mortality, the latter higher in typical antipsychotics. The extrapyramidal side effects are well recognized, more common with typical antipsychotics, and include parkinsonism (tremor, rigidity, bradykinesia), falls, akathisia, and neuroleptic malignant syndrome. Metabolic side effects include hyperglycemia, hypercholesterolemia, and weight gain. Antipsychotics can also cause delirium and cognitive decline, especially those with prominent anticholinergic side effects, such as olanzapine and quetiapine. Ventricular tachycardia, torsade de pointes, and sudden cardiac death may be associated with some antipsychotics. Importantly, several studies have shown that BPSD remain unchanged or improve when typical antipsychotics are discontinued (Ballard et al. 2009).

Benzodiazepines

Benzodiazepines may be used for agitation; however, there are no good studies in BPSD. Use should be time limited, and short-acting benzodiazepines like lorazepam are preferred to reduce the risk of accumulation. Sleep hygiene strategies should be first-line treatment for insomnia and, only if unsuccessful, short-term use of temazepam. Falls, delirium, drowsiness, and ataxia are the main adverse effects.

Anticonvulsants

Meta-analyses have shown that carbamazepine is modestly effective for agitation (Schneider et al. 2006) but inadequate evidence for sodium valproate (Konovalov et al. 2008). Side effects include falls, cognitive impairment, ataxia, blood dyscrasias, and hepatic dysfunction.

Analgesics

Systematic, effective treatment of pain may significantly reduce agitation in nursing home residents with moderate to advanced dementia. Regular paracetamol may be sufficient for the majority of this population and buprenorphine patches required for some.

Electroconvulsive Therapy

Although electroconvulsive therapy may be used for depression, psychosis, and agitation in dementia, especially in life-threatening situations or with symptoms nonresponsive to medication, evidence is restricted to case reports and series. Transient delirium is common after a treatment.

Conclusion

BPSD syndromes are an important and common development in dementia occurring at all stages in the illness. They have significant and far-reaching implications for the person with dementia and their family and caregivers. As well as considering the particular type of dementia, the behaviors or psychological symptoms should be carefully observed and described as part of a thorough assessment. Careful evaluation of the individual's social circumstances, experiences, personal history, and their medical, psychiatric, and functional history is essential to understanding the potential contributing factors. Management must similarly be tailored to the individual addressing the component causes in a collaborative approach with significant others and carers. Pharmacotherapy should be reserved for situations where other measures have failed and to target particular symptoms known to be responsive to specific medication. A plan for review and ongoing monitoring is essential. Further research that integrates neurobiological, psychosocial, and environmental domains will better develop understanding of the etiological factors underlying these clinical syndromes.

Cross-References

- ▶ Anxiety Disorders in Later Life
- ▶ Challenging Behavior
- ▶ Depression in Later Life
- ▶ Gerontechnology
- ▶ Horticultural Therapy
- ▶ Music Therapy, Applications in Geropsychology

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Berlin Aging Studies (BASE and BASE-II)

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Synonyms

Longitudinal studies of old age and aging

Definition

The Berlin Aging Studies (BASE and BASE-II) are two consecutive studies of old age and aging with an interdisciplinary focus. The disciplines involved include psychology, psychiatry, geriatrics and internal medicine, genetics, sociology, and economics. The initial BASE data collection involved 14 sessions and took place in 1990–1993 with 516 men and women aged 70 to over 100 years. BASE-II currently involves five sessions with 1,600 older adults aged 60–80 years as well as 600 younger adults aged 20–35 years, who were assessed for the first time in 2011–2014.

The initial Berlin Aging Study (BASE) was launched in 1989. In 1990–1993, 516 women and men aged 70 to 100+ years and living in the former West Berlin completed an intensive protocol of 14 sessions that exhaustively assessed their physical and mental health, life histories, living conditions, and psychological status. Subsequently, seven longitudinal follow-up assessments of surviving participants who had agreed to take part again were carried out until 2008/2009. In addition, mortality information was obtained regularly from the city registry. This allowed the examination of age- and death-related changes in old age. In 2011, a new study was launched, the Berlin Aging Study II (BASE-II), which focuses on many of the constructs examined in BASE as well as new constructs, but follows a larger group of old participants as well as a group of young adults for comparison.

In the following, BASE and BASE-II are presented in depth, first focusing on BASE, and then drawing attention to select features of BASE-II.

The Berlin Aging Study (BASE)

Institutional Background and Organization of BASE

The first study was initiated in 1989 by the West Berlin Academy of Sciences' interdisciplinary working group "Aging and Societal Development." It was initially directed by the late Paul B. Baltes, psychologist, and Karl Ulrich Mayer, sociologist (Baltes and Mayer 2001; Lindenberger et al. 2010; Mayer and Baltes 1999). From 1994 to 1999 the working group and BASE were continued by the newly founded Berlin-Brandenburg Academy of Sciences. BASE was carried out as a collaboration among several institutions including the psychology and sociology research centers at the Max Planck Institute (MPI) for Human Development, the Department of Psychiatry at the Freie Universität Berlin, institutes and research groups at the Virchow Clinic of the Humboldt-Universität zu Berlin, and the Evangelisches Geriatriezentrum Berlin. Over time, the study was funded by various German federal ministries (Federal Ministry for Research and Technology, Federal Ministry for the Family and Senior Citizens, and finally until 1998 Federal Ministry for the Family, Senior Citizens, Women, and Youth). The Max Planck Society for the Advancement of Science currently supports the study. The study also received additional support from the Berlin-Brandenburg Academy of

Sciences and the cooperating institutes and research groups.

The multidisciplinary nature of BASE is reflected in four research units: internal medicine/geriatrics (Elisabeth Steinhagen-Thiessen), psychiatry (Hanfried Helmchen), psychology (Paul B. Baltes, succeeded by Ulman Lindenberger and Jacqui Smith), and sociology/social policy (Karl Ulrich Mayer). At the beginning of the study (1990–1993), the project group consisted of about 60 scientists from different disciplines. In 2015, about ten scientists are still regularly involved in the analysis of the longitudinal data. Since 2004, Ulman Lindenberger heads the current BASE core group at the MPI for Human Development. From the outset, young scientists were heavily involved in BASE. By 2014, 25 diploma and masters' theses and 22 doctoral theses analyzing BASE data were completed. In many cases, the findings were subsequently published in peer-reviewed international journals.

As mentioned above, the study involves eight measurement occasions spaced over 18 years. In addition, several subsamples have been recruited for intensive study. The key features of BASE include (1) a focus on the very old (70 to 100+ years); (2) a locally representative sample, stratified by age and sex; (3) a broadly based interdisciplinarity; and (4) an emphasis on methodological issues, such as selective attrition and the measurement of change.

Theoretical Orientations

In addition to discipline-specific topics, four integrative theoretical orientations have guided the study: (1) differential aging, (2) continuity versus discontinuity of aging, (3) range and limits of plasticity and reserve capacity, and (4) aging as a systemic phenomenon.

The theoretical orientations led the selection and analysis of the central topics of BASE that were presented in the initial monographs on the study (Baltes and Mayer 2001; Lindenberger et al. 2010; Mayer and Baltes 1999). The concept of *differential aging* covers a broad range of questions. For example, the cumulative effects of early life experience (such as historically explainable cohort differences in education, consequences of war and epidemics, etc.) on old age, social inequality and aging, and differences between older men and women were analyzed. The question whether dementia represents *discontinuity or continuity* in the course of aging was one of the main research topics of the BASE psychiatry unit. Issues related to *reserve capacity and plasticity* in old age were important for the analyses of the geriatrics unit and the psychology unit. The consideration of aging as a *systemic phenomenon* has always been a key focus in BASE. Here, connections were made across domains such as sensorimotor functioning and cognition or health and well-being, and in a holistic person-oriented approach, subgroups of older adults were identified based on their profiles of functioning.

Sample

The initial focus of BASE (1990–1993) was to obtain a heterogeneous sample, stratified by age and sex, of individuals aged 70 to 100+ years who completed a 14-session intensive protocol that involved detailed measures from each of the four participating disciplines at the first occasion of measurement. The stratified sample participating in this intensive protocol consisted of 258 men and 258 women from the former West Berlin aged 70–74, 75–79, 80–84, 85–89, 90–94, and 95+ years. The parent sample was drawn from the obligatory city register. A standardized intake assessment was also used to collect multidisciplinary data at early stages and as a repeat instrument at each later occasion of measurement. For a detailed documentation of sampling procedures and sample selectivity, see Lindenberger et al. (2001).

Longitudinal Continuation

In order to focus on the theoretical orientations that actually emphasize the *processes* of aging as well as the dynamics and consequences for differential aging, a longitudinal continuation of the study was put in place. With longitudinal data, decisive information can be gained on all four theoretical orientations. In particular, longitudinal data allow the identification of interindividual differences in intraindividual change, provide insights into the determinants of change, and enable analyses of systemic linkages among behavioral changes. Seven longitudinal follow-ups of the survivors from the initial sample involving different depths of assessment were completed at approximately 2-yearly intervals. A single-session multidisciplinary assessment was collected in 1993–1994 ($N = 361$), reduced versions of the intensive protocol (six sessions) were collected in the periods 1995–1996 ($N = 206$) and 1997–1998 ($N = 132$), and repeats of parts of the psychology battery together with multidisciplinary outcome variables (e. g., screening for dementia, assessment of well-being) were collected in 2000 ($N = 82$), 2004 ($N = 46$), and 2005 ($N = 37$). In addition, mortality information about the entire BASE sample is updated at regular intervals. At the eighth (and probably final) measurement occasion in 2008–2009, 22 surviving participants were reexamined, concentrating on psychological, geriatric, and dental assessments.

An additional focus that also influenced the design of the longitudinal study deals with the transition of the Third Age to the Fourth Age. Within the last phase of the life span, in old age, scientists differentiate between the Third and Fourth Age or between the "young old" and "old old" (Baltes and Smith 2003). This differentiation is based on the heterogeneity within the elderly population with respect to important characteristics such as morbidity, the need for care, cognitive functioning, well-being, social participation, and mortality. The precise definitions of the determinants of membership in the one or the other group or that characterize the transition from the Third to the Fourth Age still need to be identified. Based on theory, the Third Age can be described as a phase of positive quality of life, whereas the Fourth Age is characterized by dysfunction, illness, and death. Some demographers have identified the age of 85 as the average entrance criterion into the Fourth Age (Suzman et al. 1992). However, the question remains open whether this age is a fixed or mobile criterion for the end of the Third and beginning of the Fourth Age. Therefore, the analysis of the longitudinal BASE data also focuses on the investigation of the transition from the Third to the Fourth Age and the characteristics of the Fourth Age.

Data from the Berlin Aging Study continue to provide the basis for new original publications on individual differences in late-life development. Furthermore, DNA specimens, derived from blood samples frozen at the first occasion of measurement to allow later analyses, have been retrieved and analyzed for about 380 BASE participants. Adding genetic information to the BASE data set allows researchers to explore and test genetic contributions to individual differences in late-life development.

The initial sample of 516 individuals formed the basis of the cross-sectional analyses reported in two monographs (Baltes and Mayer 2001; Mayer and Baltes 1999). Current interests of the BASE core group include issues of sample selectivity and representativeness; intraindividual variability and change; terminal decline; cognitive aging; mortality prediction; self-related change, well-being, and antecedents of successful aging; and genetic predictors of individual differences in cognitive and self-related change in old age.

The BASE data set is rich: For the first cross-sectional data collection alone, there are already 10,000 variables available per participant. External scientists can apply for access to parts of the BASE data set. Data can then be made available in accordance with the German data protection laws. In the interest of scientific exchange, BASE researchers have invested much effort and time into the documentation and archiving of the data set. This is in line with endeavors in the USA to make central data bases of important studies available to the scientific community. The data of BASE are described in an extensive and detailed documentation that can be provided on a compact disc. Copies of the questionnaires used in BASE can also be requested, and some are already part of the documentation. The BASE website (www.base-berlin.mpg.de) provides an overview of the study and includes a searchable catalog of the numerous BASE publications. It is updated regularly and includes a contact e-mail address (basempi@mpi-berlin.mpg.de) for reprint or information requests.

Trajectories of Change: Age Versus Time to Death

One example of the kinds of analyses possible with the BASE data was published by Denis Gerstorf et al. (2013). Mortality-related processes are known to modulate late-life changes in cognitive abilities, but it is an open question whether precipitous declines with impending death generalize to other domains of functioning. The authors used 13-year longitudinal data from 439 deceased BASE participants to compare changes as a function of time since birth (i.e., age models) with changes as a function of time to death (i.e., mortality models). Across a large range of functional domains such as subjective health, emotional loneliness, grip strength, perceived control, and the score in the Digit Letter Test (a marker of perceptual speed), mortality models revealed reliably steeper average rates of change than age models. These findings underscore the pervasive presence of processes leading toward death in old age. Multivariate analyses with more closely spaced multi-domain measurements are needed to identify the temporal dynamics and dimensionality of this end-of-life cascade.

Genetic Contributions to Individual Differences in Late-Life Cognitive Development

Another example of BASE findings highlights the importance of the genetic analyses that have become possible. The brain-derived neurotrophic factor (BDNF) promotes activity-dependent synaptic plasticity and contributes to learning and memory. Paolo Ghisletta et al. (2014) investigated whether a common Val66Met missense polymorphism (rs6265) of the *BDNF* gene is associated with individual differences in cognitive decline in old age. A total of 376 BASE participants with a mean age of 84 years at the first occasion of measurement were assessed longitudinally up to 11 times (due to multiple testing at several occasions of measurement) across more than 13 years on the Digit Letter Test. Met carriers (n = 123, 34%) showed steeper linear decline than Val homozygotes (n = 239, 66%). This effect was not moderated by sex or socioeconomic status and was also observed when individuals at risk for dementia were excluded from the analysis. This finding is in line with the hypothesis that normal aging magnifies the effects of common genetic variation on cognitive functioning.

The Berlin Aging Study II (BASE-II): Understanding Heterogeneity in Aging

BASE findings confirmed that heterogeneity is one of the most salient aspects of aging. Some individuals maintain their health and preserve their cognitive abilities into advanced ages, whereas others show precipitous and early decline. To understand the mechanisms that produce this diversity of outcomes and trajectories of aging, individuals need to be followed over time. With this goal in mind, researchers from Berlin and Tübingen initiated the Berlin Aging Study II (Bertram et al. 2014). Like BASE, BASE-II was set up as a multidisciplinary and multi-institutional longitudinal study that captures a wide range of different functional domains. Geriatrics and internal medicine, psychology, sociology, and economics are again among the disciplines involved, moreover, immunology and genetics were additionally included. Thus, the BASE-II steering committee represents a wide range of these disciplines and involves many of the scientists who also collaborated in BASE. Elisabeth Steinhagen-Thiessen, Evangelisches Geriatriezentrum Berlin, was the first BASE-II speaker from 2010 to 2014. In 2015, she was succeeded by Denis Gerstorf, Humboldt-Universität zu Berlin. The study received financial support from the Federal Ministry of Education and Research, the Max Planck Society for the Advancement of Science, and other participating institutions.

The BASE-II Sample

The recruitment of the BASE-II cohort resulted in a consolidated baseline sample of 1,600 older adults aged 60–75 years and of 600 younger adults aged 20–35 years (Bertram et al. 2014). Potential participants were drawn from a pool of individuals originally recruited at the MPI for Human Development for a number of earlier projects with a focus on neural correlates of cognition.

Briefly, participant recruitment was based on advertisements in local newspapers and the public transport system of Berlin. Interested individuals of the greater metropolitan area of Berlin were further screened to meet the inclusion criteria of BASE-II (either in-house or by telephone) leading to 2,262 healthy individuals who were eligible for inclusion in BASE-II. Individuals were included if they were not taking medication that could affect memory function and did not report a history of head injuries or neurological or psychiatric disorders. Finally, 2,200 individuals were selected to represent the BASE-II baseline cohort.

It is well known that some age-related functional and cognitive changes, such as decline in perceptual speed, evolve in early adulthood. At the same time, recent longitudinal studies indicate that other cognitive abilities, such as episodic memory (EM), are relatively stable until about 60 years of age and start declining thereafter. In order to identify and follow associations of multiple factors influencing age-related changes, the decision was taken to start observing healthy older adults at an age of relative health and stability, but where most would be at risk of subsequent age-related changes on multi-dimensional variables of interest. Thus, a total of 1,600 participants were assigned to an older subgroup aged between 60 and 80 years, and 600 individuals were assigned to a younger subgroup (serving as a reference population) aged between 20 and 35 years. By design, each age subgroup contains an approximately equal number of men and women. To estimate sample selectivity, data from this baseline sample are linked to the German Socio-Economic Panel (SOEP) study, a longitudinal panel survey that is representative of the German population. To date, BASE-II only includes cross-sectional variables but is planned as a longitudinal study.

Interdisciplinary Research in BASE-II

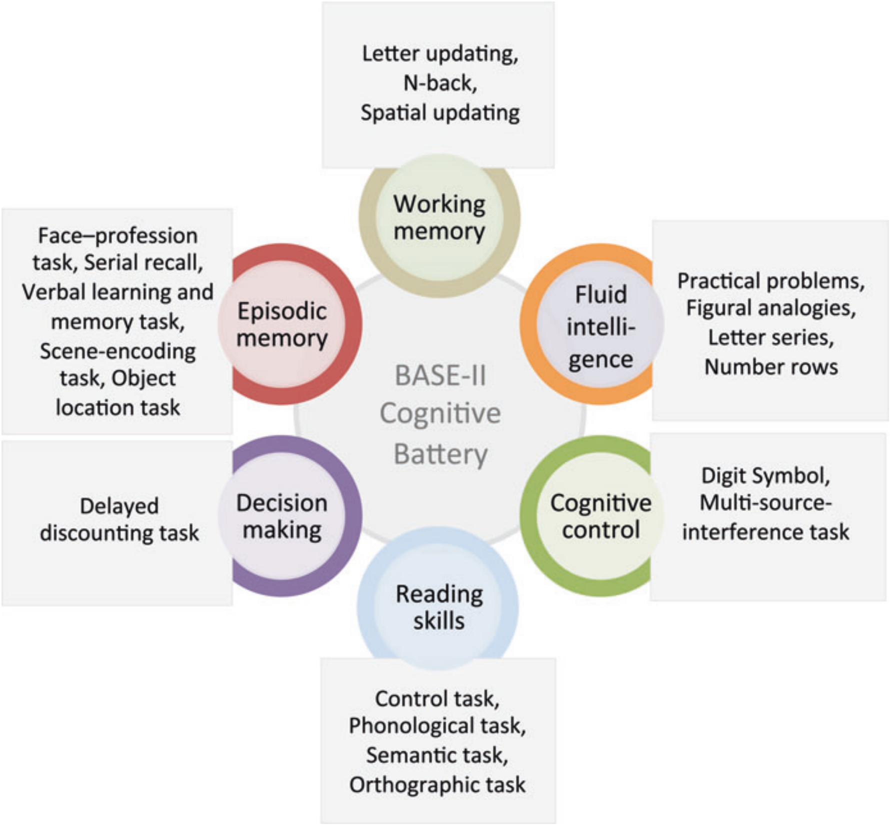
In many countries around the world, current cohorts of adults are living longer than earlier cohorts and are reaching old age in better health. There is a growing need to investigate the interactions among genetic, psychosocial, demographic, and lifestyle factors that shape individual pathways into old age (Lindenberger 2014). Multidisciplinary approaches are required to understand how individual differences in cognitive and psychosocial domains of functioning relate to the wide range of genetic, somatic, and sociological markers and constructs assessed in BASE-II and how these associations change over time. Additionally, socioeconomic data and data about life satisfaction and habits, the social environment, and attitudes in life were collected and can be taken into account as explaining factors. The BASE-II design allows younger and older participants to be directly compared on all dimensions assessed.

An overarching goal of BASE-II is to follow up the trajectories and the strengths of the multidisciplinary associations revealed in the first wave of BASE-II. Repeated investigations after a certain time will allow more specific observation and classification of individual trajectories of aging. Longitudinal findings may contribute toward bolstering action strategies for demographic change and increasing knowledge of the conditions necessary for independent living.

Assessing Cognitive Functioning

A major aim of the psychology subproject is to obtain a detailed and comprehensive picture of cognitive abilities and psychosocial characteristics that can serve as a solid baseline for subsequent longitudinal observations (Fig. 1). Throughout all analyses, structural equation modeling was used (McArdle 2009) in order to establish latent constructs and examine associations among them. Thus, by relating individual differences in cognitive abilities to variations in lifestyle, environmental factors, and personality, it is possible to identify different patterns and psychosocial contexts of cognitive aging and to investigate links to multiple domains within BASE-II (Fig. 1).

After extensive piloting, a comprehensive battery of cognitive tests and a psychological questionnaire were added to the baseline protocol in 2013. The cognitive battery of BASE-II covers key cognitive abilities such as episodic memory



Berlin Aging Studies (BASE and BASE-II), Fig. 1 Overview of cognitive domains with associated tasks within the baseline assessment of BASE-II

(EM) as well as measures of working memory (WM), cognitive control, fluid intelligence (FI), reading skills, and decision making. The assessment is distributed across two testing sessions that last three hours each and are seven days apart. The Digit Symbol Substitution Test (WAIS-II; paper-and-pencil version) was applied to relate performance levels observed in BASE-II to other studies, including BASE (cf. Gerstorf et al. 2015). In summary, the psychometric space of human cognitive abilities is represented more broadly than in most other comparable studies.

Assessing Psychosocial Functioning

To cover a broad range of key psychosocial correlates of health and cognition in old age, a comprehensive psychosocial assessment battery was compiled for BASE-II. A total of eight domains of psychosocial functioning are assessed. Data collection takes place between the first and second cognitive session at the participants' place of residence (i.e., private household or institution). Overarching constructs include well-being, affect, perceived stress, motivation and control, personality, perceptions of time and aging, social embedding, and perception of neighborhood characteristics. The selection of psychosocial measures was based on conceptual considerations and empirical evidence to permit the investigation of links to physical health and cognitive functioning (e.g., Diener et al. 2006). Selection of (sub) scales and items for the constructs was based on empirical reports attesting that psychometric properties were acceptable. To allow for direct empirical comparison across studies, several (sub)scales and items that were also applied in closely related studies, including SOEP (Headey et al. 2010), BASE (Baltes and Mayer 2001;

Lindenberger et al. 2010; Mayer and Baltes 1999), and the COGITO study (Schmiedek et al. 2010), were chosen. This design strategy allows comparison of individuals from the later-born cohorts of BASE-II with their age peers from earlier cohorts in BASE (e.g., comparing 75-year-olds born in 1915 with 75-year-olds born in 1938). The strategy also makes it possible to analyze longitudinal data from participants who were previously part of the SOEP and COGITO studies.

Developing New Measures of Active Aging

Maintaining cognitive abilities in aging is important for everyday competence and an independent lifestyle. A lifestyle associated with exposure to novel and varied information ("enriched environment") is considered beneficial for healthy cognitive aging (Lindenberger 2014; Hertzog et al. 2008). Psychological concepts of motivation postulate that the subjective appraisal of the time left to life affects individuals' goal- and activity-related motivations (Lang and Carstensen 2002). Hence the "Subjective Health Horizon Questionnaire" (SHH-Q) was developed and validated. This novel questionnaire captures individuals' expectations regarding their ability to explore and engage with novel information in the future alongside their expectations concerning bodily health and fitness. The SHH-Q is administered within the cognitive session by means of a computer. The SHH-Q forms four correlated but distinct subscales: (1) novelty-oriented exploration, (2) bodily fitness, (3) occupational goals, and (4) goals in life (cf. Düzel et al. under review).

Summary of Initial Results from BASE-II

Changes in psychosocial functioning across cohorts. Initial analyses of the psychosocial measures focused on secular changes in aspects of motivation and control, social embedding, and perceptions of time and aging. As mentioned above, levels of functioning in more objective and performance-based measures assessed in BASE and BASE-II such as physical health and cognition were higher in more recent cohorts of older people. Does this mean that they also perceive themselves as having more control over their life and feel socially integrated and young? To examine these questions, Hülür and colleagues (in press) compared data obtained in BASE (in 1990–93) and BASE-II (in 2013–2014) and applied a case-matched control design based on age, gender, education, comorbidities, and cognition. Results revealed evidence for considerable secular changes in people's perceptions of their lives. For example, 75-year-olds nowadays hold fewer external control beliefs and report less loneliness. Possible correlates underlying such cohort differences are being examined at the time of writing.

Cognitive functioning. Using confirmatory factor analysis (CFA), it was possible to validate a three-factor model of memory for both age groups. This latent approach is important to further investigate the associations between cognitive functioning and other psychosocial, medical, genetic, and socioeconomic indicators assessed in BASE-II.

Associations between health and cognition. Being physically active and having a higher overall health status have protective effects on brain structure and function and are associated with later onset or lower degree of age-related cognitive decline (Hertzog et al. 2008; Maass et al. 2015). The examination of associations of health- and fitness-related measures to global measures of cognitive functioning using CFA is in planning. Medical data are used to generate global measures of health (e.g., grip strength) and fitness (e.g., lung functioning). Initial multiple hierarchical regression analyses with the sample of older BASE-II adults showed that grip strength predicts performance in all memory domains (FI, WM, and EM) beyond age, gender, and years of education. In the younger BASE-II subsample, neither of these health and fitness measures was associated with any of the three cognitive abilities. Future analyses will investigate age group differences in the associations between somatic health and cognition.

Establishing metabolic status as a latent construct. Epidemiological studies have linked features of the metabolic syndrome (MetS; a clustering of several frequent medical disorders such as abdominal obesity, hypertriglyceridemia, and hypertension) to cognitive decline in old age. However, it is not clear to what extent each indicator of MetS contributes to pathophysiology and how single or combined MetS features affect cognitive functioning. Additionally, little is known about associations among vascular risk, metabolic status, and cognition in healthy aging. The underlying hypothesis is that memory functions are moderated by metabolic and vascular factors. Biomarkers were collected within the medical subproject of BASE-II and include systolic and diastolic blood pressure, glucose and insulin area under the curve, triglycerides, HDL cholesterol, body mass index (BMI), waist circumference, and trunk fat. To investigate the aforementioned links between MetS and cognition, MetS was established as a latent construct, again using CFA. A one-factor model of MetS provided acceptable model fit, with three measures loading adequately on the MetS factor (triglyceridemia, trunk fat, fasting glucose level). This factor is in line with medical descriptions of MetS. Initial analyses suggest reliable associations among MetS, cognition, and subjective measures of future time horizon.

Psychosocial functioning. With the validation of SHH-Q, the new self-report measure of distinct future time perspectives, within the healthy older sample of BASE-II, the SHH was shown to account for a significant proportion of memory performance variability. Initial analyses indicate that greater self-reported novelty orientation is associated with higher EM performance and greater self-reported bodily fitness with better metabolic status (Düzel et al. under review). These initial results pave the way to a better understanding of the connections between subjective activity-related motivation and health behavior.

Outlook

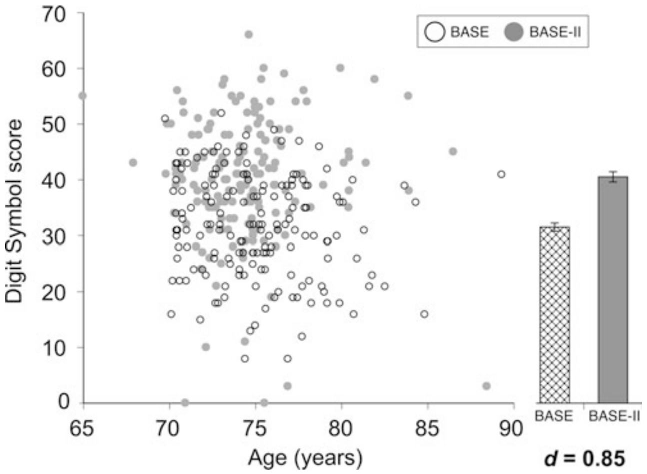
The psychometric validation of the BASE-II cognitive battery is an important starting point toward investigating associations with other functional domains. In particular, analyses at the latent level will enhance statistical power and generalizability when exploring links to genetic variation (e.g., Papenberg et al. 2014). Further analyses will explore across-domain associations between aspects of physical health, cognitive functioning, and psychosocial characteristics. Additional analyses will focus on identifying psychosocial variables that may serve as protective or risk factors for dealing with health challenges. To move toward a better understanding of whether and how contextual factors shape individual functioning and development, geo-coded information (e.g., to index distance to green spaces) will be linked to psychosocial characteristics (e.g., chronic stress) and to health information (e.g., biomarkers of stress).

Synergies between BASE and BASE-II

One way to explore the malleability of the human life course is to directly compare different cohorts of the same age across historical time (Baltes 1968; Schaie 1965). The similarities between BASE and BASE-II offer excellent opportunities for comparisons of this kind. In a recent study, Gerstorf and colleagues (2015) quantified secular increases in fluid intelligence in old age favoring later-born cohorts. They compared data obtained 20 years apart in BASE and BASE-II, applied a case-matched control design, and quantified sample selection using a nationally representative sample as the reference (Fig. 2; see also Hülür et al. in press). The later cohort performed better on the fluid intelligence measure and reported higher morale, less negative affect, and more positive affect than the earlier cohort. The authors concluded that secular advances have resulted in better cognitive performance and perceived quality of life among older adults. To the extent that BASE-II will be continued as a longitudinal study, it will permit researchers to study the ways in which longitudinal trajectories of adult development evolve over historical time.

Summary

Taken together, the combination of findings from BASE and BASE-II and the possibility to analyze



Berlin Aging Studies (BASE and BASE-II), Fig. 2 Average cohort differences and individual differences in cognitive performance. The dots represent participants' scores in the matched BASE (*open circles*) and BASE-II (*gray circles*) samples. Sample means and standard errors for each cohort are displayed separately. Participants in the BASE-II cohort (data obtained in 2013–2014) showed higher levels of cognitive performance ($d = 0.85$) than the BASE cohort (data obtained in 1990–1993). For details, see Fig. 2 in Gerstorf et al. (2015)

BASE-II data in conjunction with BASE data provide singular opportunities to address a wide range of questions about old age and aging. Both studies are unique with their wide-ranging interdisciplinarity that allows processes of aging to be examined across a broad spectrum of domains. As is already the case for BASE (Lindenberger et al. 2010), BASE-II is likely to yield a rich scientific harvest over the next years, as foreshadowed by initial publications (e.g., Bertram et al. 2014; Gerstorf et al. 2015; Hülür et al. in press; Maass et al. 2015; Papenberg et al. 2014).

Cross-References

- ▶ Aging and Psychological Well-Being
- ▶ Cognitive and Brain Plasticity in Old Age
- ▶ Distance-to-Death Research in Geropsychology
- ▶ Individual Differences in Adult Cognition and Cognitive Development
- ▶ Plasticity of Aging
- ▶ Psychological Theories on Health and Aging
- ▶ Sensory Effects on Cognition in Later Life
- ▶ Time Perception and Aging
- ▶ Psychosocial Well-Being

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Bibliotherapy and Other Self-Administered Treatment

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Synonyms

Bibliotherapy; Self-administered treatment; Self-help

Definition

The formal implementation of written or digital materials to facilitate understanding or assist in efforts relevant to a person's developmental or therapeutic needs.

General Overview

In its simplest form, bibliotherapy uses literature to facilitate improvements in the well-being or functioning of an individual or group of individuals. The literature may be instructional in nature (i.e., a therapeutic manual written in narrative to aid the client in self-administered treatment) or conceptual (i.e., a fictional or autobiographical piece which illustrates issues and/or dealings related to the reader's problem of interest). Through the years, the media of bibliotherapy has broadened. Electronic and auditory formats are often available to the public; websites, handouts, and even smartphone applications have been developed to present material. The role of the psychotherapist in bibliotherapy may vary as well (i.e., completely self-administered, therapist guided, therapist administered). The following entry will outline the basic principles and concepts associated with bibliotherapy and related forms of self-help, discuss current modes of distribution and application, and, finally, review the general state of bibliotherapeutic endeavors in older adult populations and outline future directions.

The general purpose has remained the same despite the varied formats in which bibliotherapy may appear and be administered: to facilitate the participant's consideration and understanding of the problem of interest and to encourage beneficial change in knowledge, perspective, and application of skills. Bibliotherapy has been defined as the use of written material: "…for the purpose of gaining understanding or solving problems relevant to a person's developmental or therapeutic needs" (Marrs 1995). In current application, and for the purposes of this entry, this definition can be extended to include media-based products (e.g., DVDs, audio files, community websites).

Concepts, Principles, and Modalities of Self-Help

In many cases in which bibliotherapy is recommended, it provides a portable venue in which therapeutic change may occur both inside and outside the therapeutic setting. Difficult to access populations (e.g., mobility-restricted persons, prison populations) may benefit from this more transportable and time-flexible approach. Furthermore, bibliotherapy may provide a *foot in the door* technique to facilitate a change in one's attitude toward seeking mental health treatment. Those who are unsure of the merits of psychological treatment or hold negative or ambivalent feelings toward mental health treatment may find themselves more open to seeking treatment if given a tangible medium of treatment that they can evaluate and reevaluate at their leisure. This, of course, assumes the recommended self-help material is sound and plausible. Bibliotherapy may also provide anecdotal material to stimulate and direct discussion in group or social settings. For instance, it may be less threatening to talk about an issue embedded in the struggles of a literary character or relevant problem portrayed by the interaction of individuals in a written, spoken, or filmed illustrative example. Reading about others with similar experiences may also decrease feelings of social isolation and promote healthy perspective taking.

Openness to psychotherapy varies as a function of many factors, including one's cohort. The issues faced by older adults may also vary, and physical and geographical access to individuals struggling through similar situations may be limited. In summary, bibliotherapy presents a form of psychological treatment that is easily distributed and is often more financially accessible. It can be retained as a useful resource to refer back to, can help connect older adults with others who share similar experiences, and allows the individual to dictate the pace and frequency in which they approach psychological change.

Varying Levels of Administration

The overarching principle of psychologically based self-help programs such as bibliotherapy is that, for some problems, consumers may be able to implement treatments with little or no professional assistance. The goals of psychotherapy and bibliotherapy are generally the same. The difference is largely in the degree to which professional involvement is included in treatment. One conceptualization has been that professional involvement exists on a continuum. This continuum ranges from traditional psychotherapist-administered psychotherapy (with no self-help augmentation) to entirely self-administered treatment (typified by the purchase of written or DVD materials that are implemented with no therapist assistance). Most of the evidence-bases exist around the midpoint of this continuum and are concerned with the effects of minimal-contact or guided self-help and therapist-administered self-help (defined further below).

Though the categorical definitions of self-help can vary, three broad categories are likely the most common descriptive derivations in use today (Glasgow and Rosen 1978). Varying in the degree of professional, or colloquially stated, therapist assistance, these three categories outline important aspects of bibliotherapeutic delivery and are therefore useful keywords to implement when searching for, or publishing, research in this area. In *therapist-administered self-help*, the psychotherapist or trained professional plays their most active role in treatment process. For example, clarification of and elaboration on materials by the psychotherapist would be administered in conjunction with self-delivered administration of bibliotherapy to facilitate and guide treatment throughout. The second category, *minimal-contact self-help*, refers to the psychotherapist or trained professional primarily playing a role in familiarizing the client with materials at the outset and subsequently minimizing their involvement to monitoring the client's ongoing experience with intermittent check-ins. These first two categories fall into guided self-help, which may be delivered in person, over the phone, or via computerized communication (e.g., e-mail communication, website or computer program-delivered guidance, or smartphone applications). Conversely, s*elf-administered self-help* refers to interventions which rely on client or patient administration, without the benefit of a trained professional or psychotherapist's introduction to self-help materials. The evaluation of treatment effectiveness is then, most often, limited to assessment-driven contact. This category of self-help is the type that is most often commercially distributed and is the least scientifically evaluated.

Other useful categorizations include didactic versus imaginative materials (Riordan et al. 1996) and individually delivered versus group administration. In some instances, the use of self-help materials may play a role in a stepped-care approach, or approach where a client's first introduction to treatment efforts begins with self-administered self-help materials. An individual's treatment and care is then "stepped up" as needed into increasingly more direct forms of treatment (e.g., check-in calls, telephone-based sessions, in-person sessions). Inversely, self-help programs may be applied in a form of "stepped-down" care. In other words, guided or minimal-contact bibliotherapy could be utilized as psychotherapists move toward termination and progressively extinguish a client's reliance on in-person sessions and encourage self-efficacy in self-care. In this scenario, bibliotherapy could provide personalized evidence that consumers have the skill to select, maintain, and direct positive change independently. In addition to the varying levels of administration, the delivery of self-help materials will likewise vary depending on the preferences of the person, the role of clinical judgment where trained professionals are involved, and the accessibility of the self-help materials.

Modalities of Self-Help

The term bibliotherapy evokes images of written or printed materials. However, as time progresses and technology with it, self-help materials continue to adapt to fit the currently preferred audio formats (i.e., from cassette tapes, to CDs, to podcasts). Visual materials have also been developed to accompany treatment or serve as standalone applications (e.g., workbooks, videos, DVDs). Existing printed materials have been modified to fit our ever increasingly technology-savvy population by transforming workbook pages to online tablets or client workbooks to an audio format (e.g., Shah et al. 2014). Internet-based interventions have arisen and evidence for their efficacy is continuing to grow in the research literature. Even commercially available games (i.e., the Nintendo DS version of *Brain Age*) have been evaluated for their efficacy as a self-help memory training application (Presnell and Scogin 2015). Future directions in research should consider the efficacy of available phone apps aimed at preventative care (e.g., phone apps aimed at preventing the onset of clinically significant depressive symptoms).

Clinicians initiating treatment with new clients should consider the self-help methods currently used by their clients, as well as those implemented before they first sought professional psychotherapeutic treatment. Clinicians and clients alike will need to keep in mind the broad range of self-help modalities (e.g., books, videos, websites), as both may neglect recognizing and categorizing readily available materials as "self-help" (e.g., Weight Watchers, various websites providing psychoeducation on depression). With the advent of the smartphone, the varying levels of administration (i.e., client-administered, therapist-guided, and therapist-administered self-help) can likewise take on a more fluid and nuanced role in mental health treatment and the tracking of treatment progress. Moreover, the speed at which these resources become available to the public surpasses the research base's ability to evaluate their efficacy. With the ready accessibility and near-universal adoption of personal electronic communication devices (e.g., smartphones, tablets), the rate of creation and distribution of self-help materials is expected to be exponential. The following section will discuss current clinical applications of self-help.

Clinical Application of Self-Help

The programs with the greatest evidentiary corpus tend to be those which lend themselves best to self-administration, such as cognitive behavioral approaches (Anderson et al. 2005). The range of self-help applications across the lifespan is quite large and covers much of the territory deemed appropriate for traditional therapist-administered treatments. Materials created and implemented to address issues related to depression and anxiety have received the most extensive review, but areas such as weight-control, sexual dysfunctions, addictive behaviors (e.g., substance abuse, smoking), and less obvious targets such as nail-biting also carve out a place in the literature. Contraindications for self-help and bibliotherapy, primarily based on clinical intuition and not empirical fact, include conditions such as schizophrenia, psychotic depression, and bipolar disorder. Other questionable candidates for self-administered intervention include those with a personality diagnosis, typified by ego-syntonic disorder, who may fail to see the applicability of the materials or have otherwise impeded ability to adhere to a self-directed regimen. For example, a person with narcissistic personality disorder will often perceive their behaviors, feelings, and values as ego aligned (in support of the goals and needs of their ideal self-image) and may see little to no utility for changing their behaviors, feelings, or values. Conversely, a person with a depression disorder (an ego-dystonic disorder) often has a poor self-image and behaviors, feelings, and values that are not aligned with their ideal self and may predispose to attempt the changes and activities outlined in self-help protocols. Client characteristics may also contraindicate the use of self-help programs. Visual ability and literacy or reading skills should be considered, especially when the material is presented in written form.

None of these contraindications preclude a person from pursuing a purely self-administered program. As Lehane (2005), a community psychiatric nurse in Cardiff, succinctly points out, “Book prescriptions are on the increase and general opinion appears to favor this change.” Whether a mental health professional actively incorporates bibliotherapy and self-help techniques into their service repertoire is beside the point. Self-help programs are available, and clients/patients, co-workers, and family members will use them. Unfortunately, there is practically no evidence on the efficacy of entirely self-administered programs. This is due in part to the logistics involved and the understandable reluctance of university IRBs to approve such research. Similarly, selection of evidence-based minimal-contact and psychotherapist-administered programs remains limited, but continues to grow as those in the field turn their interest toward selecting evidence-based treatments (those with randomized control trials establishing the effectiveness of the self-help program in treating or addressing the problem of interest). As a subset of the general population, the evidence for self-help programs targeted toward older adults is similarly limited. Thus, practitioners will need to base their recommendations largely on what is known to work with younger adults.

Individuals will continue to use self-help materials. Thus, psychologists in particular have a continued interest in evaluating the evidence for, selection of, and guidance of self-administered treatments, no matter their form and degree of professional involvement. “Psychologists are in a unique position to contribute to the self-help movement. No other professional group combines the clinical and research experiences that are part of the clinical psychologist’s educational background. Clinical psychologists are skilled in current therapeutic techniques, they have clinical experience and sensitivity, and they have the training to assess empirically the efficacy of the programs they develop. This would represent a most significant and new development in the area of self-help approaches to self-management" (Rosen 1982). As such, familiarizing oneself with the benefits, limitations, and varied administration of self-help therapies is of import to beginning and established psychologists alike.

Used in conjunction with other treatment options, bibliotherapy and related self-help efforts offer cost-benefit opportunities. A plethora of extant self-help materials are commercially available at relatively low cost and may be sifted through in pursuit of extending the reach of the clinician past the therapy room. Non-exhaustive resources (e.g., Norcross et al. 2003, 2013) have been compiled over time in an effort to guide the selection and implementation of bibliotherapy, but selection of material remains largely dictated by the clinician's own familiarity with the material or, by extension, at the recommendation of their peers.

Evidence Base for the Use of Bibliotherapy with Older Adults

In the early 2000s, several systematic reviews were carried out evaluating evidence-based treatments for older adults. Several of these reviews found promising evidence for the continued use and further development and evaluation of bibliotherapies in this context. The review led by Scogin and colleagues was the only review team in a multi-team effort to establish evidence-based treatments in older adults to find bibliotherapy to meet evidence-based treatment criteria (Scogin et al. 2005). Specifically, though behavioral bibliotherapy and Internet-based cognitive behavioral therapy were deemed as promising (e.g., awaiting a second confirmatory controlled experiment), cognitive bibliotherapy was the only form of self-help with enough research for its establishment as an evidence-based treatment for depression. The systematic review led by the evidence-based treatment search for anxiety also found promising evidence for bibliotherapy treatment, but was unable to establish its effectiveness due to limited, controlled-experiment research in this field. These findings highlight the need for continued efforts to establish and evaluate bibliotherapy treatments in the population as a whole and within older adult populations specifically.

Depression

As previously discussed, the methods and interventions used in self-help largely span the same domains as seen in traditional psychotherapy, and cognitive behavioral models (widely defined) tend to be most frequent (a trend also seen in face-to-face delivery of psychotherapy). With respect to older adult clientele and the self-help materials for depression, there are several well-known self-help books that have been marketed and evaluated. Examples include self-administered self-help books with CBT-based models (e.g., *Feeling Good*, by Burns) as well as those that are more behaviorally based (e.g., *Control Your Depression*, by Lewinsohn) and therapist-administered client manuals (e.g., Dick et al. 1996). Additionally, CBT-based models of self-help have also been adapted or newly generated to be distributed specifically within research contexts to address issues experienced by older adults (e.g., improving self-care management in the frail elderly, improving sleep and preventing depression in rural older adults). Though further materials may be indicated in treatment of late-life depression, relatively few have received adequate scientific scrutiny to promote their recommendation beyond that which can be obtained through careful clinical judgment and solicitation of knowledgeable peers.

Anxiety

Meta-analyses suggest that self-help for common mental health disorders (e.g., depression, anxiety) can be just as effective as face-to-face therapy (e.g., Cuijpers et al. 2010). In addition to their documented efficacy, self-help treatments of anxiety, such as exposure and relaxation, have been applied in digital formats. Specifically, Internet-based treatments such as therapist-guided administrations with in vivo exposure (Andersson et al. 2006) and live versus Internet treatment of panic disorder (Carlbring et al. 2005) are on the rise. Instances that tender prime candidates for self-help treatments include situations where motivation to seek, or accessibility of, services is especially impacted. With the rising frequency in which computers, tablets, and smartphones are readily available and pre-existing in a client's accessible environment, the applicability of providing in-home treatments (e.g., exposure and guided meditation from an off-site location) likewise increases. Problematic issues with a depression-related lack of motivation and clinically elevated worry or panic related to leaving one's home (e.g., panic disorder, agoraphobia) may be especially indicated for self-administered or therapist-guided administration. Individuals suffering from these conditions may look to stepped-care approaches and consider self-administered treatment as at their own initiative or at the recommendation of their clinician or concerned family member. Truthfully, many individuals with varying levels of symptom severity may look no further than these commercially or electronically available treatments due to scarcity of, low trust in, or financial inaccessibility of local mental health resources.

Sleep Problems

Sleep problems, which can be treated with cognitive behavioral interventions, require the individual to apply what they have learned in a clinical setting to their sleeping environment. As such, it could be argued that a major aspect of insomnia-related problems lends itself well to various forms of self-help treatments. Specifically, CBT for insomnia (CBT-I) has been evaluated in pure, self-help formats. Comparisons to therapist-guided versions yield favorable outcomes as well. Though therapist-guided methods tend to produce greater positive change, CBT-I self-help methods serve as a viable first-line treatment (e.g., Rybarczyk et al. 2011). Self-administered and minimal therapist-contact CBT-I have also been shown to be effective in older adult populations (e.g., Morgan et al. 2012; Riedel et al. 1995), even in the context of chronic health conditions that likely acerbate the formation and endurance of sleep problems.

Memory Training

Memory or cognitive training is a good fit for various forms of self-administration. The material is largely didactic in nature and involves learning and practicing various techniques. One version of self-administered memory training involves instruction in several mnemonic techniques and has been evaluated in several experiments (Scogin et al. 1985; Woolverton et al. 2001). Techniques presented in this bibliotherapy approach include categorization and chunking strategies, the method of loci, and novel interacting images for remembering names. Self-administered memory training capitalizes on the finding that self-paced learning is optimal for older adults. Given the concern that many elders have for changes they experience in cognition, it is desirable to have multiple modes of training delivery including self-administered versions and variations on presently available technology. Examples of the latter include the "brain training" programs available through the Internet or digital means. Presnell and Scogin (2015) conducted an experiment on the *Brain Age* program and found that it produced direct effects on a speed of processing task but had no evidence of transfer effects to skills not directly trained. This is a finding often reported in the memory and cognitive training arena but serves as a caution that we should be circumspect in claims for the efficacy of these interventions.

Other Areas

In addition to the disorders and psychological well-being areas discussed above, self-help materials have been developed and evaluated by the psychological community. Unfortunately, the evidence base specific to older adults is quite limited in these other areas (e.g., assertiveness, death and grieving, sex) and will not be discussed at length here. Clinicians and other medical professionals in the position of recommending self-help materials are encouraged to solicit guidance from the existing evidence base for adults and cautiously extend their recommendations to older adults while being ever mindful that some mediums of self-help may better match the needs and style of younger cohorts.

Conclusion

Self-help resources should be considered, both for their clinical application and for their obvious continued appeal in community settings.

One need not look further than their local bookstore to find evidence of self-help's popularity. Conversely, one must look a bit further before one finds clinically relevant resources guiding the hand of the psychotherapist or other mental health workers, in selecting and recommending these resources to those we serve. Consequently, the responsibility is upon us to continue the evaluation of the utility, applicability, and efficacy of self-help materials, in their various formats of administration. We must ask ourselves, if we do not take it upon ourselves to apply our training, expertise, and clinical knowledge to the assessment of these materials, which qualified other will?

Cross-References

- ▶ Anxiety Disorders in Later Life
- ▶ Behavior Modification
- ▶ Cognition
- ▶ Cognitive Behavioural Therapy
- ▶ Insomnia and Clinical Sleep Disturbance

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Bipolar Disorder in Later Life

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Synonyms

Bipolar affective disorder; Manic depression

Definition

A chronic affective disorder characterized by major depressive episodes, mild elation (i.e., hypomania), irritability, or extreme elation (i.e., mania).

Bipolar Disorder

Bipolar disorder (BD; previously known as *bipolar affective disorder and manic depression*) is a chronic affective disorder that affects nearly six million American adults. Classified as a mental disorder by the American Psychiatric Association (APA), BD is characterized by extremes of mood. Although nearly everyone experiences mood variability, people with BD experience very profound shifts in mood (e.g., periods of clinical depression, mild elation [hypomania], or extreme elation [mania] or irritability). The condition is both complex and heterogeneous; an individual with BD can experience symptoms of depression, mania (elated mood), hypomania, or psychosis, or indeed experience combinations of each in varying sequences. Moreover, those with BD may rapidly cycle between these states.

Despite advances in treatment and management, BD remains highly debilitating and can have a profound and deleterious effect on health and quality of life (Murray and Lopez 1997). The World Health Organization (WHO) estimates that BD is the sixth leading cause of disability worldwide, making it a serious public health concern in the USA and abroad. For instance, up to 15% of people with BD will commit suicide (Goodwin and Jamison 2007). Even optimal medication management fails to forestall all mood episodes; the course of BD is typically characterized by high rates of relapse. Longitudinal study findings suggest that 37% of persons with BD prescribed mood stabilizers will relapse within 1 year, 60% in 2 years, and 73% over 5+ years; moreover, psychosocial functioning often remains compromised even when individuals are euthymic (i.e., in neither depressed nor manic state; (Goodwin and Jamison 2007)).

Given its debilitating effects, BD has been deemed the most expensive mental health diagnosis in the USA (Peele et al. 2003). The estimated annual cost of BD is over $45 billion in the USA, with treatment alone costing approximately $5000 per patient (Hirschfeld and Vornik 2005); however, the majority of the economic burden typically arises from indirect costs such as lost productivity and absenteeism. Compared to those with unipolar depression, the relative impact of BD versus unipolar depression indicates that persons with BD have lower income levels, higher mental health disability days, and self-reported job insecurity (McIntyre et al. 2008). Despite these difficulties, there is also evidence demonstrating that people with BD can identify ways to live well and experience good quality of life. Generally, this requires more than pharmacology alone (Suto et al. 2010).

Psychosocial research on BD is nascent (Thomas 2010). Although many persons with BD are living to older adulthood for the first time in human history, there is a paucity of knowledge about the course of BD in later life. There is some evidence suggesting that BD becomes less prevalent with age yet still accounts for the same percentage of psychiatric admissions. Existing research on symptom intensity and variability with older adults with BD has been conducted largely with small samples.

Prevalence of BD in Later Life

Community surveys have suggested that the prevalence of BD among adults 65+ years of age is between 0.1% and 0.5% (Hirschfeld and Vornik 2005), yet these percentages are likely underestimates. For instance, older adults residing in assisted living were not included. Within mental health settings, however, bipolar disorder remains a common diagnosis for older adults accounting for between 8% and 10% of all psychiatric diagnoses (Depp and Jeste 2004).

There are a number of reasons that BD may appear less prevalent in later life. Higher rates of suicide among younger individuals with BD may reduce the number of persons surviving into older adulthood.

Characteristics of BD in Later Life

Some have suggested that BD symptoms decrease in intensity over the life span (Kraepelin 1921) yet intervals between depressive and manic episodes may shorten with age. As the age of BD onset is generally between 20 and 25 years, the majority of older adults with BD have lived with the disorder for many years. The impact of BD may change over time as individuals develop effective self-care behaviors; however, kindling theory proposes that with each mood episode, the brain becomes more deficient in its ability to manage shifts in mood, increasing the frequency and intensity of BD symptoms over time (Post et al. 1986).

A small percentage of those with BD experience their first manic or depressive episode after the age of 50. There are important differences between those with early-onset versus late-onset BD. For instance, persons with late-onset BD are more likely to have a history of sustained employment or be in a relationship at the time of diagnosis increasing the likelihood of successful functioning across domains. More commonly, however, those first diagnosed with BD in later life have gone undiagnosed or misdiagnosed for years or decades.

Existing research suggests that older adults may experience less severe symptoms of mania compared to younger adults (Young and Falk 1989). There is also evidence that community-dwelling older adults experience more symptom-free days (Calabrese et al. 2003). Despite this limited evidence for reduced symptoms, older adults with BD often have additional medical costs, which might, in turn, complicate BD care management in later life. For example, older adults with BD are at higher risk of both diabetes and cardiovascular disease compared to those without a mental health condition (Kilbourne et al. 2004). Moreover, poor health habits such as smoking and physical inactivity are common among older adults with BD. Research also suggests that approximately half of older adults (60+ years of age) with BD display significant cognitive impairment when euthymic (Gildengers et al. 2004). This may further complicate care management and treatment adherence. What remains unknown, however, is whether cognitive impairments such as dementia progress at an increased rate for individuals with BD. Other medical conditions common to later life such as stroke, brain tumors, and multiple sclerosis may mimic symptoms of bipolar disorder.

One important finding that appears to distinguish older adults with BD is a reduced likelihood of substance use disorders. Substance misuse with BD is a common means of self-medication. Whereas the prevalence of substance use disorders may be as high as 60% for younger adults with BD, substance misuse may be as low as 20–30% with older adults (Cassidy et al. 2001). Substance use disorders exacerbate BD-related disability.

Treatment of BD in Later Life

The efficacy of BD treatments in the second half of life has not been widely studied (Thomas 2010). In clinical settings, treatment recommendations for older adults with BD are derived largely from studies of younger and middle-aged adults. Yet there are important physiological and psychological changes that occur over a person's lifetime that may limit the effectiveness of various BD treatments.

Pharmacotherapy is the primary treatment for older adults with BD, yet some medications pose challenges for this population. Although anticonvulsant medications are commonly prescribed, lithium carbonate remains a common mood stabilizer. Yet age-related decline in kidney functioning reduces the rate of elimination from the body, and lithium has been shown to negatively affect kidney functioning. Moreover, other medications commonly prescribed in later adulthood can interfere with the body's ability to process lithium.

Antidepressants are also commonly prescribed for older adults with BD as well as anxiolytics for those with comorbid anxiety disorders. Antipsychotic medications are commonly prescribed for those with BD who experience psychosis. For older adults with cognitive loss, however, these medications increase the risk of stroke.

Beyond pharmacological treatments, electroconvulsive therapy (ECT) has also been used effectively with older adults whose mood episodes are mostly depression. Given that memory loss is a common side effect, special consideration must be taken for older adults with cognitive loss. Psychotherapy can be used in conjunction with the above methods, yet few psychosocial interventions for BD have been adapted or validated for older adults.

Conclusions

It is clear that aging with bipolar disorder presents many unique challenges. As the aging population continues to grow, these challenges will pose greater burdens on individuals and the medical community at large. Despite its highly debilitating and costly nature, little is understood about BD in later life. As a result, the management of BD symptoms for older adults remains deficient. In order to fill this gap, additional research is needed on the course and characteristics of BD in later life, particularly the potential interference of other medical conditions. As little knowledge has been accumulated regarding treatment of BD in old age specifically, this is an additional area that requires attention in both research and clinical domains. Alternatively, more research is needed on the positive aspects of aging that may contribute to BD management. Our understanding of BD would be greatly enhanced by a more complete life-span perspective on this mental illness.

Cross-References

- ▶ Comorbidity
- ▶ Depression in Later Life
- ▶ Schizophrenia and Other Psychotic Disorders in Older Adults
- ▶ Suicide in Late Life

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Blue Zones

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Synonyms

Longevity Blue Zone (LBZ)

Definition

The term *Blue Zone* (BZ) refers to a rather small, homogenous geographical area where the population shares the same lifestyle and environment and its exceptional longevity has been scientifically proven. To date, four regions have been identified around the world as possessing the requirements to achieve *Blue Zone* status. They are located in Okinawa, Sardinia, Costa Rica, and Greece.

Blue Zone or, to be precise, *Longevity Blue Zone* (LBZ) is a term coined in 2000 by the Belgian demographer Michel Poulain and the Italian physician Gianni Pes in the context of age validation of centenarians in Sardinia, and it was used for the first time in 2004 in an article published in *Experimental Gerontology* (Poulain et al. 2004). Initially the term was given to a mountainous area located in the central-eastern part of the Mediterranean island of Sardinia, where the two scholars had found a population with exceptional longevity. Although longevous individuals exist in all parts of the world, in this area Poulain and Pes identified a cluster of villages with an outstanding number of centenarians and they named it *Blue Zone* simply because a blue felt-tip pen was used to draw the first longevity map. The LBZ concept defined above is related to *population longevity* and contributes to defining a new paradigm in the research on longevity determinants. By studying a population that shares the same lifestyle within the same environment and enjoys an extraordinary life-span, the search for longevity determinants could be facilitated. The LBZ concept was later popularized by the American journalist Dan Buettner through the article he published in the *National Geographic* on exceptional longevity in Okinawa, Sardinia, and Loma Linda (USA) (Buettner 2005). Since 2006, Buettner has collaborated with the two scholars and organized expeditions to Costa Rica and Greece where they identified the existence of two other LBZs (Buettner 2008). At present, four LBZs have been validated worldwide: (i) Okinawa, the southernmost island of Japan; (ii) an area covering 14 villages in Ogliastra and Barbagia in the mountainous zone of Sardinia; (iii) an area including five *cantons* within the Nicoya Peninsula of Costa Rica; and (iv) the island of Ikaria in Greece.

The first and most important problem that must be faced with regard to these LBZs is to ascertain age authenticity of the oldest members of these exceptionally longevous populations. In actual fact, in the past the existence of longevous populations stimulated the collective imagination but belonged far more to folklore than to documented history and stringent validation rules, and none of these early alleged longevous communities were confirmed after thorough scientific investigation (Mazess and Forman 1979). The oldest members of these populations were often the subject of misreporting or exaggeration of their age. Many alleged cases of exceptional longevity examined in Russia, the Caucasus, China, Pakistan, and the Andes were later invalidated through careful demographic investigation (Garson 1991). To be specific, the validation of populations with a longevity level that can be statistically shown as higher than the values usually found elsewhere requires the availability of historical registers, such as birth and death records which can prove, with the greatest accuracy and completeness, the age of the members of the populations under investigation. Validation of the exceptional population longevity characterizing an LBZ is based on conventional individual age validation, as well as on a careful choice of demographic indices that reliably reflect the remarkable survival of community members as a whole (population longevity). To meet these requirements is often challenging, and this may explain why research on longevous populations has only progressed recently and solely where the required documental sources do exist. It is crucial that age be accurately verified before any attempt is made to ascertain the possible determinants of such exceptional longevity.

Currently, the populations of each of these four LBZs are being studied by several groups of researchers aiming to trace the determinants of this phenomenon. When seeking population longevity determinants, the relevant characteristics or behaviors are those shared by a large part of the population. By considering these common characteristics, the chance of finding more powerful explanatory variables is increased as most of the people concerned were born and live in the same place and are thus more likely to share genetic makeup and early life conditions, as well as traditional behaviors and habits, including the consumption of the same locally produced food. By studying the various LBZ populations, therefore, identification of the causal factors of longevity might be enhanced. As a rule, aging successfully is a multifactorial achievement that implies avoiding diseases and maintaining a high standard of functional and cognitive performance. In the following paragraphs, the main characteristics of these areas, in terms of genetic structure, ethnicity, and lifestyle, are briefly described and a summary given of the features shared by these populations.

Okinawa

Okinawa is a group of some 160 islands which form the southwesternmost part of Japan's 47 prefectures. There are currently 934 centenarians in Okinawa out of a total population of 1.37 million inhabitants (2015). In Japan, women of Okinawa show the highest life expectancy at birth among all prefectures (87.15 years in 2010–2013). Special attention has been devoted to validation of the individual ages of the oldest people in order to ascertain exceptional longevity in Okinawa (Willcox et al. 2008; Poulain 2011). Since 1976, the Okinawa Centenarian Study has investigated the causes of the exceptional longevity of the islanders, attributing an essential role to genetic, dietary, climatic, cultural, and social factors, although it is likely that the real explanation lies in a combination of all of these. Okinawans are genetically distinct from the Japanese, and even show some of the features of a genetic isolate, a condition that may have reduced their genetic pool variability and favored life extension (Bendjilali et al. 2014). Moreover, traditionally, Okinawans practiced a high rate of endogamy (i.e., marrying within the limits of one's local community); this would have increased the inbreeding coefficient and may possibly have caused the genetic variant related to longevity to be selected. A study revealed that siblings of Okinawan centenarians have 2.58 times (females) and 5.43 times (males) more likelihood of reaching the age of 90 compared with their age-matched birth cohort of the same area (Willcox et al. 2006). Specific HLA DR1 polymorphisms have been found in Okinawan centenarians that may reduce the risk of inflammatory and autoimmune diseases (Takata et al. 1987). Apart from the influence of genetic factors, the role of environmental (e.g., low level of pollution) and lifestyle factors has also been explored. Sociocultural and psychological factors, in particular the degree of social integration of elderly people and the excellent quality of intergenerational relationships, physical and cognitive functions, and sleep habits, especially the frequency of naps (Uezu et al. 2000), have been considered beneficial. In addition, environmental conditions seem to be important, such as climate, agriculture, and other occupational activities (Robine et al. 2012). A considerable amount of research has addressed the relationship between diet and longevity in Okinawa. A reduced calorie intake (60% of the average Japanese diet) has been claimed to be responsible for longer survival of Okinawans, probably due to reduced mortality from cardiovascular diseases, diabetes, and cancer (Willcox and Willcox 2014). The lower calorie intake is believed to be at the origin of the lower body mass index and shorter stature of Okinawans. Traditionally sweet potato, a good source of trace elements and vitamins, accounted for up to 93% of the staple diet, a percentage far superior to that of the rest of Japan. Other allegedly longevity-promoting foods are green and yellow vegetables, soy products, fish, and moderate amounts of meat, usually goat and pork (Willcox et al. 2014). However, it is clear that in Okinawa, the post-war generations have largely modified their diet, replacing sweet potato soup with rice and meat under the influence of mainland Japan and US cultures (Todoriki et al. 2004). Due to globalization, these post-war generations have largely *westernized* their lifestyle, thus recently causing a drop in Okinawa's ranking among the Japanese prefectures in terms of life expectancy.

Sardinia

Validation of the age of Sardinian centenarians (Poulain et al. 2006) revealed exceptional longevity and unexpected gender equality and resulted in the identification of the Sardinian LBZ, a cluster of 14 villages nestled around the highest mountain of the island, with their epicenter in the village of *Villagrande Strisaili*, where men have been found to live as long as women (Poulain et al. 2011). Various hypotheses have been put forward to explain exceptional longevity in the Sardinian LBZ (Poulain et al. 2011; Pes et al. 2013). This population remained isolated for centuries, which contributed to the stabilization of its gene pool (Cavalli-Sforza 2000) and the respective preservation of sociocultural and anthropological features throughout its history. Considering the characteristics of this genetic isolate, as well as the low gender ratio among Sardinian oldest people, several genetic association studies have been performed on Sardinian centenarians, using markers already known to be associated with longevity in a gender-sensitive manner. They include Y chromosome SNP (Passarino et al. 2001), genetic markers associated with cardiovascular mortality, cancer, and inflammation (Pes et al. 2004; Lio et al. 2003). However, in terms of frequency, none of these markers have been shown to diverge significantly from that of the general population, thus the relative importance of genetic factors in Sardinian longevity still remains unknown. Among the non-genetic factors that might be important to account for the exceptional longevity recorded in central Sardinia and the low female/male ratio among the oldest people, the role of physical activity and nutrition has been the subject of recent research (Pes et al. 2013). The role of traditional foods, influenced by the widespread practice of cattle breeding, typical of a society centered on pastoralism, was investigated by means of historical studies (Pes et al. 2014). In addition to any hereditary factor, growing interest has emerged in the role of behavioral factors and the sociocultural context in successful aging of the Ogliastra population. These studies, based on measuring self-referent metacognitive efficiency, subjective wellness, and depression, have revealed that the elderly in central Sardinia self-rated lower levels of depression and cognitive impairment and had greater levels of emotional competence (Fastame and Penna 2014). It will be necessary to await the results of further research to better understand the role of gene–environment interactions as well as epigenetics.

Nicoya

The population of the Nicoya Peninsula in the northwestern region of Costa Rica shows an overall mortality rate 20% lower than that of the rest of the country, whereas life expectancy at age 60 is 24.3 years for men and 24.2 years for women, compared with 23.6 years for both genders combined in the rest of Costa Rica. This remarkable situation, pointed out by Rosero-Bixby (Rosero-Bixby 2008), aroused some suspicion among demographers as it is usually assumed that longevity increases with economic development, and Costa Rica is still a developing country. Among centenarians, the female/male ratio is close to 1, whereas in most developed countries, it is usually higher. The results of the Costa Rican Longevity and Healthy Aging Study (CRELES, or *Costa Rica Estudio de Longevidad y Envejecimiento Saludable*), which took into account some biomedical markers, showed that the average height of the inhabitants of Nicoya is greater than that of the general population of Costa Rica, and their body mass index is lower, as is the prevalence of physical and mental disability (Rosero-Bixby et al. 2013). From the biological and genetic point of view, telomere length was found to be greater in the inhabitants of Nicoya than in the general population of Costa Rica (Rehkopf et al. 2013), which, however, as reported by Cassidy in 2010 (Cassidy et al. 2010), could also depend on lifestyle-related factors, such as stress and daily physical activity, and not merely reflect the individual's genetic makeup. The diet of the Costa Rica Blue Zone inhabitants is based on low-glycemic-index traditional foods including rice, beans, fish, beef, pork, and chicken and is high in fiber (Rosero-Bixby et al. 2013). Some environmental factors may also be relevant for the longevity of Nicoya: drinking water in the region has a high calcium content that might have exerted a protective effect against cardiovascular disease and age-related osteoporosis. Furthermore, the elderly population residing in the peninsula experiences a particularly low level of stress: this finding seems to be confirmed by certain social indicators like the rate of suicide in Nicoya, with the lowest value in the whole of Costa Rica recorded here. Finally, it should be noted that current longevity in Nicoya is also related to improved socioeconomic conditions, an efficient social security system, and free healthcare guaranteed by the government (Rosero-Bixby et al. 2013).

Ikaria

Ikaria, an island in the Aegean Sea inhabited by just over 8,000 inhabitants, has one of the highest life expectancy in Greece and a female/male ratio among the oldest people that is also close to 1. Most of the inhabitants of Ikaria follow a traditional lifestyle involving a local version of the Mediterranean diet, vigorous physical activity, and lack of stress (Siasos et al. 2013). The Ikarian diet includes vegetables, olives, moderate consumption of cheese, and goat milk, with two features curiously reminiscent of those of the Sardinian LBZ: an abundant traditional use of potatoes and relatively low consumption of fish. Perhaps the most striking feature of Ikarians is their widespread lack of stress, as evidenced by their proverbial indifference to money and the accumulation of material goods; their habit of taking naps in the afternoon is also widespread, and according to some research, it might reduce the risk of coronary death (Panagiotakos et al. 2011). As Ikaria is the last LBZ to have been identified, investigations are still ongoing to disentangle the role of possible factors underlying its longevity.

Lessons from the Longevity Blue Zones and Directions for Future Research

The various LBZs offer an example of how successful aging can be achieved by a significant number of members of a community. The criteria for any candidate LBZ population must, however, be very stringent and not merely based on the emergence of some sporadic cases of exceptional longevity. Genuine LBZ represent indeed a new scientific paradigm that may prove to be particularly fruitful in testing the association between longevity and various potential explanatory factors. At the present state of the research, the number of potential factors behind a complex trait like population longevity is from the start very large, although it is hoped that a core of major *longevity* *determinants* present in these populations may be identified more efficiently. As for the genetic aspect, it should be noted that some LBZ populations have undergone long periods of isolation due to their geographical location or for cultural-historical reasons. Thus, through mechanisms such as inbreeding and genetic drift, specific genetic variants causing longer survival could have been selected. Moreover, the insularity or near-insularity of most LBZs could explain the delay in socioeconomic development at the beginning of the capitalist era and may have been the cause of the lower per capita income compared with the reference population. This economic insecurity mostly disappeared during the last century when all LBZs experienced relative high-quality life and improved availability of health services without losing the benefits of their traditional lifestyle. This is particularly evident in the case of diet, which until recently was dependent on local production and favored foods with low-calorie-density but higher in nutrients (Willcox and Willcox 2014). Besides, although Calorie Restriction with Optimal Nutrition (CRON) – currently considered the only diet that promotes longevity – was hypothetically included among the longevity-associated factors in some of the LBZ populations like Okinawa, in other LBZs there is no compelling evidence that it has been a constant feature in the history of these populations. It is probable that the quality of foods, rather than the amount of food itself, has exerted a role in maintaining high health standards in these populations. Moreover, the traditional diet could have acquired more positive aspects during nutrition transition (Pes et al. 2014). The delay of economic development in the LBZ, implying low mechanization in agriculture, could have promoted a more active lifestyle in the population, stimulating considerable energy expenditure during outdoor activities and occupational work. The prevailing attitude observed in the LBZ is of collectivist and egalitarian communities rather than individualistic, which in the past may have reduced competitiveness between social classes and limited average stress levels, and may have delayed the onset of age-related diseases. This attitude is reflected in the psychological solidarity observed in most LBZ inhabitants: these people show a strong sense of their role within the community and strong self-esteem, which might help them to feel a part of society until the end of their existence (Poulain et al. 2013). This has undoubtedly contributed to reinforcing family ties and to the awareness of the most fragile members of the community that they can rely on a network of social support that is still efficient. In the LBZ, the elderly are generally well integrated into the community and cared for by close family relatives (usually a spouse and children) until late in life, thereby experiencing meaningful emotional contacts across generations.

LBZ research is still developing, and a multidisciplinary strategy alone will help to disentangle the complex phenomenon of exceptional longevity, and in particular to address the classic nature-nurture dilemma. From a biomedical perspective, genetic and epigenetic research must be increased, although the relatively small number of LBZ inhabitants makes this strategy difficult. More attention should be devoted to possible gene-environment and gene-nutrition interactions. From a demographic standpoint, a possible extension of the number of LBZ and in-depth analysis of each of them, also including the genealogical reconstruction of large longevous communities, may increase understanding of the characteristics of these rare populations and may enable longevity theories to be tested with greater statistical power (Poulain et al. 2013). It can be concluded that LBZ have gradually changed from being the focus of simple anthropological curiosity to being an effective model of healthy aging that could be followed by the post-industrial societies of the twenty-first century, too, to meet the challenge of the growing elderly population and consequent substantial healthcare costs.

Finally, a theoretical issue that concerns the nature of LBZ is their temporal evolution. Since some of the factors supposedly involved in LBZ emergence tend to disappear, it might arise that the phenomenon of population longevity be transitory in itself. In fact, there is some evidence that attenuation of the phenomenon is underway in Okinawa (Willcox et al. 2014), and the same tendency may occur in other LBZ in the future. Besides, the survival advantage disappears in out-migrants from Nicoya, indicating a stronger influence of non-genetic environmental factors (Rosero-Bixby et al. 2013). An interesting aspect is that what LBZ have achieved on a small scale could be transferred to larger human aggregates. It is plausible that the geographic clustering of long-livers currently representing the most salient feature of the LBZ will disappear, leaving average-level, widespread longevity. Future trends will reveal whether what is observed today in the LBZ will persist and even become *commonplace* (Appel 2008).

Cross-References

- ▶ Aging and Quality of Life
- ▶ Aging and Mental Health in a Longitudinal Study of Elderly Costa Ricans
- ▶ Health Promotion
- ▶ IKARIA Study, Greece
- ▶ Rural Health and Aging: Global Perspectives

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Brain Tumors in Older Adults

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Synonyms

Neoplasm

Definition

A brain tumor is a mass of abnormal cells. There are two broad categories of brain tumors. *Primary* brain tumors arise from an abnormal proliferation of cells within the central nervous system (CNS). In contrast, *metastatic* tumors originate elsewhere in the body and spread to the brain and are therefore "malignant" (Blumenfeld 2010). Brain tumors that are "malignant" usually grow rapidly, are life threatening, and have the potential to spread and infiltrate the CNS (Blumenfeld 2010). Brain tumors are thought to be "benign" if they are slow growing, have distinct borders, and do not infiltrate or disseminate widely within the CNS (Blumenfeld 2010). This entry will focus on primary brain tumors and will overview classification, types, incidence, etiology, symptoms (including cognitive disorders), treatments, and prognosis, with particular reference to older adults.

Classification of Brain Tumors

The World Health Organization (WHO) classification of tumors of the central nervous system

(Louis et al. 2007a) is a way of grading the biological behavior or “malignancy.” The WHO grading system is based on the microscopic appearance. WHO grade can be a key factor influencing the choice of therapies, particularly the use of specific chemotherapy and radiation protocols (Louis et al. 2007b; Du Plessis 2005). Grade I applies to tumors with low proliferation potential and the possibility of “cure” following surgical resection alone. Grade II usually applies to tumors that are generally infiltrative and can recur, despite low-level proliferation, and some progress to higher grades of malignancy. Grade III tumors are actively reproducing abnormal cells; they infiltrate adjacent normal brain tissue and tend to recur, often as a higher grade. Grade IV tumors are very abnormal and reproduce rapidly, forming new blood vessels to maintain rapid growth (Louis et al. 2007a, b).

Box 1: Overview of World Health Organization (WHO) Tumor Classification System

- **Grade I:** Tumors with low proliferation potential
- **Grade II:** Infiltrative tumors with potential for low-level proliferation
- **Grade III:** Infiltrative and actively growing tumors that tend to recur
- **Grade IV:** Highly abnormal and rapidly growing tumor

Types of Brain Tumor

The most common type of primary malignant brain tumor, accounting for around 70–80% of patients, is malignant glioma (Omuro and DeAngelis 2013; Cancer Council of Australia 2011). Within the malignant glioma group, the following types and WHO grades have been identified: astrocytoma (WHO Grade I-IV), oligodendroglioma (WHO Grade II-III), ependymomas (WHO Grade I-II), mixed oligoastrocytomas, and other rarer forms (as summarized in Table 1). Astrocytomas grow from glial cells and grow slowly or rapidly. Oligodendrogliomas grow from cells that insulate the nerves (oligodendrocytes). Glioblastoma multiforme or “GBM” (also astrocytoma Grade IV) commonly contains a mix of cell types and is highly malignant. At present, with the advent of new technologies such as next-generation sequencing and proteomics, the classification of malignant gliomas is changing as more information about the molecular changes occurring at each step of the tumorigenesis process comes to light (McKay 2014).

Brain Tumors in Older Adults, Table 1 Abridged summary of the main categories of WHO Classification System (2007) for central nervous system tumors. The most common types in older age groups (>55 years) are indicated in **bold** (Dolecek et al. 2012)

Tumors of the neuroepithelial tissue
Astrocytic tumors
Oligodendroglial tumors
Oligoastrocytic tumors
Ependymal tumors
Choroid plexus tumors
Other neuroepithelial tumors
Neuronal and mixed neuronal-glial tumors
Pineal tumors
Embryonal tumors
Tumors of the cranial and paraspinal nerves
Tumors of the meninges
Tumors of the meningothelial cells
Mesenchymal tumors
Lymphomas and hematopoietic neoplasms
Germ cell tumors
Tumors of the sellar region
Metastatic tumors

Meningiomas are often WHO Grade I and benign. However, meningiomas can also be malignant, the latter tending to be of a higher WHO Grade (II or III) (Dolecek et al. 2012).

Incidence and Age

The median age at diagnosis for all primary brain and CNS tumors is 59 years, according to the 2005–2009 CBTRUS statistical report for the

United States (Dolecek et al. 2012). With increasing age, meningiomas are the most common type of brain tumor diagnosed, followed by gliomas which peak in incidence at age 65–74 years (Dolecek et al. 2012; Wrensch et al. 2002). Meningiomas have a significantly higher incidence (3.5 times) in individuals >70 years, compared to <70 years.

Etiology

The causes of brain tumors remain elusive. However, there is a slightly *higher risk with increasing age*, being male rather than female and with exposure to ionizing radiation (Cancer Council of Australia 2011). Individuals with rare genetic conditions such as neurofibromatosis type 1 or 2 have a higher risk of developing a brain tumor than the general population (Cancer Council of Australia 2011). The molecular causes of malignant glioma are highly variable between individual patients, even within each subset (Omuro and DeAngelis 2013). In the case of malignant gliomas, such as astrocytomas and oligodendrogliomas, it is characteristic for multiple cell changes to be present at the molecular or DNA level. These may include chromosomal aberrations, single DNA base substitutions of mutations, DNA methylation, or epigenetic modifications. Recently, changes in gene activity that are not caused by changes in the DNA sequence, or epigenetic alterations, have been linked to the formation of cancer (McKay 2014).

Symptoms and Diagnosis

The presenting symptoms of a primary brain tumor are determined by several factors including the tumor's size, location, and rate of growth. Common symptoms include headache nausea/vomiting, changes in cognition and personality, gait imbalance, urinary incontinence, hemiparesis, aphasia, hemi-neglect, visual field defect, and seizures (Omuro and DeAngelis 2013; McKay 2014).

Headaches are relatively frequent, presenting in about 50% of patients at diagnosis, but usually with a nonspecific pain pattern, progressive severity, and unilateral localization. In an individual older than 50 years, a new-onset headache may be indicative of a tumor-associated headache from a benign headache. However, the likelihood of a brain tumor being the underlying cause of headaches is less than 1 in 1000, and new-onset seizures also has extremely low predictive value for indicating the presence of a tumor, being <2% (McKay 2014). Nevertheless, as one example, the current Australian guidelines recommend that a patient with new-onset seizures or recurrent headache uncharacteristic for that patient should undergo brain imaging to establish the cause, particularly if focal neurological symptoms such as dysphasia, hemiparesis, or hemianopia are present (McKay 2014).

Neurological Signs

Changes or disturbance to cognitive functions, or "thinking skills," may develop as a result of brain tumors. Cognitive functions allow an individual to respond to both the demands of the environment and also to their own internal desires and needs. Cognitive skills include the ability to speak, concentrate, remember, reason, reflect, perceive, and understand. Cognitive disorders can occur when the brain is damaged or disrupted, for example, with growth of a brain tumor. Changes in cognitive functions can be interpreted as "personality changes" or can be mistaken for psychiatric disorders or dementia, particularly in older adults (Cancer Council of Australia 2011; McKay 2014). Cognitive difficulties may be a presenting symptom or they may arise during or after treatments such as surgery, radiation, or chemotherapy (see below for further details of cognitive changes).

Focal neurological signs such as hemiparesis, sensory loss, or visual field disturbances are common and typically indicate the tumor location in the brain. Other neurological signs that arise usually in larger tumors that cause mass effect or displacement within the brain include gait imbalance and incontinence.

Brain Imaging

Imaging of brain tumors is first to diagnose or confirm a suspected diagnosis. Secondary to this is precise localization and characterization to inform further treatment and/or management (Cancer Council of Australia 2011). Computed tomography (CT) and magnetic resonance imaging (MRI) are currently the main brain tumor diagnostic imaging techniques.

MRI has largely replaced CT scanning in the management of patients with brain tumors, with CT only used in initial imaging and in monitoring acutely changing neurological symptoms. When evaluating non-enhancing tumors, MRI has the benefit of being more specific and sensitive than CT. MRI imaging modalities include MR spectroscopy, perfusion imaging, and diffusion scanning. These MRI techniques are beneficial in differential diagnosis of high-grade gliomas, such as anaplastic astrocytoma and anaplastic ependymoma, primary CNS lymphoma, metastatic tumors, brain abscess, and other neurologic processes (McKay 2014). Although both MRI and CT imaging techniques reveal structural information, they are limited in providing information about the tumor itself in terms of biology and activity.

Molecular imaging with positron emission tomography (PET) has recently been used in brain tumors. PET provides the ability to ascertain additional metabolic information that can be helpful for patient management as well as for evaluating the indication of other therapeutics (McKay 2014). For example, there are several benefits to using PET with radiolabeled glucose and amino acid analogues such as MET or 11C-methionine. In particular, this form of PET can help with the following: tumor diagnosis, differentiation between recurrent tumors and tissue death due to radiation, and guiding a biopsy or treatment. In recent years, fluorinated amino acid tracers such as FET, or [18 F] Fluoroethyl-l-tyrosine, have also been used to guide treatments including surgery in patients with primary brain tumors.

Prognosis

The survival time after treatment can vary and depends on several factors including tumor type and grade, location of tumor within the brain, gross total tumor resection, age, and general health preoperatively, which is often indicated by the Karnofsky Performance Status score (Chaudhry et al. 2013). However, negative predictors and generally poorer prognosis are indicated if an individual is *older* (>60 years), the tumor is *high-grade*, resection is incomplete, and the tumor location is crossing the midline or is within the periventricular region of the brain (Cancer Council of Australia 2011). Although recent advances in treatments using combined chemotherapy and radiation, post-resection (Stupp et al. 2005), suggest increased survival, in general, glioblastoma multiforme (GBM) has the poorest survival in all age groups. Further, within any brain tumor type, *older adults have poorer survival rates than younger individuals* (Wrensch et al. 2002).

Treatments

The approaches to primary and metastatic brain tumor treatment are based on the histology and grade of the tumor, as well as the age and medical condition of the patient. The options for treatment include surgical resection, radiation, and chemotherapy either alone or in combination. In addition, for some tumor types or depending on a patient's general condition and age, a conservative approach of "watch and wait" is taken (Rosenfeld and Pruitt 2012). Although not yet a standard practice, increased knowledge about the molecular biology of tumors, the microenvironment of tumors, and immunologic interactions and how these relate to treatment response will lead to new personalized treatment regimes (Omuro and DeAngelis 2013; Rosenfeld and Pruitt 2012).

An important factor in improving brain tumor patient outcomes is receiving centralized care with a team of specialized health professionals (McKay 2014), which is similar to the benefit of care in an organized and centralized stroke unit when compared to a decentralized team. For primary brain tumors, analysis of surgical resections or biopsies identified that large-volume centers had lower postoperative mortality rates than centers with smaller numbers of patients.

Surgery

Surgical resection is often the first line of medical management for benign and malignant tumors, including meningiomas and gliomas that are the most common types in older adults. Thus, for benign meningiomas tumor, resection is standard, and for higher WHO grade II and III meningiomas, surgical resection and postoperative radiation therapy are recommended to increase the likelihood of reducing recurrence rates. For more aggressive high-grade gliomas, resection with combined radiation and chemotherapy has become a standard care.

In adults over the age of 60 years, surgical resection of meningiomas carries with it a higher risk of mortality and morbidity compared to intracranial tumor surgery in general (Konglund et al. 2013). Specifically, a large study of inpatients following tumor resection ($N = 8861$; 26% older persons >70 years) revealed a marked effect of older age on each of the primary outcomes. Thus, inpatient mortality rate was higher in the older patients, as well as discharge rates to a facility other than home, and older persons were more likely to have a longer inpatient hospital stay (Bateman et al. 2005). In addition, postsurgical complications in older adults have been reported to include hematomas, deep vein thrombosis, and neurological symptoms. Although the medical management for patients with life-threatening tumors is clear in that surgical resection is necessary, the increased risk of complications for individuals >70 years must be weighed against the expected positive outcomes (Bateman et al. 2005). The benefits of meningioma resection can be measured in terms of improved cognitive function on neuropsychological tests and adequate quality of life, as measured by functional independence scales like the Karnofsy performance scale (Konglund et al. 2013).

Radiation and Chemotherapy

For malignant brain tumors such as glioblastoma, radiation therapy is the treatment of choice. Whole brain radiation has been commonly used until the last decade during which time the use of stereotactic radiosurgery (SRS) has become increasingly common. The advantage of stereotactic radiosurgery is that, via this image-guided method, a precise radiation dose can be delivered, which has the potential to reduce treatment time and toxicity. Moreover, preservation of neurocognitive function is more likely with targeted rather than whole brain radiation.

As noted above, the current standard of care for the medical management of primary brain tumors and in specifically glioblastoma includes radiation treatment combined with the alkylating agent temozolomide (TMZ), followed by 6 months of adjuvant TMZ (McKay 2014; Stupp et al. 2005). In a 2005 clinical trial, this regime was found to significantly prolong survival (Stupp et al. 2005). However, the benefit of TMZ is fairly modest with a median overall survival 12.1 months for radiation treatment alone compared to 14.6 months for radiation combined with TMZ (Stupp et al. 2005; Quant and Wen 2010). New therapies, including immunotherapy, vaccines, and the use of nanoparticles, are emerging methods of medical management.

Immunotherapy

A relatively recent therapy is based on the role of immune cells in regulating tumor progression. Each tumor has its own unique set of genomic and epigenomic changes, which can influence the host immune response to tumor. Active immunotherapy relies on stimulation of the patient's immune system to increase the immune response to target tumor cells. To this end either the entire immune system can be boosted or the immune system can be trained to attack the tumor (McKay 2014). McKay and Hadfield recently summarized the three broad categories of immunotherapy strategies:

(i) *Immune priming (active immunotherapy)*, or sensitization of immune cells to tumor antigens using various vaccination protocols
(ii) *Immunomodulation (passive immunotherapy)*, which involves targeting cytokines in the tumor microenvironment or using immune molecules to specifically target tumor cells

(iii) *Adoptive immunotherapy*, which involves harvesting the patient's immune cells, followed by activation and expansion in the laboratory prior to reinfusion

Although this line of treatment is potentially valuable, it has been hampered by factors such as the blood–brain barrier and lack of lymphatic drainage in the brain (McKay 2014).

Cognitive Disorders: Detection, Assessment, and Management

Changes in thinking, behavior, or emotion are quite common in primary and metastatic brain tumors. This section will give an overview of the importance, causes, and types of cognitive disorders and current methods for detection, with examples of practical tips for managing cognitive difficulties.

Cognitive function is an independent prognostic factor in the survival of glioma patients (Taphoorn and Klein 2004). Moreover, cognitive assessment is useful for several reasons: to inform clinicians of areas to target for neurorehabilitation; to monitor progress and facilitate decision-making about further intervention; if there has been a decline in cognitive function, to ask whether the tumor has recurred or progressed; and if there are subtle alterations in cognitive function, to address whether these are significant or not, particularly when monitoring slow-growing low-grade gliomas (Robinson et al. 2015).

Disturbance to cognitive function in the context of a brain tumor can be due to the location and size of the tumor, prognosis (benign or malignant and WHO grade), treatment (surgery, radiation, chemotherapy), secondary medical complications of treatments, and also an individual's psychology response (anxiety, depression) (Cancer Council of Australia 2011).

Cognition and Aging

An additional factor in older adults is the nature of aging itself. With increasing age, there is a disproportionate loss of both white and gray matter particularly to the frontal regions of the brain (Resnick et al. 2003). The frontal cortex is associated with complex thinking and adaptive behavior also known as "executive functions." In addition, age has been found to exacerbate executive dysfunction in patients with focal frontal lesions, such as a brain tumor in the frontal cortex (Cipolotti et al. 2015).

Overview of Cognitive Disorders

- *Aphasia and language*: A disorder of language that can affect speaking (expressive aphasia) or understanding (receptive aphasia) or both (global aphasia). The most common language disorder affects the ability to retrieve words or names of objects, people, or places (nominal aphasia). In subtle forms of aphasia, an individual may have difficulty thinking of what they want to say (dynamic aphasia). Literacy and numeracy disorders are termed *dyslexia* when the problem is with reading, *dysgraphia* when the problem is with spelling, and *dyscalculia* when arithmetic difficulties are present.
- *Amnesia*: This is a disorder of memory that can affect personal memories (autobiographical memory), learning new information (episodic memory) or general knowledge about the world (semantic memory). Amnesia can affect verbal or visual information (selective amnesia) or both (global amnesia).
- *Agnosia*: This is a disorder of perception and can be present in any form of sensation (e.g., touch, taste, hearing, smell, and vision). The most common form is visual agnosia, that is, when someone does not recognize what they are looking at with their eyes or they have difficulty knowing exactly where something is in the surrounding environment.
- *Attention and concentration:* Disorders of attention and concentration are common in any condition affecting the brain. Difficulties can be in focusing attention or in sustaining attention over time. Problems can manifest as distractibility or impulsivity.
- *Executive dysfunction*: Executive functions are comprised of many different abilities, including problem solving, reasoning,

decision-making, judgment, initiation of behaviors, monitoring and self-regulation of behaviors, abstract thinking, and strategic thinking. These skills can be disturbed separately or several executive functions may be affected. These are the abilities that enable an individual to adapt their behavior in order to respond and interact appropriately in any situation. The executive abilities are uniquely human and especially vulnerable to the aging process.

- *Speed of information processing*: When information processing is disturbed, thinking can be slowed down and other cognitive skills can be affected as the amount of information processed may be limited.

Detection and Management of Cognitive Disorders

A significant issue in brain tumors is the method for detection of cognitive disorders. The most widely used method is cognitive screening tools such as the mini-mental state examination (MMSE) or the Montreal Cognitive Assessment (MoCA). However, recent studies have shown that, although the MoCA is better at detecting cognitive deficits than the MMSE, the MoCA fails to detect mild and/or focal cognitive deficits in patients with brain tumors (Robinson et al. 2015). This is particularly for attention, language, and executive functions. Thus, best practice is to assess cognitive disorders with a brief cognitive assessment that is tailored to a patient based on tumor location and presenting neurological and neuropsychological symptoms (Robinson et al. 2015).

Simple strategies can help minimize the impact of cognitive disorders. Detailed strategies can be obtained from specialists in neuropsychological rehabilitation. However, see Box 2 for simple handy tips when experiencing thinking problems.

Box 2: Examples of Handy Tips for Thinking Problems

- **Stimulation:** Reduce background noise in the environment to limit the amount of information to be processed. For example, turn off the television or radio unless watching or listening to a program.
- **Memory:** Use technological supports like a smartphone, calendar, or notebook to remember appointments and important information.
- **Fatigue:** If easily fatigued, plan activity in “intervals,” i.e., activity interspersed with rest throughout the day.
- **Words:** If names of people or things are difficult, ask someone to give the name (rather than guess), repeat it aloud, and/or write down important names.
- **Problem solving:** When planning an activity or how to complete a complex task, break it down into steps and then order the steps and complete these.

General Summary

Age poses an increased risk of developing a primary brain tumor, from the age of 55 years but particularly for those over 65 years of age. The most common types of tumors in older adults are meningiomas and gliomas. Moreover, prognosis for survival is poorer if an individual is *older* than 60 years. In the context of aging, this is associated with an increased loss of brain volume in the frontal region, impacting complex thinking and adaptive behavior. Older adults are particularly vulnerable for tumors disrupting the frontal cortex. Thus, despite the rarity of primary brain tumors, older adults may experience more postsurgical complications, and they have a poorer prognosis for survival.

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Bridge Employment

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Synonyms

Phased retirement; Work beyond retirement

Definition

Henkens and van Solinge (2014) note that definitions of bridge employment vary along a number of dimensions. It has been defined as participation in the labor force between retirement from full-time work and complete workforce withdrawal (Shultz 2003; Topa et al. 2014). Alcover et al. (2014) suggest that as such bridge employment can be conceptualized as "forms of retirement that prolong working life" (p. 7). As Topa et al. (2014) note, this type of paid employment can be in the "same occupation or different occupations, on a part-time, temporary or full-time basis" (p. 226). Henkens and van Solonge (2014) note that bridge employment can be for an employer or include self-employment. In sum, bridge employment is paid work undertaken after retirement from the main career job but before exiting the labor force completely (Topa et al. 2014).

Introduction

The rapid change to the nature of work and working lives in the past few decades has seen a concomitant transformation of the pathways to workforce exit. Retirement is no longer necessarily a "clean break" characterized by an abrupt departure from the workforce. The transition from work to retirement is now "blurred" and "fuzzy" – retirement is no longer a single discrete event but can be viewed as a dynamic and individual process that may occur over a short period of time in one's life or may include an extensive period of withdrawal and reentry to the paid workforce (Beehr and Bennett 2007; Bowlby 2007). Individuals may reduce their work responsibilities or hours of employment or take on some form of temporary work or limited contract position. Thus "bridge employment" can be characterized as a "transition into some part-time, self-employment or temporary work after full-time employment ends and permanent retirement begins" (Feldman 1994, p. 286).

Conceptualizing Bridge Employment

One way to conceptualize bridge employment is through a life course perspective. Dingemans et al. (2015) argue that life transitions, such as those incurred through bridge employment, do not operate within a vacuum. Rather, individuals are embedded within personal and social environments that shape their life histories and these may hinder or facilitate late-life career choices. Thus, the life course approach suggests that many factors, such as socioeconomic, psychosocial, and health factors, interact to influence the participation in bridge employment.

In their recent work, Zhan and Wang (2015) provide another organizational framework for conceptualizing and theorizing bridge employment. First, bridge employment can be viewed within a decision-making framework as rational planned behavior. That is, employees choose to engage in bridge employment (for numerous reasons) voluntarily. The decision to participate in bridge employment may be made multiple times once the retirement process has been embarked upon, and these decisions may be influenced by personal and contextual factors (Wang and Chan 2011; Zhan and Wang 2015). Second, bridge employment can be seen as a career development stage where employees use bridging opportunities to pursue career goals. Bridge employment may offer the flexibility and autonomy to pursue generativity goals or to fulfill ambitions of self-employment (Zhan and Wang 2015). Third, bridge employment may be regarded as an adjustment process where those intending to retire use bridge employment as a mechanism to adapt to future retirement, both financially and psychologically. Finally, Zhan and Wang (2015) conceptualize bridge employment from the employer's point of view as a function of human resource management processes to attract, motivate, and retain older workers.

Types of Bridge Employment

Bridge employment can be categorized into two types – career consistent bridge employment and noncareer bridge employment. In the first, individuals may stay within the same organization or move to a different organization but will remain in the same occupation. In the second, individuals move to a different field where flexibility is a key criterion and status and pay may be reduced to reflect this (Alcover et al. 2014). This type of bridge employment is thought to be the more common and often involves self-employment as it provides greater flexibility and autonomy compared to salaried positions (Alcover et al. 2014).

Zhan and Wang (2015) note that this typology may not be sufficient to accurately capture the nature of bridge employment and suggest four key criteria that can assist in understanding the complexity of patterns of participation in bridge employment. The first criterion is working field. This reflects the typology described above in that individuals may undertake bridge employment in the same field as their career jobs, or in a different field. Reflecting the decision making conceptualization proposed earlier by Zhan and Wang (2015), individuals "assess the information of their personal characteristics and work-related characteristics to determine which working field to choose for bridge employment" (p. 209). These factors can be related to the individual's financial situation (Wang et al. 2008) or work attributes such as job strain, job-related skills, and job characteristics (Gobeski and Beehr 2009).

The second criterion suggested by Zhan and Wang (2015), related to their Human Resource Management conceptualization of bridge employment, is the organization or employer. Organizations are increasingly striving to attract, motivate, and retain older employees. Thus they may influence the choice between same versus different organizations by providing flexible work environments that meet the changing needs and abilities of older workers seeking to engage in bridge employment. Along with the notion of same versus different organizations in which to undertake bridge employment, a third option is that of self-employment. Zhan and Wang (2015) note that self-employment increases with age and is one of the most common pathways through bridge employment to full retirement for older workers. This is reflected in the conceptualization of bridge employment as a career development stage, providing arguably the greatest flexibility and autonomy for the adjustment process to retirement.

The third criterion suggested by Zhan and Wang (2015) is that of the time commitment toward bridge employment and reflects the conceptualization of adjustment outlined earlier. Operationalizing bridge employment as the time committed to work-related activities highlights the dynamic process of adjusting to full-time retirement and underscores the fact that most bridge employment is undertaken on a part-time basis. Thinking of bridge employment from a temporal perspective also allows investigation of the transitional nature of the process where individuals may move in and out of part-time employment over a period of time as they move toward full-time retirement.

The final criterion suggested by Zhan and Wang (2015) is that of motive. Citing Mor-Bank's (1995) typology of work-motivation factors for older adults (financial, personal, social, and the generativity factor), the authors argue that different motivations for bridge employment have consequences for outcomes. That is, motivations will work differentially on job and career satisfaction and retirement adjustment.

Determinants and Outcomes of Bridge Employment

Dingemans et al. (2015) propose a number of life course determinants of bridge employment such as socioeconomic and health factors, work and retirement context, and family commitments.

First, socioeconomic factors and health are determinants of work force participation. Financial circumstances may be a strong determinant of whether individuals engage in bridge employment in the transition to retirement. Bridge employment may offer the opportunity of boosting pension or superannuation payments for some (Doeringer 1990), where for others it may be the only source of income before becoming eligible for such benefits (Atchley and Barusch 2004; Zhan et al. 2009). Dingemans and Henkens (2014) found that those who engaged in "involuntary bridge employment" reported lower levels of life satisfaction than those who were motivated to engage in bridge employment for intrinsic enjoyment. However, engagement in bridge employment after involuntary retirement partially mitigated the negative effects of involuntary retirement on life satisfaction.

Poor health may result in involuntary bridge employment as it dictates the commitment individuals can make to work with reduced hours or responsibilities, often the result of decreased physical and mental capacity. On the other hand, good health can enhance the individual's capacity to continue in some form of paid employment well beyond socionormative expectations (Zhan et al. 2009). Work attributes such as occupational status and level are also related to the probability of undertaking bridge employment (Dingemans et al. 2015). Bridging employment can also help to maintain the sense of structure and worth that full-time employment may have provided (Kim and Feldman 1998; Wang et al. 2008) even though bridging jobs tend to be at a lower status and lower rate of pay than the individuals' previous full-time job (Atchley and Barusch 2004).

The context in which retirement occurs also influences whether bridge employment is undertaken (Zhan and Wang 2015). Involuntary or early retirement through organizational restructuring or personal circumstances may push retirees toward seeking bridge employment in order to gain a “sense of control” or to comply with societal norms surrounding work roles (Dingemans et al. 2015). Organizations themselves may facilitate or hinder opportunities for bridge employment. That is, organizations in an effort to attract or maintain older workers may provide more flexibility and design the workplace to accommodate the needs of older workers (Zhan and Wang 2015).

Family factors are also important contextual considerations in the retirement process, although the impact of these may be more distal than job-related factors (Wang et al. 2008). The work situation of a spouse may determine the timing and extent of workforce disengagement for individuals, as do caring commitments for family members including spouse, parents, children, and grandchildren.

Wang et al. (2014) distinguish between micro-, meso-, and macro-levels of bridge employment antecedents. Similar to Dingemans et al.’s (2015) life course perspective, micro- or individual factors include financial status and health plus other demographic factors such as age, education, and gender. Older workers are less likely to take up bridge employment, while those with higher education levels are more likely to engage in bridge employment (Wang et al. 2014). Henkens and van Solinge (2014) found that men were more work-oriented postretirement than women, although this was dependent on education level. They also found that married people were more likely to engage in bridge employment than single or divorced older workers.

Meso- or job-related factors include the work environment, work role, and attitudes (Wang et al. 2014) and highlight the role of organizational context in facilitating the uptake of bridge employment (Dingemans et al. 2015). Do organizations put in place practices to encourage bridge employment for older workers such as flexible working hours, improved work design, and reduced workloads? Can organizations provide opportunities for recognition of skills and experience while meeting both organizational goals and employees’ desire for bridge employment? Flexible work arrangements are often cited as important to older workers, but are often not offered by employers (Alpass et al. 2015).

Finally, macro- or societal-level factors, such as government policies, the employment rate, and the economy can also impact on the likelihood of the availability of opportunities for bridge employment (Wang et al. 2014). As Dingemans and Henkens (2014) note, the impact of these factors on the availability of bridge employment opportunities is not under the individual’s control.

The potential consequences of engagement in bridge employment are many and varied with evidence for improved health, quality of life, life satisfaction, and retirement satisfaction for those who engage in bridge employment compared to those who retire completely from the workforce (Dingemans and Henkens 2014; Topa et al. 2014; Wang 2007; Zhan et al. 2009). Two theoretical perspectives that provide insight into the potential benefits of bridge employment for the individual are continuity and role theory.

Continuity theory contends that as people age, they strive to preserve internal and external behavior and circumstances in order to maintain and improve well-being (Atchley 1993). Older adults’ beliefs about self and identity are tied to their roles and activities. Continuity theory would suggest that any new activities will be in the general area of former activities. Thus, based on this theory we would expect retirees that continue some form of employment after exiting their career job to experience better health and well-being, and this would be more so for those who continue in bridge employment in same field of work (Zhan et al. 2009). There is some evidence to suggest this is the case. Kim and Feldman (2000) found in a sample of early retirees that those more involved in bridge employment (both within and outside their previous employer) were more satisfied with both retirement and life in general. Zhan et al. (2009) in a longitudinal investigation using Health and Retirement Study (HRS) data found similar results for the benefits of career and noncareer bridge employment on physical health and functional limitations while controlling for baseline health and demographics, although only career bridge employment was beneficial for mental health. Consistent with continuity theory, Wang (2007) found, again in longitudinal analyses of HRS data, that retirees with bridge jobs were more likely to be in a "maintaining pattern" of psychological well-being in retirement compared to retirees without bridging employment. That is, they experienced fewer changes in psychological well-being during the transition to retirement compared to their fully retired counterparts. In a longitudinal study, Dingemans and Henkens (2014) found that those who wanted a bridge job but were unable to secure one reported decreased life satisfaction with their lives postretirement. Similar to Baltes' model of Selective Optimization with Compensation, Atchley's theory does allow for some changes or withdrawal from activities in order to adapt to changed circumstances, such as declines in health, function, or motivation. Key resources that individuals rely on to maintain continuity include educational level, health, and financial status (Wang et al. 2008).

Role theory maintains that the roles available to the individual change as they transition to retirement. Roles may need to be substituted or adapted in order to prevent stress and anxiety and to successfully adjust to retirement (Bosse et al. 1996). One way for retirees to manage the loss of the career work role is to engage in bridge employment to maintain role identity. In doing so they may mitigate the negative health effects of role loss and role transition (Zhan et al. 2009). Zhan et al. (2009) argue that the effects of participation in bridge employment can be viewed as similar to those associated with job reemployment (where the unemployed reenter the work role). That is, where reentering the work role can restore well-being to preunemployment levels, so too can the bridge employment role have a positive impact on health and well-being for those previously engaged in career employment.

On the other hand, substituting the work role with other roles on retirement such as those associated with leisure and family pursuits may also contribute to sustaining and maintaining well-being (Wang et al., 2009).

Future Directions

What are the promising future directions for research on bridge employment? Zhan and Wang (2015) suggest three areas as foci for new directions in this field of research: the engagement in bridge employment and the transition to retirement from the retirees' perspective, organizational human resource (HRM) practices and job design, and issues related to refining the measurement of bridge employment.

Wang et al. (2011) note the lack of empirical studies examining individual resources and individual differences such as personality and dispositional traits as predictors of retirement adjustment in general. Zhan and Wang (2015) also cite a lack of evidence around the role of retirees' psychological characteristics in the bridge employment process and suggest a stronger focus on personality traits (e.g., the big five), individual motivations, and attitudes to work and retirement in general in understanding the nature of retirement transitions. As Zhan et al. (2009) argue, understanding the motivations for engaging in bridge employment (e.g., for fulfilling career goals, transition to full retirement) may provide insight into the different health trajectories that occur in retirement and beyond into older age.

Human resource practices are also suggested as an avenue for future research in understanding bridge employment decision making. What types of work environments encourage older workers to engage in bridge employment either within their own career field or in another field? Flexible work arrangements such as working from home, reduced workload pressures, flexible work schedules, and phased retirement, although valued by older workers, are often not made available by organizations (Alpass et al. 2015). Zhan and Wang (2015) argue that organizations would benefit from an understanding of the work preferences of older workers so that HRM practices can be designed to maximize the potential of older workers for remaining engaged in the workforce.

As noted earlier, there have been numerous definitions put forward to describe the experience and process of bridge employment. In addition, categories for different types of bridge employment have been put forward (e.g., career bridge employment versus bridge employment in a different field). Alcova et al. (2014) propose that researchers develop internationally useable definitions that precisely specify the different types of bridge employment. This would encourage more cross-country comparisons of the nature and extent of bridge employment. Zhan and Wang (2015) note that precise definitions are required so that the impact on bridge employment decision making of societal and economic factors (e.g., retirement age, workforce age structure, and social security systems) can be more fully investigated. In addition, multiple indicators of retirement adjustment are needed (Wang et al 2011), incorporating inter- and intradisciplinary approaches and the use of longitudinal data to understand both proximal and distal influences on the retirement adjustment process should be prioritized (Alcova et al. 2014).

The participation in bridge employment is not necessarily under the individual's control (Dingemans and Henken 2014). Dingemans and colleagues (2015) found that the transition to bridge employment is "strongly influenced by the opportunities and restrictions in the social context in which the retirement process unfolds" (p. 10). They argue that a "process of cumulative disadvantage" may hinder some older workers who seek to extend their working lives. There is little empirical work that has investigated the process of seeking bridge employment and whether older workers can get the jobs they want (Zhan and Wang 2015). Dingemans et al. (2015) suggest further research needs to investigate the relationship between intentions to engage in bridge employment and subsequent behavior and the factors that can impact on that relationship. The role of social networks and social support in assisting the move from full-time employment to bridge employment and the potential to mediate the relationship between the retirement transition process and health outcomes has also been suggested as a potential future direction for research (Wang et al. 2011; Zhan et al. 2009). One way to incorporate these considerations in future research is to take a dynamic perspective to bridge employment as proposed by Wang and Shultz (2010). Instead of conceptualizing bridge employment as a one-off decision, a dynamic perspective views bridge employment as part of a longitudinal transition process from the individual's retirement decision to the state of full retirement. The approach allows for the investigation of proximal and distal predictors of bridge employment as well as outcomes variables in retirement such as adjustment, life satisfaction, and mental and physical health.

In sum, it has become increasingly obvious over the past three decades that retirement can no longer be described as a discrete event. Instead, as Wang and colleagues argue, retirement should be viewed as a dynamic process nested within the individual context and societal circumstances. The process of retirement may occur over an extended period of time in one's life and may include an extensive period of withdrawal and reentry to the paid workforce through bridge employment. Engagement in bridge employment may be driven by a number of factors, including personal, work-related, organizational, and societal factors. The effects of bridge employment on postretirement outcomes are coming under increased focus and future research directions provide the opportunity to investigate new theoretical perspectives and further refine measurement.

Cross-References

- ▶ Career Development and Aging
- ▶ Employment of Older Workers
- ▶ Flexible Work Arrangements
- ▶ Job Loss, Job Search, and Reemployment in Later Adulthood
- ▶ Motivation to Continue Work After Retirement
- ▶ Postretirement Career Planning
- ▶ Work to Retirement

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Burden of Disease and Aging

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Synonyms

Disability-Adjusted Life Years (DALYs); Quality-Adjusted Life Years (QALYs); Years Lived with Disability (YLD); Years of Life Lost (YLL)

Definition

Burden of disease (BoD) is a population measure of the effects of a specific disease or health problem.

It is usually measured by Disability-Adjusted Life Years (DALYs) and/or by the related concept of Quality-Adjusted Life Years (QALYs). A DALY is a year of healthy life that is "lost" because of a specific condition. When the DALYs associated with a condition within a population are summed, this is the burden of disease (BoD). The burden of disease is the number of healthy years lost in a population compared to full health. The QALY is the person's length of life multiplied by a valuation of their health-related quality of life. QALY measures are frequently used in the economic evaluation of health interventions. The World Health Organization coordinates a major ongoing global study of BoD, the Global Burden of Disease Study.

Introduction

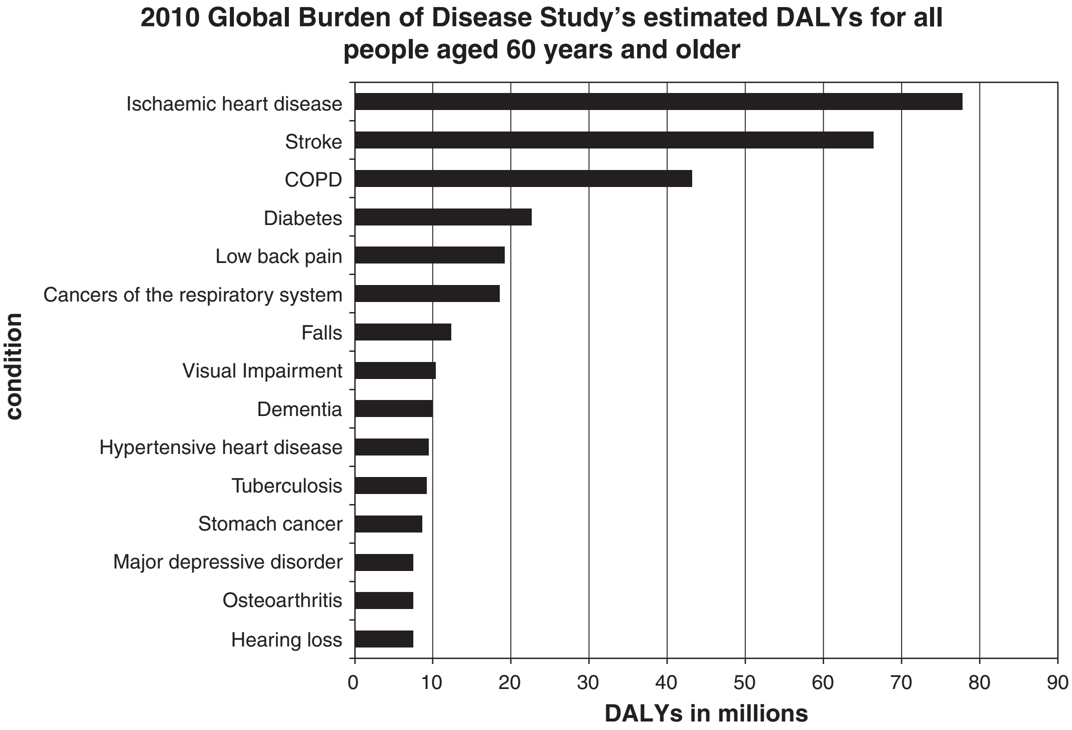
The purpose of this chapter is to outline BoD in older populations, define, discuss and critically evaluate BoD concepts and measures, and discuss statistical, moral, and ethical issues in the use of BoD concepts particularly in older populations.

Most countries use DALYs in their health economics analyses and health and social policy-making. There has been strong global co-operation in global burden of disease studies in the form of the Global Burden of Disease program. The Institute for Health Metrics and Evaluation (IHME) at the University of Washington supervises the conduct of the Global Burden of Disease (GBD) program in close collaboration with the World Health Organization. In its initial 1990 emendation, the GBD program was predominantly funded by the World Bank in partnership with WHO, and the outcomes were reported in its landmark 1993 World Development Report (World Bank 1993). The GBD program has grown substantially from its initial Harvard University base. It now involves over 1,000 researchers from over 100 countries. In the 2010 GBD study, the Gates Foundation and other sponsors supported the program, and it includes statistics for 291 diseases across 21 regions and 187 countries across the full sociodemographic range. The GBD program has partnered with Lancet to provide a widely accessible publication forum for its results. The 2013 update following on the 2010 study is the first of a series of annual updates that will track changes and trends in GBD into the future. This will provide a more frequent and regular ability to governments to track key trends and patterns in health and disease within their countries. This is a highly useful policy and decision-making tool.

Patterns of Burden of Disease Among Older People

As outlined in the 2013 GBD update, the growth in global burden of disease is fueled by population aging: ". . . the analysis showed the global transition towards a rapid increase in YLDs due to global population growth and ageing, combined with little progress in reduction in age-specific YLD rates (Global Burden of Disease Study 2013 Collaborators, 2015). Thus, globally policy makers are increasingly focused on the gains that can be made in terms of increased health status and well-being and reduced burden of disease among older people.

As illustrated in Fig. 1 below which shows DALYs for people aged 60 years and over, noncommunicable diseases (NCDs) have been identified as the major global source of and underlying cause for burden of disease. The World Economic Forum's (Bloom et al. 2011) report asserted that NCDs represent 63% of all deaths being "the world's main killer." The Forum asserted that over the next 20 years, NCDs will cost $USD30 trillion (or 48% of the 2010 global GDP) and that they will have devastating global economic impacts. Burden of disease concepts and data are therefore used to identify where resources may be most optimally allocated to achieve the greatest impact across the target populations. The link between population aging and increased impact of NCDs has been widely



Burden of Disease and Aging, Fig. 1

acknowledged both by researchers and policy makers.

These data provide interesting insights into the drivers of population of burden of disease. Many of these conditions are influenced by personal behaviors and lifestyle factors, in addition to the environmental and genetic factors. Before the discussion of the critiques of BoD and the utility of BoD concepts in older populations, the following section describes the operationalization of BoD measures.

Rationale for and Operationalization of Measures

Burden of disease is a population measure of the effects of a specific disease or health problem. Murray's (1994) landmark article in the Bulletin of the WHO outlines the intent and technical characteristics of BoD indicators and specifically the DALY indicator.

Murray's paper provides a clear discussion of the design choices made in the construction of the DALY. He stated:

> The intended use of an indicator of the burden of disease is critical to its design. At least four objectives are important.
>
> 1. To aid in setting health service (both curative and preventive) priorities;
> 2. To aid in setting health research priorities;
> 3. To aid in identifying disadvantaged groups and targeting of health interventions;
> 4. To provide a comparable measure of output for intervention, programme and sector evaluation and planning.

There are various measures of burden of disease with the two most common being Disability-Adjusted Life Years (DALYs) and Quality-Adjusted Life Years (QALYs). These in turn rely upon the measurement of Years of Life Lost (YLL) from premature mortality in the population and the Years Lived with Disability (YLD) for people living with the condition.

The equations and definitions for each of these measures are as follows:

A Disability-Adjusted Life Year (**DALY**) is a year of healthy life that is “lost” because of the condition. When the DALYs associated with a condition within a population are summed, this is the burden of disease. The burden of disease is the number of “healthy” years “lost” in a population compared to full health taking into account both deaths and years lived in suboptimal states of health:

$$\mathbf{DALY = YLL + YLD}$$

Years of Life Lost (YLL) are years lost to premature disability. Years of Life Lost are the difference between the actual age at death and the longest expected life expectancy for a person at that age. So if a person dies at 70 but the life expectancy is 80, then the Years of Life Lost is 10 years.

Years Lived with Disability (YLD) is the number of years lived with less than perfect health. The prevalence of the health condition being measured is multiplied by the (disability) weight for that specific condition. The weights are determined by expert analysis of community studies of health impacts of the condition (See Klarman et al. 1968; Torrance 1986). The disability weight is the severity or extent of health loss for the specific health state or condition. There is a considerable literature concerning the most appropriate methods for estimation of health utilities and weights.

A **QALY** is a year of life spent in perfect health. In this sense a QALY is a mirror image conceptualization of disease burden when compared to a DALY. The National Institute for Health and Clinical Excellence (NICE) has provided the following definition of QALY as a “measure of a person’s length of life weighted by a valuation of their health-related quality of life.”

$$\textbf{QALY} = \textbf{Life expectancy} * (\textbf{weighted quality of the remaining life years})$$

QALYs are typically combined with cost estimates of what it would cost for an intervention to generate a year of perfect health (a QALY) and that process yields a cost utility ratio estimate. This process enables the benefits of different interventions to be compared with each other, the goal generally being to obtain interventions that have a low cost per QALY. However, the use of these data in this fashion has generated some controversy.

Critiques of Burden of Disease Concepts and Measurement

The burden of disease concept has been subjected to significant, some may say trenchant, criticism by a variety of scholars since its inception. Park’s (2014) review of burden of disease provides a clear analysis of the key arguments advanced by its critics. She acknowledges that DALYs are “in wide use in the field of global health” but that they have been subjected to a “barrage of criticism” (Anand and Hanson 1997) over an extended period. Phillips argues that “QALYs are far from perfect as a measure of outcome, with a number of technical and methodological shortcomings,” but she also notes that “Nevertheless, the use of QALYs in resource allocation decisions does mean that choices between patient groups competing for medical care are made explicit.”

Essentially the criticism falls into two main categories: linked conceptual and statistical objections and ethical/moral objections.

Conceptual and Statistical Issues

Weighting

The statistical objections concern the measurement and weighting systems used in the measurement process underpinning BoD. Essentially in assessments of the “perfect” health state, the arbitrary value of 1.0 is assigned to perfect health and the arbitrary value of 0.0 is assigned to death. Intermediate values on this continuum are calculated using tools and methods that have been subject to expert review and considerable debate. Arnesen and Nord (1999) express their conceptual concerns neatly when they note that “The disability weightings in use tell us that the value of one year for 1000 people without disabilities on average is set equivalent to the value of one year for 9524 people with quadriplegia, 4202 people with dementia, 2660 blind people, 1686 people with Down's syndrome without cardiac malformation, 1499 deaf people, 1236 infertile people, and 1025 underweight or overweight people" (1999, p. 1424).

Thus, while these tools may well have been designed by experts, the values assigned at the end of the day are arbitrary constructs that do not relate directly to the natural world. As with all tools measuring constructs, the burden of disease measurement tools are not psychometrically perfect. No tool is. Hence they contain measurement error and hence intrinsically on occasion will provide erroneous results. Nevertheless the statistical assumptions for the tools are clearly stated and therefore can be evaluated. Burden of disease is a key tool in health policy and program evaluation. It has deficiencies in its implementation, but there is a clear focus to address them in its many users.

Individual Differences Among Older People and Multi-morbidity

While the uses of concepts such as burden of disease intrinsically take a population or large subgroup perspective, the large individual differences among older people must be recognized and incorporated in service design and policy. Failure to understand that BoD measures use the concept of the average person or the aggregated person who do not in fact exist is a major concern in the use of such measures. Beard and Bloom's 2015 Lancet commentary includes the highly pertinent comment that "great interindividual functional variability is a hallmark of older populations." They go on to conclude that this variability poses major challenges to policy formulation and program design. There are many studies that support the general finding that aging involves the experience of different individual trajectories that one size does not fit all. Hsu and Jones (2012) provide details of the quite variable trajectories that older people follow in aging.

A growing preoccupation in burden of disease research and service delivery is the issue of multi-morbidity or multiple conditions experienced by especially older people. Various studies have identified very high rates of multi-morbidity among older people. Marengoni and colleagues' (2011) systematic review of multi-morbidity found that among 41 reviewed papers that prevalence of multi-morbidity in older persons ranged from 55% to 98% with increasing rates for older people, females, and low socioeconomic status. The number of conditions experienced especially by older people is quite high. For example, Collerton and colleagues (2016) report a multi-morbidity rate of 92.7% with a median number of 4 conditions among the Newcastle 85+ study sample.

Fortin et al. (2014) who are the pioneers of multi-morbidity research have recently published studies linking multi-morbidity and (unhealthy) lifestyle factors including smoking, alcohol consumption, fruit and vegetable consumption, physical activity, and body mass index. The aggregation of unhealthy lifestyle factors has been found to be strongly associated with multi-morbidity. Multi-morbidity can create technical problems in the measurement of burden of disease because of the need to attribute the unique contributions of individual diseases or conditions to the levels of disability experienced by the individuals concerned.

Afshar and colleagues (2015) have made the pertinent point that while aging is considered an important driver of increased burden of disease, multi-morbidity and socioeconomic factors are also important related factors.

Ethical and Moral Issues

In terms of ethical and moral arguments against DALYs and other BoD measures, some disability advocates have argued that the whole concept of disease burden intrinsically devalues the lives of people with disabilities by representing them as of "lesser" value than those experiencing good health.

With regard to the use of QALYS and DALYs in health resource allocation, one might arrive at the conclusion that it is poor public policy to over-invest in services for older people because they will not deliver the returns in terms of DALYs and QALYs that are achievable with other groups. However, the evidence for this proposition is highly arguable as illustrated in the previous sections of this entry. Older people respond well and effectively in terms of disease burden reduction to investment in them. Ory and Smith's volume contains numerous counterexamples to this position. Murray's exhortation that BoD indicators must "aid in identifying disadvantaged groups" is also a reminder of how the pioneering developers of burden of disease concepts and methodology argued from the outset that burden measures were not intended to be used to justify disinvestment in health programs and services for older people.

Can Burden of Disease Be Modified and Reduced Among Older People?

There is ample evidence that the health of older people can be improved through interventions. However, the quantification of the benefits that is required to calculate reliable cost utilities is a particular challenge. Providing a key policy framework for healthy aging, the WHO World Report on Ageing and Health (Beard et al. 2015) points to the major gains that can be obtained with coordination of focus on healthy aging in health and social programs. The policy actions outlined in Table 1 below are proposed within the report to enhance healthy aging and reduce age-related burden of disease. There is a strong psychosocial and cultural focus in the proposed actions. The identification of the need to "combat agism," to "improve understanding of the health status and needs of older populations," and to "enable autonomy" for older people reflects an approach that is not merely centered on disease.

Many commentators have argued for the high utility of investment in health promoting actions among older people (Prince et al. 2015). Fortunately there are now many interventions and programs that have established evidence for effectiveness in the prevention and management of NCDs among older people. Most of them include behavioral changes (Browning and Thomas 2005) in the targeted populations. Ory and Smith's (2015) volume in *Frontiers in Public Health* includes 59 contributions concerning successful health-related programs and interventions for older people from a range of countries and is indicative of the strong and growing evidence base for effective interventions for older people.

Burden of Disease and Aging, Table 1 WHO policy actions to promote healthy aging in older people

Actions
Ensure access to older person-centered and integrated care
Orient systems around intrinsic capacity
Ensure a sustainable and appropriately trained health workforce
Establish the foundations for a system of long-term care
Ensure a sustainable and appropriately trained workforce for long-term care
Ensure the quality of long-term care
Combat agism
Enable autonomy
Support healthy aging in all policies at all levels of government
Agree on metrics, measures, and analytical approaches for healthy aging
Improve understanding of the health status and needs of older populations
Increase understanding of healthy aging trajectories and what can be done to improve them

Conclusion

BoD is a widely used system of measurement of the effects of diseases in populations. BoD in older populations is currently driven largely by ischemic heart disease, stroke, and COP-D. Criticisms of BoD focus on the arbitrary nature of the statistical weightings and the intrinsic devaluation of people with disabilities involved in measuring their decrements. For older people the concept is often applied in a way that does not address heterogeneity/individual differences in health outcomes in old age and multi-morbidity, but this current practice is not an intrinsic feature of its design. Despite these shortcomings, BoD can help policy makers make transparent and informed decisions about where to place resources to maximize health outcomes for older people. The early prevention and management of chronic diseases and conditions are an obvious approach to promoting healthy aging. However the design and implementation of programs to promote health and manage disease for older people need to incorporate the structural drivers of health, namely, healthy environments and person-centered, diversity sensitive, and integrated health-care systems.

Cross-References

- ▶ Healthy Aging

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