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Abstract:

**Table of Contents**

[Literature Review 7](#_Toc35414074)

[Environmental Gerontology 7](#_Toc35414075)

[Subjective Well-Being and Quality of Life in Old Age 9](#_Toc35414076)

[QoL Models, Frameworks, Predictors, and Measuring Instruments 10](#_Toc35414077)

[The Social Production Function Theory 11](#_Toc35414078)

[The Connection Between Physical Layout and Physical needs 13](#_Toc35414079)

[The Connection between Physical Layout and Social Needs 14](#_Toc35414080)

[Social Engagement 14](#_Toc35414081)

[Activity Involvement 18](#_Toc35414082)

[Physical Layout and Autonomy, Control, and Privacy 19](#_Toc35414083)

[Autonomy 19](#_Toc35414084)

[Privacy……... 21](#_Toc35414085)

[Assessing the Quality of Physical Layout: Evaluation Methods 23](#_Toc35414086)

[The Current Proposal 25](#_Toc35414087)

[Methodology 25](#_Toc35414088)

[Study One: Methodological Research to Develop a Physical Layout Assessment Tool for LTCFs 26](#_Toc35414089)

[Aims and Objectives 26](#_Toc35414090)

[Study Hypothesis 26](#_Toc35414091)

[Procedure 26](#_Toc35414092)

[Data Analysis 27](#_Toc35414093)

[Study Two: Associations between Physical Layout of LTCF Units and Residents’ Subjective Well-Being and Quality of Life 27](#_Toc35414094)

[Aims and Objectives 27](#_Toc35414095)

[Study Hypothesis 27](#_Toc35414096)

[Participants 27](#_Toc35414097)

[Instruments 28](#_Toc35414098)

[Procedure 31](#_Toc35414099)

[Data Analysis 31](#_Toc35414100)

[Study Three: The Association between Physical Layout of LTCF Units and the Experience of Burnout Among Caregivers 31](#_Toc35414101)

[Aims and Objectives 31](#_Toc35414102)

[Study hypothesis 32](#_Toc35414103)

[Participants 32](#_Toc35414104)

[Instruments 32](#_Toc35414105)

[Procedure 34](#_Toc35414106)

[Data Analysis 34](#_Toc35414107)

[Bibliography 35](#_Toc35414108)

Increasing longevity has expanded the number of people who are frail and who are living with chronic disease or functional disabilities. This population poses significant challenges, since they require high levels of care. Many are unable to have their needs met at home and thus the demand for long-term care (LTC) solutions is rising, and is expected to continue to grow. Long-term care facilities (LTCF) strive to offer a living environment that not only provides shelter and optimal care but that serves as a new home for impaired older adults. LTC solutions differ according to the severity of their residents’ cognitive and physical disabilities and the level of support they require in activities of daily living (ADLs). Various types of care may be subject to rules and restrictions. Some facilities offer only housing and housekeeping services, while others also provide personal care, medical services, or special programs for people with Alzheimer’s disease and other types of dementia.

For new residents, relocation to an LTCF is a significant life event that may add new traumatic layers to the many age-related losses (e.g. cognitive, social, physical, and health-related) that they may have already experienced (Bridges et al., 2010; Chaudhary, 2003). Residents may experience a sense of being enclosed and cut off; they may be uncomfortable with the facility’s formally administered routine; and may mourn the loss of control over their everyday personal routines and environment, their ability to make autonomous decisions, their privacy, and aspects that have defined their identity (e.g., status, sentimental possessions, and critical social relationships). These cumulative losses may result in depression, withdrawal (which could lead to further physical or cognitive decline (Brooke, 1989), poor self-esteem, and a decrease in perceived well-being (Iwasiw et al., 1996; Sharma & Sharma, 2010).

In order to support residents’ sense of self and identity, and overall quality of life and well-being, LTCFs often highlight a person-centered approach that aims for successful transition and adaptation to the new environment. Person-centered care (PCC), which emphasizes viewing the resident as a whole person, is a concept that has been defined and implemented in a variety of frameworks, and has driven numerous studies throughout the world. Following the introduction of this concept, new PCC movements and LTCF solutions emerged in the U.S. and Europe that diverge from earlier LTCF concepts, and many of the new institutions tried to address the issue by emphasizing a home-like environment (Fitzpatrick & Tzouvara, 2018; Fraher & Coffey, 2011; Standards & Committee, 2015; Sury et al. 2013).

Increasing knowledge about PCC has led to new reforms and laws (e.g., OBRA, 1987). These focus on one hand on following strict regulations that enable monitoring the quality of care (as per ministries of health regulations), while on the other hand, emphasizing services that sufficiently attain and maintain the residents’ highest practicable physical, mental, and psychosocial well-being (Fazio et al., 2018; Koren, 2010). Since then, the growing body of scholarly knowledge on the association between different dimensions of an environment’s physical layout, subjective well-being (SWB), and Quality of Life (QoL) has led to advanced new laws and regulations including design regulations and guidelines that aim to utilize terms such as psychosocial well-being, quality of life, and physical well-being. The LTCF design, guidelines, and recommendations are often written by a panel of experts that include gerontologists, governmental health policymakers, and architects. Despite being detailed and in-depth, these guidelines often fail to reflect LTCF residents’ actual needs, which would enhance their SWB and QoL (Regnier, 2003). The design of an LTCF’s physical layout, which is often a reflection of the personal viewpoint of architects regarding LTCFs, have created a need for defining, measuring and understanding the dimensions of these subjective concepts. This need has generated numerous studies that focus on the importance of an environment’s role in creating suitable, person-centered LTCFs, and have occupied environmental gerontology researchers worldwide.

 The current study aims to investigate and deepen the knowledge of physical layout as a “silent partner” in the SWB and QoL of LTCF residents. The following literature review will focus on environmental gerontology and on up-to-date research about the relationship between physical layout, SWB, and QoL.

# Literature Review

## Environmental Gerontology

The correlation between the physical layout of LTCFs and the SWB and QoL of older adults living in them is a rich, multidisciplinary subject that has occupied many environmental gerontology researchers. The field of environmental gerontology emerged in the late 1950s, when the discussion of person-environment considerations expanded to including the aging population. Proponents from the field claimed that understanding the aging process and the existing problems of habitation (private or institutional settings) could help society design proper housing and neighborhoods for older adults. These new arguments prompted theoretical, empirical, and solution-focused initiatives by diverse professionals, including psychologists, sociologists, architects, health professionals, community planners, and social policy advocates. Such professionals combined their knowledge to help older adults cope with their immediate environment according to their needs, resources, and behavioral requirements (Samuel, 2017). The most significant interdimensional intervention in environmental gerontology from this early era to the present was the “environmental press model” (Nahemow & Lawton, 1973).

The environmental press model took into account the fact that older adults experience age-related losses, such as health-related or cognitive loss as well as a decline in competence, and as a result, they may perceive their environments as more demanding, problematic, and stress-evoking. High levels of competence result in a more positive outcome and lead to better adaptation to a broader range of environmental pressures, which the model terms “environmental press.” On the other hand, deficit or excess of press, relative to competence, can cause maladaptive behavior and adverse effects (Bowling et al., 2015).



Figure 1. Graphic presentation of an ecological theory of adaptation and aging (Nahemow & Lawton, 1973)

This model stimulated a wide range of innovative theoretical improvements, practical applications, and theoretical developments regarding the relationship between environment and older adults (Ferdous & Moore, 2014). These revised theoretical improvements mainly focus on person-centered reform, to enable a better fit between an individual’s needs and the resources available to them, and have led to advanced thinking about WB and QoL in old age.

## Subjective Well-Being and Quality of Life in Old Age

In order to understand Subjective Well-Being (SWB) and Quality of Life (QoL) in old age it is important to define them and to highlight the changes that might be affected by longevity, age-related losses, health-related problem, and increased dependencies. SWB and QoL are key concepts describing the experience, capacities, states, behaviors, appraisals, and emotional reactions to circumstances. The literature describes the relationship between SWB and QoL as inconclusive, and often the two terms are used interchangeably, which highlights the confusion about the theoretical differences between them (Camfield & Skevington, 2008; Peasgood et al., 2014).

The definition of SWB involves an assessment of a person’s life, particularly the person’s experience, which includes subjective cognitive evaluations and positive and negative aspects that they perceive (Diener et al., 1985). While the definition of SWB is therefore rather straightforward, defining the QoL is complex and can be inconsistent because of the multitudinous, diverse components and indicators that define it. This is especially so when addressing both overall QoL and health-related QoL (Kane, 2003; Kane et al., 2003).

Defining QoL of older adults is uniquely complex. Firstly, older adults face physical, social, and psychological losses and usually need help in order to maintain a high level of QoL ( Gerritsen et al., 2004). Secondly, when measuring QoL in LTCFs for example, it is hard to measure and validate QoL since there are discrepancies between the assessment by the self-rating by older residents and those of informant-rated, or by proxy-rated questionnaires. Studies have found that staff members, aides, and family members defined the QoL mainly in terms of care and the residents’ perceptions of QoL, focusing mainly on their social and psychological needs (Hyde et al., 2003; Steverinket al., 2020).

### *QoL Models, Frameworks, Predictors, and Measuring Instruments*

This complexity has accentuated the need to focus on changes that occur in old age and to investigate the vast array of QoL models, frameworks, predictors, and measuring instruments (Langlois & Anderson, 2002; Skevington & Böhnke, 2018). Maslow’s theory of human needs that was offered in 1962 was the first to proclaim that the need for satisfaction is hierarchical, progressing from the lower level of physiological needs (health-related) to those of safety, belonging, esteem, and self‐actualization (Maslow, 1968). The theory led to further interest in basic universal psychosocial needs. In particular, social needs were found to be strong predictors of several QoL dimensions (Diener et al., 2010; Steverink et al., 2020)

Numerous models address the SWB and QoL of older adults living in LTCFs. Gerritsen et al. (2004) examined existing QoL frameworks and models (n=719) in nursing homes in order to clarify how QoL can be optimized for residents. The QoL models were evaluated and filtered according to three criteria: (1) comprehensiveness (aspects of QoL for human beings in general) (2) clearly described dimensions, relationships between the dimensions, and their contribution to QoL (3) consideration of individual preferences. The research found six leading models that included at least two of the above criteria. These were: 1) Lawton’s four sectors of the good life; 2) Faulk’s board and care home hierarchy of needs (based on Maslow’s hierarchy of human needs); 3) Hughes’ QOL-network; 4) Katz and Gurland’s challenges to adaptation; 5) Balls QOL domains; and 6) the theory of Social Production Function (SPF). The theory of SPF was found to be the most suitable framework for QoL assessment tool.

### *The Social Production Function Theory*

The SPF theory (Lindenberg, 1996) asserts that the daily functions of people are an outcome of the general aim to achieve two universal goals (physical and social well-being) and five instrumental goals by which these universal goals are achieved (status, behavioral confirmation, and affection to achieve social well-being, and stimulation and comfort to achieve physical well-being). The SPF theory was generated by combining Lindenberg’s Behavioral Theory with different goal theories such as Maslow’s hierarchy of needs, multiple discrepancies theory by Michalos, resource theory by Schulz, life domain satisfactions theory by Andrews and Withey, and other theories of basic needs, that in some ways link well-being to objective conditions (Nieboer et al., 2005).

The SPF theory also asserts that even though these goals are hierarchical, the existence of higher levels in the hierarchy can be substituted to compensate for deficiencies in lower levels. For example, when opportunities to gain status (e.g., at work) decrease, an individual may intensify social contact (affection). Therefore, it is important to create reserves of higher-level resources that will be available as buffers in times of decline in other areas (Nieboer & Lindenberg, 2002). The SPF theory also addresses the broad consensus that overall SWB is measured by life satisfaction (cognitive evaluation of a person’s overall well-being measured by Cantril’s Ladder) and by positive and negative components (affective component measured by the PANAS, see Nieboer & Lindenberg, 2002).



Figur 2. Social production function theory explaining the hierarchy of well-being.

( Nieboer & Cramm, 2018b)

The SPF-IL questionnaire was developed as a complementary, reliable, and valid tool to measure well-being, addressing need-related domains: affection, behavioral confirmation, status, comfort, and stimulation (Lindenberg, 1996). Nieboer et al. (2005) also developed a short version of the scales with three items for each social or physical need (SPF-IL(s)). The short version has been used in many studies among chronically ill patients and frail older people in various countries (Crammet al., 2015; Cramm & Nieboer, 2014, 2015; Nieboer & Cramm, 2018a) It was validated again with various samples of older populations (all Cronbach’s alpha values were acceptable, with ranges of 0.631–0.836 for the frail older sample) (Nieboer & Cramm, 2018b).

SPF was used as a framework in another recent study by Steverink et al. (2020) that addressed the social needs of older persons (n=over 13,000 people). The study reinforced the need for close relationships and respect from others, finding these elements to be strong predictors of happiness and positive feelings (Steverink et al., 2020).

The SPF theory claims that for purposes of distinguishing between all needs and tracing their consequences in general, and in old age specifically, one should be able to distinguish the deficits that may occur when each need is not sufficiently met and understand the consequences of those deficits. When distinguishing between deficits that are connected to the physical layout, it is essential to define the different aspects of the physical layout and their connection to the QoL dimensions. Therefore, the current study has found the SPF to be a useful methodological platform that is able to associate the different physical and social well-being needs with well-researched QoL-oriented physical layout variables.

The following section will address the existing literature on the connection between the physical layout of LTCFs to each specific need outlined by SPF theory. In addition, since privacy, autonomy, and control are considered substantial aspects of QoL they will also be reviewed, separately, along with the existing literature on their connection to SWB and QoL.

## The Connection Between Physical Layout and Physical needs

Most environmental models focus on the connection between physical well-being and competence, referring to the type of demands placed on the person by the environment in terms of, for example, physical comfort and physical stimulation (Morgan et al., 1984; Bowling et al., 2015).

Physical comfort is a psychological subjective state based on basic needs being met—the absence of, for example, thirst, hunger, pain, fatigue (Ormel et al., 1999). It is achieved through the ability to control the environment, and therefore it is not necessarily directly connected to the built environment. However, if one is dependent on external help such as staff or visitors to control the environment (and thus enable physical comfort), their ability to provide help may be related indirectly to the environment (e.g., walking distance from the facility and availability).

Physical stimulation involves environmental sources of stimulation that trigger a cycle of goal-directed behaviors (e.g., planning, actions, intentions, affective responses, and outcome evaluation). Indeed, reduced responsiveness to environmental stimulation, lack of motivation, and reduced goal-directed behaviors were found to be connected to apathy ( Jao et al., 2019; Jao et al., 2016b). Thus, physical stimulation has a role in the SWB and QoL of LTCF residents.

For environmental stimuli to have a substantial impact, they must be present at an accessible distance and noticeable while also involving tailored interpersonal interactions that actively involve the resident and prompt their engagement. The environmental stimulation can be influenced by aspects of an LTCF’s physical structural layout (e.g. size, distance), aspects of the physical environment (e.g. furniture arrangement, decoration, noise levels), and by the social environment (e.g. people, activities, conversations).

## The Connection between Physical Layout and Social Needs

Fulfillment of social needs, such as the need for relationships, approval, empathy, and respect from others, are crucial predictors of subjective well-being, happiness, and positive feelings (Diener et al., 2010). In contrast, deficits and deprivations in the fulfillment of social needs have been shown to lead to aversive and pathological outcomes. Below, several specific social needs are discussed.

### *Social Engagement*

SWB for older individuals is connected to their social engagement and social support (Baltes, 1996; Mendes de Leon et al., 2003), which serve to satisfy a variety of social needs. Social engagement involves interpersonal relationships and active participation in social activities that involve interaction with at least two people as well as social support and social exchange (i.e. giving or receiving something from others) ( Prohaska et al., 2012). Social engagement is also associated with a sense of belonging, which was identified as the third most significant basic human need on the path toward self-realization (Maslow, 1943). It is, therefore, meaningfully associated with psychological well-being (Lambert et al., 2013; Park, 2018).

In the context of older adults moving from a private home to an LTCF setting, the nature of their social engagement is considered to be one of the most drastic and significant changes they encounter (Pirhonen et al., 2018). The adjustment to their new environment may lead to residents to withdraw, and to experience loneliness and isolation (Goffman & Helmreich, 2018; Jang et al., 2014). Indeed, establishing new social connections takes time, but following the period of adjustment, new social networks are formed. These interactions and relationships can be divided into three separate social spheres: relationships with staff members, with family and old friends, and with peer residents.

#### Social Engagement and LTCF Staff. Beyond their everyday caregiving responsibilities, LTCF staff members serve as the residents’ primary providers of psychological needs, through social interaction and support (Marquis, 2002). Therefore, there is an ongoing need for them to offer time and attention to residents. As a resource, the amount of time staff give to residents depends on their work efficiency and motivation, which are correlated to burnout at work (Cutler et al., 2006). Workplace turnover—a by-product of staff burnout—may prevent meaningful resident–staff bonding (Grenade & Boldy, 2008). Thus, besides addressing patient needs directly, addressing staff needs is an essential factor in enhancing LTCF residents’ SWB (Danaci & Koç, 2019).

There is ample evidence from the design literature connecting the health-care built environment to the SWB and job performance of staff and to the satisfaction of both formal caregivers and patients (Becker, 2007). Studies affirm that design influences the staffs’ schedule (time spent in the patient rooms and at the nursing station, and time spent going to the supply room) and is connected to the staff’s stress and fatigue levels (correlated to the walking distance). Other studies have highlighted the importance of the physical layout and its effect on communication with inter-professional team members and peers. This was also associated with the perception of isolation and teamwork, higher job satisfaction, staff members’ plans of how long to stay in the current job, sense of safety, and burnout score (Durham & Kenyon, 2019).

#### Social Engagement and Visitors. Social separation from the outside world causes residents’ contact with friends, relatives, and neighbors to decrease (Burton et al., 2011). These relationships often become less intimate, which can trigger feelings of being remote or cut off from society (Pirhonen et al., 2018). Social engagement with external visitors such as family, friends, or paid visitors can help preserve residents’ identity. Family involvement, in particular, maintains a sense of continuity and of family life, and the knowledge that they care. It offers a break from interaction only with caregivers, a sense of change in their engaged involvement, and a sense of worth stemming from these unique relationships and their history. Increased social engagement with family has been associated with positive psychosocial outcomes (Greene & Monahan, 1982), and decreased mortality (Gaugler, 2005; Kiely, et al., 2000). Moreover, family involvement helps the staff by providing residents with affection (e.g., holding hands or touching), personal and instrumental care (e.g., grooming), promoting better outcomes (e.g., accompanying the residents in their daily activities) and initiating actions to ensure proper staff/resident relations (Gaugler, 2005).

The reasons why and how often family members continue their involvement with their relatives in an LTCF are complex and are affected by external and internal barriers. These include finances, location, culture, family-level factors, health issues, and staff–family relationships (Førsund et al., 2016). However, the most widely reported barrier preventing family involvement is the psychological barrier, which can involve guilt or depression, or feelings of being emotionally overwhelmed, heartbroken, and uncomfortable during visitations (Miller, 2018).

The literature on how LTCFs’ physical environment influence visitor satisfaction is still limited. The environmental, physical characteristics that have been studied include privacy (i.e. private rooms or gathering spaces for family activities), atmosphere at mealtime, smell, cleanliness, pleasantness, comfort, and safety of the facility (Cutchin, 2003; Ejaz et al., 2002; Harmer & Orrell, 2008; Stadnyk et al., 2013).

#### Social engagement with other residents. Encouraging social connections among LTCF residents is a challenge due to their physical and cognitive impairments, psychological impairments like depression (Pirhonen et al., 2018), and chronic health conditions. These can decrease social engagement in the LTCF public spaces and foster social withdrawal, with residents spending more time in their rooms, a lack of self-esteem or energy, and can lead to boredom and cognitive decline (Jarrott et al., 2008). On the other hand, social interactions, when used systematically as an intervention, can help focus attention and create interest (Dodge et al., 2013), regardless of residents’ physical and cognitive abilities (Cohen-Mansfield et al., 2010a).

Researchers have been trying to understand specific environmental components that affect social interventions by examining how patterns of congregation are associated with different physical characteristics such as the size of the unit, amount of residents, bedroom size, and size of the windows. The findings of these studies indicate that there are no conclusive results and that additional work is needed to recognize which facility characteristics can enhance social engagement in LTCF settings.

### *Activity Involvement*

Activity involvement, which engages residents’ time and attention, may lead to self-realization, which is considered another domain of social needs for aging people in LTCFs, who most often spend their time without any activity and with minimum stimulation (Cohen-Mansfield et al., 1992; Kitwood, 1997; Perrin et al., 2008; Train et al., 2005; Van Haeften-Van Dijk et al., 2015). Activities in an LTCF can include work, play, and leisure, but also necessary everyday activities such as getting up, eating and drinking, receiving physical care, interest in objects, helping others, social conversation, and more (Smit et al., 2014). Studies have shown that a large variety of meaningful individual or group activities that refer to self-identity (i.e. experiences, interests, and hobbies) and are compatible with the residents’ disability can affect the residents’ attitude, duration of attention, and increase SWB (Brooker et al., 2007; Cohen-Mansfield et al., 2010a).

However, occupation remains a challenge for the residents of LTCFs who suffer from increasing dependency on their caregivers and the environment, decreased autonomy, and loss of skills to initiate activities (Harmer & Orrell, 2008) as well as loss of visual or verbal prompting to start an occupation (Cook et al., 2008). Several studies also found a correlation between the physical environment and activity involvement, especially the location of the LTCF and home-like characteristics, namely smaller facility size. Knight & Mellor (2007) have found that an activity location that does not meet the needs of LTCF residents might decrease their involvement and facilitate only superficial interaction with others. In addition, central activity programs that emphasize the feeling of living in a facility rather than a home may cause declined activity involvement; a “club area” has been found to be correlated with improved behavior, nutritional status, and decreased social isolation (Smit et al., 2014).

Studies have found that LTCFs with a smaller number of residents, and thus a more home-like environment, were found to be a predictor of residents’ activity involvement (Cohen-Mansfield et al., 2010b) especially participation in household chores and everyday life (Smit et al., 2012; Verbeek et al., 2009). Surprisingly, some studies have found no correlation between other environmental characteristics, such as visual stimuli (Wood et al., 2005). In conclusion, there is a lack of knowledge concerning the impact of LTCF environmental characteristics on resident activity involvement. Further investigation is needed.

## Physical Layout and Autonomy, Control, and Privacy

Autonomy, control, and privacy are noted as significant physical and social needs in many general QoL models, and, due to the particular circumstances of LTCF residents, are certainly relevant to the present discussion of residents’ SWB and QoL. The following section offers a brief overview of the large body of literature that examines the relationship between physical layout and these dimensions.

### *Autonomy*

There are inconsistencies in the literature regarding the definitions of perceived autonomy and perceived control, and disagreement about whether autonomy and control are indeed different from one another. Patrick and Skinner (1993) claim that control and autonomy are conceptually distinct, with autonomy defined as freedom from the interference of others (mainly social), and control defined as an intervention in the environment. However, the separate definitions of autonomy and control merge into a single concept when we focus on the needs of older people; their increased cognitive impairment leads to decreased physical independence and limited capacity to make decisions (Natrop, 2017).

Ayalon (2016) states that autonomy in old age is multidimensional, and divides it into two categories: the physical components of autonomy and the psychological components of independence. The physical components of autonomy is reflected in freedom of mobility, physical independence (Ayalon, 2016; Ball et al., 2004), and environmental mastery, meaning the ability to choose and create environments that meet one’s specific needs, for example in terms of lighting, smell, temperature, and noise (Ryff, 2005). The psychological components of autonomy are associated with mental independence, and are reflected in the freedom to make choices and the ability to maintain a sense of control to make decisions about one’s everyday lives, despite physical or cognitive changes and losses that may occur. The ability to choose, have control, and be autonomous is empowering for individuals, enhancing their sense of personal competence (Ferrand et al., 2014; Lawton & Brody, 1969). These have a positive effect on SWB and QoL, depression, and even on reduced mortality among LTCF residents (Johnson & Namazi, 1992).

The importance of autonomy for LTCF residents can conflict with various ethical principles concerning healthcare, making it challenging for providers to offer conditions for personal autonomy. For example, on the one hand, healthcare providers want to ensure safety through constant observation of residents, to minimize the risk of falls and other accidents. On the other hand, the outcome of this is restricted privacy, dignity, and freedom for residents. This restraining behavior can also be expressed in inappropriate measures such as the unnecessary use of diapers and sedatives instead of other tools for resident health such as exercise (Preshaw & Frolic, 2016).

It has been found that an environment can support residents’ need for independence by enhancing perceived control and perceived autonomy. However, there is a lack of studies investigating factors associated with such alternatives for autonomy in LTCFs ( Schopp et al., 2018).

### *Privacy*

Privacy is considered one of many dimensions of autonomy, and its components resemble the different aspects of control. The need for privacy is subjective, and studies have found that an individual’s perceived need or loss of privacy is connected to culture (norms and rules), demographics, gender, and age (Schopp et al., 2008). Privacy has different multidimensional definitions, which are divided into four categories: physical privacy, psychological privacy, privacy of information, and social privacy (Leino-Kilpi et al., 2001). Physical privacy relates to the human ability to control visual, noise, and smell intrusion into one’s personal space and individual territory (Hsieh, 2014). Psychological privacy refers to the ability to control self-value, self-perception, affection, and spiritualism. The privacy of information refers to controlling how one collects and distributes one’s personal information. Social privacy is related to the ability to control one’s social exchanges, for example to decide on the frequency, length, and participation in social exchanges (Hughes, 2004).

All four categories of privacy are connected through environmental characteristics, which play an essential role in the control of privacy (Hsieh, 2010). LTCF residents become progressively dependent on others and are unable to rely on their own resources to maintain their subjective privacy needs. A significant number of studies investigated the privacy in LTCFs and addressed various environmental components that contribute to creating a sense of privacy among residents. The findings indicated that the highest perceived privacy was strongly associated with the bedroom privacy for LTCF residents (Morgan & Stewart, 1999; Hsieh, 2010). Design components of individual patient rooms such as having a single room (as opposed to a shared room), fewer overall patient beds, and larger area per bed were strongly correlated with higher perceived privacy. Moreover, residents living in double bedrooms were more likely to develop territorial behavior and might have territory-related conflicts with their roommates, which can lead to aggressive or violent behavior, or to withdrawal and seclusion (Hsieh, 2014). However, double-occupancy bedrooms were connected with lower rates of falling and loneliness (Singh et al., 2016).

It was found that LTCF residents had very limited privacy during interactions with staff such as during treatment, exercise, changing diapers, and staff-patient communication. Nor did they have privacy during private social interactions with family, guests or other informal caregivers, and there was more probability of medication errors (Schopp et al., 2008; van de Glind et al., 2008).

Other elements of a room’s privacy include the distance from the staff nursing station and the visual view of the room from the outside, which affect residents’ perceived privacy (Cutler et al., 2006). Studies have shown that some LTCF residents may be willing to accept reduced privacy in exchange for increased visual surveillance and visibility from the nursing station (Lu et al., 2017). The evidence for residents’ preference is considered inconclusive, and the different preferences emphasize the need for a mix of room types that can support person-centered care and fit the residents’ personal needs (Taylor et al., 2018).

In summary, the physical layout of LTCFs is an essential factor in promoting well-being among residents (Chaudhury et al., 2018). The factors that create a well-designed physical layout are still relatively unexplored and require further research. Evaluation methods that aim to define the appropriate design of high-quality healthcare environments are limited, and most of the design guidelines and recommendations are based on sporadic information from credible research and evaluation of completed buildings (Sloane et al., 2003; Ulrich et al., 2011).

## Assessing the Quality of Physical Layout: Evaluation Methods

The Post-Occupancy Evaluation (POE) (Zimmerman & Martin, 2001) and Evidence-Based Design (EBD) have been used as assessment models to ensure a high-quality environment. Through interviews, the POE assesses how users appraise the design of an existing structure and how it supports certain activities. The EBD, on the other hand, is a reflective process that takes place during the planning stages of a building project, examining the impact of different architectural design solutions on people, costs, and management. However, the use of EBD for LTCF environments requires a valid and usable instrument that can evaluate the environmental design based on building elements that are known to relate to positive healthcare outcomes and SWB (Craik & Femer, 1987). The appropriate instrument must be able to standardize the information and enable the researcher to compare different environments, offer insights into how environments can be better adapted to patients’ and staff needs, and identify strengths and weaknesses in the environment.

Space Syntax (SPS) is a robust quantitative assessment tool that creates precise quantitative identification and measurements of spaces in light of human behavior and cognition. It has been applied to the study of healthcare facilities since the late 1990s. SPS captures behavioral movement environmental characteristics (using axial maps), connectivity between spaces, step-depth and integration (the shape of the corridors), and axial lines (i.e. the set of fewest walking paths to reach all of the spaces). SPS also documents visibility from particular points within a layout, using isovist maps that offer a number of geometrical measures such as properties like isovist perimeter and area (Yu et al., 2011), and documents the arrangement of programmatic spaces that explore the physical accessibility of space .

Elf et al. (2017) conducted a review of 23 specific instruments for assessing the quality of physical layout in healthcare environments. Seventeen out of the 23 instruments were developed for LTCFs, and some instruments were developed explicitly for use in dementia care settings (e.g., EAT (Fleming, 2011) and the Evidence-Based model (Zeisel et al., 1994)).

 The findings of the review (Nordin & Elf, 2018) revealed that most of the instruments demonstrated a rather weak empirical base and have not been used consistently since their development, or have not been used by other researchers, making it difficult to assess the applicability and feasibility of the instruments. Only three of the instruments were found to be more commonly used: the TESS-NH (Sloane et al., 2003), the MEAP (Moos & Lemke, 1996)and the PEAP (Lawton et al., 2000). These models were developed in the 1990’s and are therefore less relevant to contemporary LTCFs that focus on person-centered care. Furthermore, both MEAP (Moos & Lemke, 1996) and PEAP (Cutler et al., 2006) are described as complex to use. In conclusion, this review highlights the need for more research to develop instruments that are theoretically well-grounded, that rely on current or emerging models of care and modern healthcare environments (including LTCFs), and focus on SWB and QoL.

## The Current Proposal

The main goal of the current proposal is to deepen the existing knowledge on the correlation between the physical layout in LTCFs to SWB and QoL of residents. In order to achieve this goal, the study aims to produce a robust, theoretically-based tool that will help create an SWB- and QoL-oriented assessment tool for LTCFs, based on architectural plans. These typologies will be used by consecutive studies that intend to understand the contribution of each architectural factor (separately or as a group, directly or indirectly) on the QoL and SWB of LTCF residents. To build this tool, a set of criteria will be built that can be used to examine architectural plans of LTCFs in Israel.

# Methodology

The current research will involve three different studies. The first study will develop a new physical layout evaluation tool for LTCF unites. The new research tool will assess the physical layout (architectural plans) of LTCF units (that are already built or are in the design process), using research-based spacial dimensions associated with SWB and QoL. The outcomes of the new tool will allow us to classify different LTCF units’ physical layout and divide them into typologies. The second study will use the typologies retrieved from the first study to search for associations between the physical layout of LTCF units and the SWB and QoL of its residents. The third study will again use these typologies to search for associations between the physical layout of LTCF units and the experience of burnout among caregivers.

All three studies will be conducted with the full approval of the ethics committee, following all required rules and guidelines.

## Study One: Methodological Research to Develop a Physical Layout Assessment Tool for LTCFs

### *Aims and Objectives*

The study aims to develop an analytical tool to assess the physical layout (architectural plans) of LTCF units. The objective for this new innovative tool is to allow differentiation between physical layouts of LTCF units based on spatial dimensions that can be perceived as related to the SWB and QoL of their residents.

### *Study Hypothesis*

1. The new tool will be able to assess the physical layouts of LTCF units based on spatial dimensions that can be perceived as related to SWB and QoL.
2. The new tool’s outcomes will allow us to classify different LTCF units’ physical layouts and, based on that, to divide them into typologies.

### *Procedure*

Developing the Assessment Tool: Based on the literature in this area, as described in the literature review, an assessment checklist will be creating by merging different physical layout dimensions that are correlated with SWB and QoL. An exact procedure and measures will be devised in order to ensure consistency of measurement. Variables will be extracted using measurements on the plans and by using techniques deployed as part of the Spatial Syntax method (Syntax, 1988).

Implementing the New Tool: Forty randomly computerized LTCF unit plans, located all over Israel, will be analyzed by the new tool. The computerized plans will be collected from the LTCF owners or managers, or by the architects of these units who give their consent to collaborate in the research. The inclusion criteria are: 1) each LTCF must have a valid license from the Israeli Ministry of Health (if not yet inhabited, the plans of the LTCF must be approved by the Ministry of Health) and 2) a minimum of twenty-four beds per unit.

### Data Analysis

A list of indicators will be measured for each of the collected plans. Factor analysis will be conducted in order to reduce the list of attributes, creating factors that can be perceived as affecting similar aspects of life in LTCF units. Following this, cluster analysis will be used to divide the plans into groups or “typologies.”

## Study Two: Associations between Physical Layout of LTCF Units and Residents’ Subjective Well-Being and Quality of Life

### *Aims and Objectives*

The second study aims to explore the association between the physical layout of LTCF units to the SWB and QoL of its residents. It will address this association by using the LTCF unit typologies retrieved from Study One.

### *Study Hypothesis*

1. There will be differences in the perceived SWB and QoL of LTCF residents living in the different typologies.
2. There will be differences in the behavioral patterns of LTCF residents living in the different typologies.

### *Participants*

One hundred and twenty LTCF residents, randomly chosen from within different LTCF typologies (retrieved from the first study) will be sampled so that they represent the different layout typologies. Inclusion criteria are: 1) participants must have appropriate cognitive and physical abilities (with a score of at least 22 on the Mini-Mental State Examination, without significant visual or speech impairment), 2) have lived in the facility for over three months, 3) are above the age of 65, and 4) speak Hebrew, Arabic, or Russian.

### *Instruments*

**Dependent variables:**

**a) The LTCF physical layout typologies**

As the independent variable, Study Two will use the LTCF unit typologies retrieved from study one.

**Independent variables:** In order to measure the dependent variables, namely SWB and QoL, the study will use several complementary research tools, as described below. One motivation for this is to allow for the fact that LTCF residents, even with appropriate Mini-Mental scores may experience communication problems.

**b) Single-item life satisfaction measure (Lucas & Donellan, 2012)**

The life satisfaction measure is commonly used as a predictor of well-being and will be measured by a single question: “How satisfied are you with your life?” with a 4-point scale from one (Very Satisfied) to four (Very Dissatisfied)

(Lucas & Donnellan, 2012; Nieboer & Lindenberg, 2002; Peasgood et al, 2014).

**c) The SPF-IL(S) questionnaire**

The SPF-IL(S) questionnaire is a validated tool that measures SWB and QoL of older adults. The questionnaire addresses five topics: affection, behavioral confirmation, status, comfort, and stimulation (Nieboer et al., 2005). The questionnaire includes fifteen questions (measured by both 1-4 to 1-5 scales). Affection is measured by questions such as “Do people pay attention to you?” or “Do you feel that people really love you?” and is scored on a four-point adverbial scale (1=Never, 2=Sometimes, 3=Often, 4=Always). Behavioral confirmation, status, comfort, and stimulation include questions such as “Do you feel useful to others?,” “Do people find you an influential person?,” “Are you known for the things you have accomplished?,” “In the past few months, have you felt physically comfortable?,” and “Do you really enjoy your activities?” These questions will be answered using a 5-point Likert scale (1=Never, 2=Sometimes, 3=Often, 4=Always, and 5=N/A). Cronbach’s alpha ranges of 0.631–0.836 for the frail older sample.

The SPF-IL(S) questionnaires will be translated to into three languages: Hebrew, Russian, and Arabic, according to academic requirements, and will be tested on five LTCF residents for further adjustments. The participants will answer the questionnaires verbally (in their native language) in a face-to-face interview. Written possible answers will be available for people who needing help to choose their answer by pointing it out. The questionnaire will be given in a private, quiet room.

**d) The Maastricht Electronic Daily Life Observation-tool (MEDLO)**

The quantitative observation tool chosen for this study is the MEDLO (Jolani et al., 2016). The tool assesses four behavioral aspects: 1) activity (activities performed by resident, engagement in the activity, and degree of physical effort), 2) physical environment and location (the location of the resident and interaction with the physical environment), 3) social interaction (levels and types of social interaction, and the nature of these interactions, including with whom it took place) and 4) emotional well-being (mood and agitation). The MEDLO provides a full description of the daily lives of LTCF residents. The tool allows researchers to assess multiple locations and aspects of behavior simultaneously. By using the tool, the results of the observations will be transformed into quantitative measurable variables that offer an efficient way of processing data (de Boer et al., 2018)

The MEDLO tool is a valid, feasible, and reliable observation tool with a Kappa value between 0.5 and 1.0, and high absolute agreement (86%) between observers and good psychometric properties.

**Control variables:** The confounding variables of the current study include information about the resident and his or her room.

**e) Socio-demographic questionnaire**

Several socio-demographic topics might be associated with the participant’s SWB and QoL. The common socio-demographic questions have been narrowed down to seven relevant topics: gender, age, country of origin, Hebrew speaker, marital status, has living children, former occupation. The questionnaires will be filled out by the appointed staff member, retrieved from the participant’s file, or filled out through personal knowledge due to familiarity with the participant.

**f) The physical status questionnaire**

Physical functioning (not general health) is a key determinant of QoL judgments (Smith et al., 1999). The physical status questionnaire will include four questions: 1) Does the participant feed him- or herself (yes/no)? 2) Does the participant walk on (yes/no)? If not, then 3) Does the participant move their wheel chair on their own (yes/no)? 4) Does the participant use the toilet regularly (yes/no)?

The questionnaires will be filled out by the appointed staff member.

**g) Participant bedroom questionnaire**

Participants’ bedrooms are often unequal in certain ways and might affect a participant’s SWB and QoL. The characteristics of participants’ bedrooms will therefore be addressed with a questionnaire. The questionnaire will include four questions: 1) Is it a private room (yes/no)? 2) Is there a bathroom entrance adjacent to the room (yes/no)? 3) Is the nursing station (NS) visible from the participant’s room entrance (yes/no)? 4) How far is the NS from the participant’s room entrance (1. Next to NS, 2. Three rooms away from NS, 3. Over three rooms from NS). The researcher will fill out the questionnaire by using the architectural plans.

### *Procedure*

After selecting the participating LTCF units according to their typologies (retrieved from Study One), we will receive the consent for collaboration from the LTCF owners or management. An appointed staff member, who has worked in the relevant unit for at least three months and is familiar with the participants, will become the referent throughout the studies and will help select the participants, help obtain participant consent, and will be in charge of filling out the participants’ socio-demographic and physical status questionnaire.

The researchers will execute the rest of the questionnaires and the observations.

### *Data Analysis*

The data retrieved from the questionnaires will be analyzed using the ANOVA test, which will address each typology according to its association with residents’ SWB and QoL.

## Study Three: The Association between Physical Layout of LTCF Units and the Experience of Burnout Among Caregivers

### *Aims and Objectives*

Psychological well-being of the residents living in LTCFs is highly related to their social engagement, social support, affection, and compassion, which is mostly provided by their caregivers (Baltes, 1996; Lindenberg, 1996; Mendes de Leon et al., 2003). However, burnout among caregivers causes decreased compassion, short temper, communication problems, reduced work motivation, decreased quality of care, fatigue, anxiety, and causes high turnover (Cutleret al., 2006; Hunt et al., 2017).

Therefore, in light of the needs fulfilled by caregivers, addressing caregivers’ burnout is essential to ensuring the SWB and QoL of LTCF residents (Danaci & Koç, 2019). The third study aims to explore the association between the physical layout of LTCF units and the experience of burnout among caregivers. The current study will address this association by using the LTCF unit typologies retrieved from Study One.

### *Study hypothesis*

1. There will be differences in burnout among caregivers working in the different layout typologies.
2. Typologies with less caregiver burnout will be associated with typologies that have better SWB and QoL (retrieved from Study Two).

### *Participants*

One hundred LTCF qualified nurses and nurse aids, randomly chosen from different LTCF typologies (retrieved from the Study One) will be sampled so that they represent the different layout typologies. Inclusion criteria are: 1) participants must have worked in a full-time position in the facility for over six months, 2) work only in a single unit and not in more than one job, 3) work directly with the residents, and 4) be able to read and understand the Hebrew questionnaire.

### *Instruments*

**Independent variables:**

**a) PTCF physical layout typologies**

The current study will address the association by using the LTCF-U typologies retrieved from Study One.

**Dependent Variables:** Caregiver burnout will be measured using two complementary tools: the single-item Life Satisfaction Measure and The Shirom-Melamed Burnout Questionnaire.

**b) Life Satisfaction Measure (Lucas & Donnellan, 2012)**

The life satisfaction measure is addressed in Study Two.

**c) The Shirom-Melamed Burnout Questionnaire (SMB-Q)**

The different conceptualizations of burnout are reflected by the variety of measures to assess it. Some asses several dimensions of burnout, and others asses a single dimension. The Shirom-Melamed Burnout Measure (SMBM) operationalizes burnout as a syndrome combining cognitive weariness, emotional exhaustion, and physical fatigue (Grossi et al., 2003; Shirom & Melamed, 2006).

The study assumes that there is a correlation between the physical layout of the LTCF units and some of the caregivers’ SMBM burnout dimensions. These include, for example, walking long distances, inefficient location of support rooms, and poor visibility (and therefore control) from the nursing station. These may be correlated with physical fatigue. Additionally, inefficient location or lack of recreation rooms for the staff may affect the caregivers’ exhaustion and cognitive weariness.

 The SMBQ contains twenty-two items (graded on a scale of 1– 7) that measure different facets of the burnout syndrome in four subscales: 1) physical fatigue (eight items such as “I feel tired” and “My batteries are dead”), 2) cognitive weariness (six items such as “I feel I am not thinking clearly” and “I have difficulty thinking about complex things”), 3) tension (four items such as “I feel tense” and “I feel relaxed”), and 4) listlessness (four items such as “I feel full of vitality” and “I feel alert”). For purposes of data reduction, the overall burnout index will be calculated for each typology. The SMBQ/SMBM's have Cronbach’s alpha values generally exceeding accepted standards (α ≥ 0.70) (Grossi et al., 2003; Schilling et al., 2019).

C**ontrol variables**:

**d) Socio-demographic questionnaire**

Several socio-demographic topics may be associated with the participants’ burnout. The common socio-demographic questions have been narrowed down to nine relevant topics: gender, age, country of origin, Hebrew speaker (yes/no), travel time to work (up to 30 min., 30-45 min., over 45 min.), education (number of years), occupation (qualified nurse or nurse’s aide), amount of night shifts per month, in charge of other employees (yes/no).

### *Procedure*

LTCF qualified nurses and nurse aids, randomly chosen from different LTCF typologies (retrieved from Study One), will answer the written questionnaires.

### *Data Analysis*

The data retrieved from the questionnaires will be analyzed using the ANOVA test, which will address each typology according to its association with the experience of burnout among caregivers. We will also consider other types of analysis, such as cluster analysis.

# **B**ibliography

Ayalon, L. (2016). Intergenerational perspectives on autonomy following a transition to a continuing care retirement community. *Research on Aging*, *38*(2), 127–149. https://doi.org/10.1177/0164027515575029

Ball, M. M., Perkins, M. M., Whittington, F. J., Hollingsworth, C., King, S. V., & Combs, B. L. (2004). Independence in assisted living. *Journal of Aging Studies*, *18*(4), 467–483. https://doi.org/10.1016/j.jaging.2004.06.002

Baltes, M. M. (1996). *The Many faces of dependency in old age*. Cambridge University Press.

Becker, F. (2007). Nursing unit design and communication patterns: What is “real” work? *HERD: Health Environments Research & Design Journal*, *1*(1), 58–62. <https://doi.org/10.1177/193758670700100115>

Bowling, A., Rowe, G., Adams, S., Sands, P., Samsi, K., Crane, M., & Manthorpe, J. (2015). Quality of life in dementia: A systematically conducted narrative review of dementia-specific measurement scales. *Aging and Mental Health*, *19*(1), 13–31. https://doi.org/10.1080/13607863.2014.915923

Bridges, J., Flatley, M., & Meyer, J. (2010). Older people’s and relatives’ experiences in acute care settings: Systematic review and synthesis of qualitative studies. *International Journal of Nursing Studies*, *47*(1), 89–107. https://doi.org/10.1016/j.ijnurstu.2009.09.009

Brooke, V. (1989). Nursing home life: How elders adjust. *Geriatric Nursing*, (10), 6–8.

Brooker, D. J., Woolley, R. J., & Lee, D. (2007). Enriching opportunities for people living with dementia in nursing homes: An evaluation of a multi-level activity-based model of care. *Aging and Mental Health*, *11*(4), 361–370. https://doi.org/10.1080/13607860600963679

Burton, L., Port, C. L., Magaziner, J., Hebel, J. R., Gruber-Baldini, A. L., Zimmerman, S. I., & Baumgarten, M. (2011). Resident contact with family and friends following nursing home admission. *The Gerontologist*, *41*(5), 589–596. https://doi.org/10.1093/geront/41.5.589

Camfield, L., & Skevington, S. M. (2008). On subjective well-being and quality of life. *Journal of Health Psychology*, *13*(6), 764–775. https://doi.org/10.1177/1359105308093860

Chaudhary, N. (2003). Speaking the self into becoming? *Culture and Psychology*, *9*(4), 471–486. https://doi.org/10.1177/1354067X0394009

Chaudhury, H., Cooke, H. A., Cowie, H., & Razaghi, L. (2018). The Influence of the physical environment on residents with dementia in long-term care settings: A review of the empirical literature. *The Gerontologist*, *58*(5), e325–e337. https://doi.org/10.1093/geront/gnw259

Cohen-Mansfield, J., Marx, M. S., & Werner, P. (1992). Observational data on time use and behavior problems in the nursing home. *The Journal of Applied Gerontology*, *11*(1), 111–121. https://doi.org/10.1177/073346489201100109

Cohen-Mansfield, J., Thein, K., Dakheel-Ali, M., & Marx, M. S. (2010a). Engaging nursing home residents with dementia in activities: The effects of modeling, presentation order, time of day, and setting characteristics. *Aging and Mental Health*, *14*(4), 471–480. https://doi.org/10.1080/13607860903586102

Cohen-Mansfield, J., Thein, K., Dakheel-Ali, M., & Marx, M. S. (2010b). The underlying meaning of stimuli: Impact on engagement of persons with dementia. *Psychiatry Research*, *177*(1–2), 216–222. https://doi.org/10.1016/j.psychres.2009.02.010

Cook, C., Fay, S., & Rockwood, K. (2008). Decreased initiation of usual activities in people with mild-to-moderate Alzheimer’s disease: A descriptive analysis from the VISTA clinical trial. *International Psychogeriatrics*, *20*(5), 952–963. https://doi.org/10.1017/S1041610208007230

Craik, K., & Femur, N. (1987). Environmental assessment. In D. Stockols & I. Altman (Eds.), *Handbook of environmental psychology* (Vol. 1, pp. 147–181). John Wiley & Sons.

Cramm, J. M., Jolani, S., Van Buuren, S., & Nieboer, A. P. (2015). Better experiences with quality of care predict well-being of patients with chronic obstructive pulmonary disease in the Netherlands. *International Journal of Integrated Care*, *15*, e208. https://doi.org/10.5334/ijic.1587

Cramm, J. M., & Nieboer, A. P. (2014). The effects of social and physical functioning and self-management abilities on well-being among patients with cardiovascular diseases, chronic obstructive pulmonary disease, and diabetes. *Applied Research in Quality of Life*, *9*(1), 113–121. https://doi.org/10.1007/s11482-013-9216-z

Cramm, J. M., & Nieboer, A. P. (2015). The importance of productive patient–professional interaction for the well-being of chronically ill patients. *Quality of Life Research*, *24*(4), 897–903. https://doi.org/10.1007/s11136-014-0813-6

Cutchin, M. P. (2003). The process of mediated aging-in-place: A theoretically and empirically based model. *Social Science and Medicine*, *57*(6), 1077–1090. https://doi.org/10.1016/S0277-9536(02)00486-0

Cutler, L. J., Kane, R. A., Degenholtz, H. B., & Miller, M. J., & Grant, L. (2006). Assessing and comparing physical environments for nursing home residents: Using new tools for greater research specificity. *The Gerontologist*, *46*(1), 42–51. https://doi.org/10.1093/geront/46.1.42

Gerritsen, ,Steverink, N., Ooms, M. E.,& Ribbe, M. W. (2004). Finding a useful conceptual basis for enhancing the quality of life of nursing home residents. *Quality of Life Research,* *13* (3), 611–624. <https://www.ncbi.nlm.nih.gov/pubmed/15130025>

Danaci, E., & Koç, Z. (2019). The association of job satisfaction and burnout with individualized care perceptions in nurses. *Nursing Ethics, 27*(1), 301–315.. https://doi.org/10.1177/0969733019836151

De Boer, B., Beerens, H. C., Zwakhalen, S. M. G., Tan, F. E. S., Hamers, J. P. H., & Verbeek, H. (2016). Daily lives of residents with dementia in nursing homes: Development of the Maastricht electronic daily life observation tool. *International Psychogeriatrics*, *28*(8), 1333–1343. https://doi.org/10.1017/S1041610216000478

De Boer, Bram, Beerens, H., Katterbach, M., Viduka, M., Willemse, B., & Verbeek, H. (2018). The physical environment of nursing homes for people with dementia: Traditional nursing homes, small-scale living facilities, and green care farms. *Healthcare*, *6*(4), 137. https://doi.org/10.3390/healthcare6040137

Debra, M., & Norma, S. (1999). The physical environment of special care units: needs of residents with dementia from the perspective of staff and family caregivers. *Qualitative Health Research*, *9*(1), 105–118.

Diener, E. D., Emmons R. A., Larsen R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment*, *49*(1), 71–75. <https://www.tandfonline.com/doi/abs/10.1207/s15327752jpa4901_13>

Diener, E., Ng, W., Harter, J., & Arora, R. (2010). Wealth and happiness across the world: Material prosperity predicts life evaluation, whereas psychosocial prosperity predicts positive feeling. *Journal of Personality and Social Psychology*, *99*(1), 52–61. https://doi.org/10.1037/a0018066

Dodge, Daly, Huyton, & Sanders. (2013). The challenge of defining wellbeing. *International Journal of Wellbeing*, *2*(3), 222–235. https://doi.org/10.5502/ijw.v2i3.4

Durham, J., & Kenyon, A. (2019). Decentralized nurse stations: A methodology for using research to guide design decisions. *Health Environments Research and Design Journal*,  *12*(4), 8–21. https://doi.org/10.1177/1937586719842356

Ejaz, F. K., Noelker, L. S., Schur, D., Whitlatch, C. J., & Looman, W. J. (2002). Family satisfaction with nursing home care for relatives with dementia. *Journal of Applied Gerontology*, *21*(3), 368–384. <https://doi.org/10.1177/073346480202100306>

Elf, M., Nordin, S., Wijk, H., & Mckee, K. J. (2017). A systematic review of the psychometric properties of instruments for assessing the quality of the physical environment in healthcare. *Journal of Advanced Nursing*, *73*(12), 2796–2816. https://doi.org/10.1111/jan.13281

Fazio, S., Pace, D., Flinner, J., & Kallmyer, B. (2018). The fundamentals of person-centered care for individuals with dementia. *The* *Gerontologist*, *58*(1), S10–S19. https://doi.org/10.1093/geront/gnx122

Ferdous, F., & Moore, K. D. (2015). Field observations into the environmental soul: Spatial configuration and social life for people experiencing dementia. *American Journal of Alzheimer’s Disease & Other Dementias*, 209–218.  <https://doi.org/10.1177/1533317514545378>

Ferrand, C., Martinent, G., & Durmaz, N. (2014). Psychological need satisfaction and well-being in adults aged 80 years and older living in residential homes: using a self-determination theory perspective. *Journal of Aging Studies*, *30*, 104–111. [10.1016/j.jaging.2014.04.004](https://doi.org/10.1016/j.jaging.2014.04.004%22%20%5Ct%20%22_blank)

Fleming, R. (2011). An environmental audit tool suitable for use in homelike facilities for people with dementia. *Australasian Journal on Ageing*, *30*(3), 108–112. https://doi.org/10.1111/j.1741-6612.2010.00444.x

Førsund, L. H., Kiik, R., Skovdahl, K., & Ytrehus, S. (2016). Constructing togetherness throughout the phases of dementia: a qualitative study exploring how spouses maintain relationships with partners with dementia who live in institutional care. *Journal of Clinical Nursing*, *25*(19–20), 3010–3025. https://doi.org/10.1111/jocn.13320

Gaugler, J. E. (2005). Family involvement in residential long-term care : A synthesis and critical review. *Aging and Mental Health*, *9*(18)(), 105-118. https://doi.org/10.1080/13607860412331310245

Goffman, E., & Helmreich, W. B. (2018). On the characteristics of total institutions 1. In E. Goffman (Ed.), *Asylums: Essays on the social situation of mental patients and other inmates* (pp. 1–124). https://doi.org/10.4324/9781351327763-1

 Greene, V. L., & Monahan, D. J. (1982). The impact of visitation on patient well-being in nursing homes. *The Gerontologist*, *22*(4), 418–423. https://doi.org/10.1093/geront/22.4.418

Grenade, L., & Boldy, D. (2008). Social isolation and loneliness among older people: issues and future challenges in community and residential settings. *Australian Health Review*, *32*(3), 468–478. [10.1071/ah080468](https://doi.org/10.1071/ah080468)

Grossi, G., Perski, A., Evengård, B., Blomkvist, V., & Orth-Gomér, K. (2003). Physiological correlates of burnout among women. *Journal of Psychosomatic Research*, *55*(4), 309–316. https://doi.org/10.1016/S0022-3999(02)00633-5

Hanneke C. B., Zwakhalen, S. M.G. Verbeek, H., Tan, F. E.S., Jolani, S., Downs, M., de Boer, B., Ruwaard, D., & Hamers, J. P.H. (2018) The relation between mood, activity, and interaction in long-term dementia care, *Aging & Mental Health*, *22*(1), 26-32. https://doi.org/[10.1080/13607863.2016.1227766](https://doi.org/10.1080/13607863.2016.1227766)

Harmer, B. J., & Orrell, M. (2008). What is meaningful activity for people with dementia living in care homes? A comparison of the views of older people with dementia, staff and family carers. *Aging and Mental Health*, *12*(5), 548–558. https://doi.org/10.1080/13607860802343019

Hsieh, Y. P. (2014). Users′ Perceptions of bedroom privacy and personalization in long-term care facilities. *Journal of Asian Architecture and Building Engineering*, *13*(3), 625–631. https://doi.org/10.3130/jaabe.13.625

Hsieh, Y. (2010). Investigation on the day-to-day behavior of a taiwanese nursing organization’s residents through shared bedroom style. *Journal of Asian Architecture and Building Engineering*, *9*(2), 371–378. https://doi.org/10.3130/jaabe.9.371

Hughes, M. (2004). Privacy in aged care. *Australasian Journal on Ageing*, *23*(3), 110–114. https://doi.org/10.1111/j.1741-6612.2004.00033.x

Hunt, P. A., Denieffe, S., & Gooney, M. (2017). Burnout and its relationship to empathy in nursing: A review of the literature. *Journal of Research in Nursing*, *22*(1–2), 7–22. https://doi.org/10.1177/1744987116678902

Hyde, M., Wiggins, R. D., Higgs, P., & Blane, D. B. (2003). A measure of quality of life in early old age: The theory, development and properties of a needs satisfaction model (CASP-19). *Aging and Mental Health*, *7*(3), 186–194. https://doi.org/10.1080/1360786031000101157

Iwasiw C., Goldenberg D., MacMaster E., McCutcheon, S., & Bol, N. (1996). Residents’ perspectives of their first 2 weeks in a long-term care facility. *Journal of Clinical Nursing*, *5*(6), 381-388. <https://doi.org/10.1111/j.1365-2702.1996.tb00271.x>

Jang, Y., Park, N. S., Dominguez, D. D., & Molinari, V. (2014). Social engagement in older residents of assisted living facilities. *Aging and Mental Health*, *18*(5), 642–647. https://doi.org/10.1080/13607863.2013.866634

Jao, Y. L., Liu, W., Williams, K., Chaudhury, H., & Parajuli, J. (2019). Association between environmental stimulation and apathy in nursing home residents with dementia. *International Psychogeriatrics*, *31*(8), 1109-1120..

https://doi.org/10.1017/s1041610219000589

Jao, Y. L., Algase, D. L., Specht, J. K., & Williams, K. (2016a). Developing the person–environment apathy rating for persons with dementia. *Aging and Mental Health*, *20*(8), 861–870. https://doi.org/10.1080/13607863.2015.1043618

Jarrott, S. E., Gozali, T., & Gigliotti, C. M. (2008). Montessori programming for persons with dementia in the group setting: An analysis of engagement and affect. *Dementia*, *7*(1), 109–125. https://doi.org/10.1177/1471301207085370

Johnson, B. D., & Namazi, K. H. (1992). Pertinent autonomy for residents with dementias: Modification of the physical environment to enhance independence. *American Journal of Alzheimer’s Disease and Other Dementias*, *7*(1), 16–21. https://doi.org/10.1177/153331759200700105

Kane, R. A. (2003). Definition, measurement, and correlates of quality of life in nursing homes: toward a reasonable practice, research, and policy agenda. *Gerontologist*, *43*(suppl\_2, 1), 28–36. https://doi.org/10.1093/geront/43.suppl\_2.28

Kane, R. A., Kling, K. C., Bershadsky, B., Kane, R. L., Giles, K., Degenholtz, H. B., Liu, J., & Cutler, L. J. (2003). Quality of life measures for nursing home residents. *The Journals of Gerontology: Series A*, *58*(3), M240–M248. https://doi.org/10.1093/GERONA/58.3.M240

Kiely, D. K., Simon, S. E., Jones, R. N., & Morris, J. N. (2000). The protective effect of social engagement on mortality in long‐term care. *Journal of the American Geriatrics Society*, *48*(11), 1367–1372. https://doi.org/10.1016/j.annepidem.2006.12.006

Kitwood, T. (1997). The experience of dementia. *Aging and Mental Health*, *1*(1), 13–22. https://doi.org/10.1080/13607869757344

Knight, T., & Mellor, D. (2007). Social inclusion of older adults in care: Is it just a question of providing activities? *International Journal of Qualitative Studies on Health and Well-Being*, *2*(2), 76–85. https://doi.org/10.1080/17482620701320802

Koren, M. J. (2010). Person-centered care for nursing home residents: The culture-change movement. *Health Affairs*, *29*(2), 1-6. https://doi.org/10.1377/hlthaff.2009.0966

Lambert, N. M., Stillman, T. F., Hicks, J. A., Kamble, S., Baumeister, R. F., & Fincham, F. D. (2013). To belong is to matter: Sense of belonging enhances meaning in life. *Personality and Social Psychology Bulletin*, *39*(11), 1418–1427. https://doi.org/10.1177/0146167213499186

Langlois, A., & Anderson, D. E. (2002). Resolving the quality of life / well-being puzzle: Toward a new model. *Canadian Journal of Regional Science*, *25*(3), 501–512.

Lawton, M. P., & Brody, E. M. (1969). Assessment of older people: Self-maintaining and instrumental activities of daily living. *The Gerontologist*, *9*(3 Part 1), 179–186. <https://doi.org/10.1093/geront/9.3_Part_1.179>

Lawton, M. P., Weisman, G. D., Sloane, P., & Calkins, M. (1997). Assessing environments for older people with chronic illness. *Journal of Mental Health and Aging*, *3*(1), 83–100.

Lawton, M. P., Weisman, G. D., Sloane, P., Norris-Baker, C., Calkins, M., & Zimmerman, S. I. (2000). Professional environmental assessment procedure for special care units for elders with dementing illness and its relationship to the therapeutic environment screening schedule. *Alzheimer Disease and Associated Disorders*, *14*(1), 28–38. https://doi.org/10.1097/00002093-200001000-00004

Leino-Kilpi, H., Välimäki, M., Dassen, T., Gasull, M., Lemonidou, C., Scott, A., & Arndt, M. (2001). Privacy: a review of the literature, *International Journal of Nursing Studies, 38*(6), 663–671. [https://doi.org/10.1016/S0020-7489(00)00111-5](https://doi.org/10.1016/S0020-7489%2800%2900111-5%22%20%5Co%20%22Persistent%20link%20using%20digital%20object%20identifier%22%20%5Ct%20%22_blank)

Lindenberg, S. (1996). Continuities in the theory of social production functions [*Thesis*, 169–184.Lu, Y., Cai, H., & Bosch, S. J. (2017). Key spatial factors influencing the perceived privacy in nursing units: An exploration study with eight nursing units in Hong Kong. *HERD: Health Environments Research & Design Journal*, *10*(4), 37–48. https://doi.org/10.1177/1937586716672857

Lucas, R. E., & Donnellan, M. B. (2012). Estimating the reliability of single-item life satisfaction measures: Results from four national panel studies. *Social Indicators Research*, *105*(3), 323–331. https://doi.org/10.1007/s11205-011-9783-z

Marquis, R. (2002). Co-Director, Freemasons Centre for Research, (I).

Maslach, C. (1978). Client role in staff burn-out. *Journal of Social Issues*, *34*(4), 111–124.

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review*, *50*(4), 370–396. https://doi.org/10.1037/h0054346.

Maslow A. (1968). *Toward a psychology of being* (2nded.).  D. Van Nostrand Company.

Mendes de Leon, C. F., Glass, T. A., & Berkman, L. F. (2003). Social engagement and disability in a community population of older adults: The New Haven EPESE. *American Journal of Epidemiology*, *157*(7), 633–642. https://doi.org/10.1093/aje/kwg028

Miller, V. J. (2018). Investigating barriers to family visitation of nursing home residents: A systematic review. *Journal of Gerontological Social Work*, *62*(3),261-267.. https://doi.org/10.1080/01634372.2018.1544957

Moos, R. H., & Lemke, S. (1996). *Evaluating Residential Facilities: The Multiphasic Environmental Assessment Procedure.* Thousand Oaks.

Morgan, D., & Stewart, N. J. (1999). The physical environment of special care units: Needs of residents with dementia from the perspective of staff and family caregivers. *Qualitative Health Research*, *9*(1), 105–118. https://doi.org/10.1177/104973299129121721

Morgan, T. J., Hansson, R. O., Indart, M. J., Austin, D. M., Crutcher, M. M., Hampton, P. W., Oppegard, K. M., & O'daffer, V. E. (1984). Old age and environmental docility: The roles of health, support and personality. *Journal of Gerontology*, *39*(2), 240–242. https://doi.org/10.1093/geronj/39.2.240

Nahemow, L., & Lawton, M. P. (1973). Toward an ecological theory of adaptation and aging. *Environmental Design Research,* *1*, 24-32.

Natrop, L. (2017). *The relation between autonomy and well-being of nursing home residents with dementia : a systematic review* [Master's thesis, University of Twente].SemanticScholar..

Nieboer, A., & Lindenberg, S. (2002). Substitution, buffers and subjective well-being: A hierarchical approach,. In E. Gullone, & R. A. Cummins (Eds.) *The universality of subjective wellbeing indicators. Social indicators research series* Vol 16. (pp. 175–189), Springer. https://doi.org/10.1007/978-94-010-0271-4\_10

Nieboer, A., Lindenberg, S., Boomsma, A., & Van Bruggen, A. C. (2005). Dimensions of well-being and their measurement: The Spf-Il scale. *Social Indicators Research*, *73*(3), 313–353. https://doi.org/10.1007/s11205-004-0988-2

Nieboer, A. P., & Cramm, J. M. (2018a). Age-friendly communities matter for older people’s well-being. *Journal of Happiness Studies*, *19*(8), 2405–2420. https://doi.org/10.1007/s10902-017-9923-5

Nieboer, A. P., & Cramm, J. M. (2018b). How do older people achieve well-being? Validation of the social production function instrument for the level of well-being–short (SPF-ILs). *Social Science and Medicine*, *211*, 304–313. https://doi.org/10.1016/j.socscimed.2018.06.036

Nordin, S., & Elf, M. (2018). The importance of the physical environment to support individualised care. In: R. Suhonen, M. Stolt, E. Papastavrou. (Eds.), *Individualized Care* (pp. 207–215). Springer. https://doi.org/10.1007/978-3-319-89899-5\_19

Ormel, J., Lindenberg, S., Steverink, N., & Verbrugge, L. M. (1999), Subjective well-being and social production functions. *Social Indicators Research*, *46*(1), 61–90. https://doi.org/10.1023/A:1006907811502

Park, I. (2018). *Role of social engagement and sense of belonging of assisted living residents: A descriptive study* [Doctoral dissertation, The University of Michigan]https://deepblue.lib.umich.edu/bitstream/handle/2027.42/147496/innpark\_1.pdf?sequence=1&isAllowed=y

Parker, C., Barnes, S., Mckee, K., Morgan, K., Torrington, J., & Tregenza, P. (2004). Quality of life and building design in residential and nursing homes for older people. *Ageing and Society*, *24*(6), 941–962. https://doi.org/10.1017/S0144686X04002387

Patrick, B., Skinner, E., & Connell, J. (1993). What motivates children’s behaviour and emotion in the academic domain? *Journal of Personality and Social Psychology*, *65*(4), 781–791.

Peasgood, T., Brazier, J., Muku*ria, C., & Rowen, D.* (2014)*.* A conceptual comparison of well-being measures usedin the UK, Project Report. *Policy Research Unit in Economic Evaluation of Health and Care Interventions* (*EEPRU*) (26), 1–55. http://eprints.whiterose.ac.uk/99497/1/A%20conceptual%20comparison%20of%20%20-%20026.pdf

Perrin, T., May, H. and Anderson, E. (2008). *Wellbeing in dementia: An occupational approach for therapists and carers* (2nd ed.). Churchill Livingstone.

Pirhonen, J., Tiilikainen, E., & Pietilä, I. (2018). Ruptures of affiliation: social isolation in assisted living for older people. *Ageing and Society*, *38*(09), 1868–1886. https://doi.org/10.1017/S0144686X17000289

Preshaw, D. H. L., Brazil, K., McLaughlin, D., & Frolic, A. (2016). Ethical issues experienced by healthcare workers in nursing homes: Literature review. *Nursing Ethics*, *23*(5), 490–506. https://doi.org/10.1177/0969733015576357

Prohaska, T. R., Anderson, L. A., & Binstock, R. H. (Eds). (2012). *Public Health for an Aging Society*. The Johns Hopkins University Press.

Regnier, V. (2003). Powell Lawton’s contributions to purpose-built housing design for the elderly. *Journal of Housing For the Elderly*, *17*(1–2), 39–53. https://doi.org/10.1300/J081v17n01\_04

Ryff, C. D. (2005). Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *Journal of Personality and Social Psychology*, *57*(6), 1069–1081. https://doi.org/10.1037/0022-3514.57.6.1069

Samuel, L. R. (2017). *Aging in America*. Praeger/ABC-CLIO. https://doi.org/10.9783/9780812293654

Schilling, R., Colledge, F., Brand, S., Ludyga, S., & Gerber, M. (2019). Psychometric properties and convergent validity of the Shirom–Melamed Burnout Measure in two German-speaking samples of adult workers and police officers. *Frontiers in Psychiatry*, *10*, 1–12. https://doi.org/10.3389/fpsyt.2019.00536

Hajek, A., Lehnert, T., Wegener, A., Riedel-Heller, S. G., König, H. H. (2018). Correlates of preferences for autonomy in long-term care: Results of a population-based survey among older individuals in Germany. *Patient Preference and Adherence*, *12*, 71–78. https://doi.org/10.2147/PPA.S146883

Schopp, A., Leino-Kilpi, H., Välimäki, M., Dassen, T., Gasull, M., Lemonidou, C., Scott, P. A., Arndt., M., & Kaljonen, A. (2003). Perceptions of privacy in the care of elderly people in five European countries, *Nursing Ethics*, *10*(1), 39–47.  https://doi.org/[10.1191/0969733003ne573oa](https://doi.org/10.1191/0969733003ne573oa%22%20%5Ct%20%22_blank)Schweber, L., & Haroglu, H. (2014). Comparing the fit between BREEAM assessment and design processes. *Building Research and Information*, *42*(3), 300–317. https://doi.org/10.1080/09613218.2014.889490

Sharma, S., & Sharma, M. (2010). Self, social identity and psychological well-being. *Psychological Studies*, *55*(2), 118–136. https://doi.org/10.1007/s12646-010-0011-8

Shirom, A., & Melamed, S. (2006). A comparison of the construct validity of two burnout measures in two groups of professionals. *International Journal of Stress Management*, *13*(2), 176–200. https://doi.org/10.1037/1072-5245.13.2.176

Shulman k. (2003). Art of the possible: a new ambulatory-care clinic for a remarkable institution seeks to become the nation’s first LEED-certified healthcare facility. *Metropolis*, *23(2)*, 124–127.

Singh, I., Subhan, Z., Krishnan, M., & Edwards, C., & Okeke, J. (2016). Loneliness among older people in hospitals: A comparative study between single rooms and multi-bedded wards to evaluate current health service within the same organisation. *Gerontology and Geriatrics: Research*, *2*(2), 1015–3.

Skevington, S. M., & Böhnke, J. R. (2018). How is subjective well-being related to quality of life? Do we need two concepts and both measures? *Social Science & Medicine*, *206*, 22–30. https://doi.org/doi:10.1016/j.socscimed.2018.04.005

Sloane, P. D., Mitchell, C. M., Weisman, G., Zimmerman, S., Long, K. M., Lynn, M., Calkins, M., Lawton, M. P., Teresi, J., Grant, L., Lindeman, D., & Montgomery, R. (2003). The therapeutic environment screening survey for nursing homes (TESS-NH): An observational instrument for assessing the physical environment of institutional settings for persons with dementia. *Research and Practice in Alzheimer’s Disease*, *7*(2), 138–145. https://doi.org/10.1093/geronb/57.2.s69

Smit, D., De Lange, J., Willemse, B., & Pot, A. M. (2012). The relationship between small-scale care and activity involvement of residents with dementia. *International Psychogeriatrics*, *24*(5), 722–732. https://doi.org/10.1017/S1041610211002377

Smit, D., Willemse, B., De Lange, J., & Pot, A. M. (2014). Wellbeing-enhancing occupation and organizational and environmental contributors in long-term dementia care facilities: An explorative study. *International Psychogeriatrics*, *26*(1), 69–80. https://doi.org/10.1017/S1041610213001397

Smith, K. W., Avis, N. E., & Assmann, S. F. (1999). Distinguishing between quality of life and health status in quality of life research: A meta-analysis. *Quality of Life Research*, *8*(5), 447–459. https://doi.org/10.1023/A:1008928518577

Stadnyk, R. L., Jurczak, S. C., Johnson, V., Augustine, H., & Sampson, R. D. (2013). Effects of the physical and social environment on resident-family member activities in assisted living facilities for persons with dementia. *Seniors Housing & Care Journal*, *21*(1), 36–52.

Steverink, N., Lindenberg, S., Spiegel, T., & Nieboer, A. P. (2020). The associations of different social needs with psychological strengths and subjective well-being: An empirical investigation based on social production function theory. *Journal of Happiness Studies*, *21*, 799–824. https://doi.org/10.1007/s10902-019-00107-9

Syntax, S. (1988). Chapter Three Bill Hillier Mapping Method: Basis Of Space Syntax Technique, (May 2008).

Taylor, E., Card, A. J., & Piatkowski, M. (2018). Single-occupancy patient rooms: A systematic review of the literature since 2006. *Health Environments Research and Design Journal*, *11*(1), 85–100. https://doi.org/10.1177/1937586718755110

Train, G. H., Nurock, S. A., Manela, M., Kitchen, G., & Livingston, G. A. (2005). A qualitative study of the experiences of long-term care for residents with dementia, their relatives and staff. *Aging and Mental Health*, *9*(2), 119–128. https://doi.org/10.1080/13607860412331310236

Ulrich, R. S., Berry, L. L., Quan, X., & Parish, J. T. (2011). A conceptual framework for the domain of evidence-based design. *Health Environments Research and Design Journal*, *4*(1), 95–114. https://doi.org/10.1177/193758671000400107

Van de Glind, I., van Dulmen, S., & Goossensen, A. (2008). Physician-patient communication in single-bedded versus four-bedded hospital rooms. *Patient Education and Counseling*, *73*(2), 215–219. https://doi.org/10.1016/j.pec.2008.07.004

Van Haeften-Van Dijk, A. M., Van Weert, J. C. M., & Droës, R. M. (2015). Implementing living room theatre activities for people with dementia on nursing home wards: A process evaluation study. *Aging and Mental Health*, *19*(6), 536–547. https://doi.org/10.1080/13607863.2014.955459

Verbeek, H., Van Rossum, E., Zwakhalen, S. M. G., Kempen, G. I. J. M., & Hamers, J. P. H. (2009). Small, homelike care environments for older people with dementia: A literature review. *International Psychogeriatrics*, *21*(2), 252–264. https://doi.org/10.1017/S104161020800820X

Wood, Harris, Snider, & Patchel. (2005). Activity situations on an Alzheimer’s disease special care unit and resident environmental interactions, time use, and affect. *American Journal of Alzheimer’s Disease and Other Dementias*, *20*(2), 105–118. <https://doi.org/10.1177/153331750502000210>

Yu, R., Gu, N., & Ostwald, M. (2011). The mathematics of spatial transparency and mystery: Using syntactical data to visualise and analyse the properties of the Yuyuan Garden. https://doi.org/10.1186/s40327-016-0033-y

Zeisel, J., Hyde, J., & Levkoff, S. (1994). Best practices: An environment behavior (E-B) model for Alzheimer special care units. *American Journal of Alzheimer’s Disease and Other Dementias*, *9*(2), 4–21. https://doi.org/10.1177/153331759400900202

Zimmerman, A., & Martin, M. (2001). Post-occupancy evaluation: Benefits and barriers. *Building Research and Information*, *29*(2), 168–174. https://doi.org/10.1080/09613210010016857