Design for Dementia: What Do We Know?

SUMMARY STATEMENT

Dementia is a brain syndrome leading to a progressive decline in cognitive, social, and emotional abilities. The number of people with dementia is increasing rapidly (Prince et al., 2013); therefore, one of the central concern of today health design industry is how to incorporate the needs of people with dementia into their built environment. Studies have been shown the therapeutic impacts of physical environments on physical and mental wellbeing as well as cognitive and functional performance of people with dementia (Day & Carreon, 2000; Fleming & Purandare, 2010; Tilly & Reed, 2008). The aim of this document is to provide a snapshot of existing evidence (ninety studies), categorized by design strategies and their impacts on main outcomes, including behavior, cognitive/functional performance, social abilities, wayfinding/orientation, and wellbeing/care outcomes (Marquardt, Bueter, & Motzek, 2014). Design strategies discussed in this document are listed as density/building layout, environmental features (lighting, noise, temperature, and use of color, contracts, and pattern), ambiance (homelike environment and multi-sensory approach), and environmental information (environmental cues and visual barriers).

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SUMMARY OF EVIDENCE

DESIGN STRATEGIES	OUTCOMES				
	BEHAVIOR	***COGNITION/ FUNCTIONAL PERFORMANCE***	***SOCIAL ABILITIES***	***WAYFINDING/ ORIENTATION***	***WELLBEING/ CARE OUTCOMES***
DENSITY/ BUILDING LAYOUT	Low density unit can lead to: 1. Reduced aggression (Morgan & Stewart, 1998b) 2. More active and engaged behavior (Hsieh, 2010) 3. Less violent behavior (Isaksson, Astrom, Sandman, & Karlsson, 2009; Nelson, 1995) Layouts with long corridors can lead to: 1. Higher restlessness and anxiety (Elmstahl, Annerstedt, & Ahlund, 1997) 2. More violence among residents (Isaksson, Astrom, Sandman, & Karlsson, 2009)		Small-group layouts can lead to: 1. More engagement (Cohen- Mansfield, Thein, Dakheel-Ali, & Marx, 2010). 2. Fewer conflict (Morgan & Stewart, 1999) 3. Higher Engagement in social interaction (Hsieh, 2010)	Direct visual access to relevant places Integration of reference points Implementation of several zones with a unique character Straight circulation system supports 1. Enhanced resident's wayfinding abilities (Elmstahl et al., 1997; Marquardt & Schmieg, 2009; Netten, 1989; Passini, Pigot, Rainvilee, & Tétrault, 2000) Supportive layout features are: A small number of doors and exit points (Netten, 1989) Spatial proximity of communal spaces (Elmstahl et al., 1997)	Single bedrooms can lead to: 1. Higher wellbeing (Morgan & Stewart, 1999) 2. improved sleep (Morgan & Stewart, 1998b) 3. Easier for staff to assist with toileting (Hutchinson, Leger-Krall, & Skodol Wilson, 1996) Units with a lower number of residents can lead to: 1. Lower drug prescriptions (Zuidema, Jonghe, Verhey, & Koopmans, 2011)

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ENVIRONMENTAL FEATURES: **LIGHTING**	Bright light can lead to: 1. Reduced negative behavioral outcomes, such as agitation, restlessness, or aggression (Dowling, Graf, Hubbard, & Luxenberg, 2007; Lovell, Ancoli-Israel, & Gevirtz, 1995; Riemersma-van der Lek et al., 2008; Thorpe, Middleton, Russell, & Stewart, 2000; van Hoof, Aarts, Rense, & Schoutens, 2009a).	However, exposure to bright light can lead to: 1. Cognitive improvement (more awake, verbally competent, and increase in MMSE total scores) (Graf et al., 2001; Nowak & Davis, 2011; Riemersma-van der Lek et al., 2008) 2. Improvements in functional performance (Nowak & Davis, 2011; Riemersma-van der Lek et al., 2008)			Exposure to bright light can lead to: 1. Improved mood (Nowak & Davis, 2011; Riemersma-van der Lek et al., 2008) 2. Reduced depressive symptoms (Dowling et al., 2007) 3. Improved in sleep or circadian rhythms (Ancoli-Israel et al., 2003; Lyketsos et al., 1999; Mishima, Hishikawa, & Okawa, 1998; Mishima et al., 1994; Satlin, Volicer, Ross, Herz, & Campbell, 1992; Sloane et al., 2007; van Hoof et al., 2009a; van Someren, Kessler, Mirmiran, & Swaab, 1997). 4. Reduces sleep disturbances in combination with melatonin intake (Riemersma-van der Lek et al., 2008)

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ENVIRONMENTAL FEATURES: **NOISE**	High levels of noise can lead to: 1. Increased wandering and aggressive and disruptive behavior (Algase et al., 2010; Cohen-Mansfield & Werner, 1995; Garcia et al., 2012; Nelson, 1995) as well as agitation (Joosse, 2009) However, a pleasant level of noise might be helpful to stimulate residents and to avoid boredom (Cohen-Mansfield & Werner, 1995) Noise control by reducing volume of electronic devices, using earphones, reducing staff talking, and fewer fast movements can lead to: 1. Reduced behavioral disturbances and violence (Meyer et al., 1992).		Moderate levels of sound can help: 1. Residents to be more engaged (Cohen-Mansfield et al., 2010) High levels of sound can lead to: 1. Less social interaction in residents (Garre-Olmo et al., 2012)	High levels of noise can lead to: 1. Reduced orientation (Netten, 1993)	Reduced noise is positively correlated with: 1. Quality of life (Garcia et al., 2012), High levels of noise can lead to: 1. Higher food and fluid intake (McDaniel et al., 2001) No effect of reduced nighttime noise on sleep in people with dementia was found in two studies at evidence level 2. This was explained by the inability to reduce noise levels sufficiently (Ouslander et al., 2006; Schnelle, Alessi, Al-Samarrai, Fricker, & Ouslander, 1999).
ENVIRONMENTAL FEATURES: **TEMPERATURE**	Comfortable temperature can lead to: 1. Less unwanted behavior, such as agitated or disruptive behavior (Cohen-Mansfield & Werner, 1995; Cohen-Mansfield & Parpura-Gill, 2007).				Uncomfortable room climate can lead to: 1. Lower wellbeing, measured as quality of life (Garre-Olmo et al., 2012)

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ENVIRONMENTAL FEATURES: **USE OF COLOR, CONTRACTS, AND PATTERN**	Neural/low-key (pale) colors and lack of contrast (doors and walls) can lead to: 1. Reduced attention and less undesired behavior (Cooper, Mohide, & Gilbert, 1989) Increased light intensity and enhanced visual contrast at dining tables can lead to: 1. Less disruptive behavior (Koss & Gilmore, 1998)	Enhanced lighting and table setting contrast can lead to: 1. Improved in function (Brush et al., 2002) Enhanced color contrast for table-ware, lower contrast and small motifs on carpets can lead to: 1. Enhanced walking performance (Perrit, McCune, & McCune, 2005)		Floor patterns and dark lines or surfaces can lead to: 1. Increased disorientation (Passini et al., 2000) However, using color can help: 1. Residents to locate their rooms (Gibson, MacLean, Borrie, & Geiger, 2004)	Increased table setting contrast, combined with lighting changes can lead to: 1. Improved residents' oral intake (Brush et al., 2002; Dunne, Neargarder, Cipolloni, & Cronin Golomb, 2004; Koss & Gilmore, 1998)
AMBIENCE: **HOMELIKE ENVIRONMENT/ NON-INSTITUTIONAL CHARACTER**	Personalized individual rooms (personalized wall decorations, ornaments, pictures, and towels) can lead to: 1. Fewer behavioral problems (Charras et al., 2010; Morgan & Stewart, 1999; Zeisel et al., 2003) Changing the seating arrangements and mealtime routines in dining rooms can lead to: 1. Improved eating behavior (Götestam & Melin, 1987; Melin & Gotestam, 1981). Decentralizing dining room to the living unit can lead to:		Changing seating arrangements can lead to: 1. Increased communication (Götestam & Melin, 1987; Melin & Gotestam, 1981) A homelike dining atmosphere with a small number of people eating together can lead to: 1. More resident directed conversations (Roberts, 2011), A non-institutional, homelike environment can support: 1. Residents' engagement in daily		A homelike environment and increased personalization were positively linked: 1. Improved quality of life (Charras et al., 2010; Garcia et al., 2012; Gnaedinger, Robinson, Sudbury, & Dutchak, 2007; Minde, Haynes, & Rodenburg, 1990) 2. Higher food and fluid intake (Reed, Zimmerman, Sloane, Williams, & Boustani, 2005) 3. Less tube feeding (Lopez, Amella, Strumpf, Teno, & Mitchell, 2010)

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	1. Reduced in assaultive behavior (Negley & Manley, 1990) An unlocked door to a safe garden area can lead to: 1. Reduced residents' agitation (Namazi & Johnson, 1992a)		activities and informal social interactions (Campo & Chaudhury, 2012; Milke, Beck, Danes, & Leask, 2009)		
AMBIENCE: **SENSORY ENHANCEMENT**	Sensory enhancement of the environment can lead to: 1. Reduced agitation and wandering frequency (Cohen-Mansfield & Werner, 1998; Yao & Algase, 2006) Increased room temperature, music, pictures, and even food in bathrooms can lead to: 1. Reduced agitated behavior (Cohen-Mansfield & Parpura-Gill, 2007; Whall et al., 1997) Use of music can lead to reduced agitation (Cohen-Mansfield & Werner, 1995; Dunn & Riley-Doucet, 2013)	Controlling sensory stimulation (using interior partitions to reduce distractions) can lead to: 1. Improved cognition by being more attentive (Namazi & Johnson, 1992b)			Reducing negative distractions from televisions and phones, as well as camouflaging exit doors can lead to: 1. Improved care outcomes, measured by less weight loss by residents and fewer cases of physical restraint use (Cleary et al., 1988)

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AMBIENCE: **MULTI-SENSORY ENVIRONMENT APPROACH**	Multi-sensory environment (rooms that are typically equipped with bubble tubes, fiber optics, revolving color wheel projectors, soft relaxing background music, and an oil burner for aromatic smells) can lead to: 1. Improved behavior (Baker et al., 2001; Hope, Keene, Gedling, Fairburn, & Jacoby, 1998; Milev et al., 2008; Ward-Smith, Llanque, & Curran, 2009)	Multi-sensory environment can lead to: 1. Improved cognition by being more attentive to their environments (Baker et al., 2001) 2. Improved motor and process scores (Collier, McPherson, Ellis-Hill, Staal, & Bucks, 2010)			Multi-sensory environment can lead to: 1. Improved well-being, including improvements in mood (Baker et al., 2001; Cox, Burns, & Savage, 2004; Hope et al., 1998)
ENVIRONMENTAL INFORMATION: **ENVIRONMENTAL CUES**		Placing labels on drawers and closet doors, making objects visible, and removing distracting items can lead to: 1. Improved residents' ability to perform activities of daily living (Chard, Liu, & Mulholland, 2009) Incorporating pictures and colors in bathrooms can lead to: 1. Improved oral care (Connell, McConnell, & Francis, 2002)		Signposting combined with verbal cues can help: 1. Residents to find their way around (Hanley, 1981; Namazi & Johnson, 1991a; Passini et al., 2000; Scialfa et al., 2008) Room numbers, nameplates, color, and personal cues (such as written names, portrait-type photographs of residents as young adults, and personal memorabilia) can help: 1. Residents locate their bedrooms (Gibson et al., 2004; Gross et al., 2004; Namazi, Rosner, &	

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				Rechlin, 1991; Nolan, Mathews, & Harrison, 2001; Nolan, Mathews, Truesdell-Todd, & VanDorp, 2002) Visual access and environmental cues can lead to: 1. Improved orientation (Namazi & Johnson, 1991b)	
ENVIRONMENTAL INFORMATION: **VISUAL BARRIERS**	Visual barriers, for example, exit doors hidden by cloth barriers, wall murals that manipulated views through window panels in the doors, and grid patterns or mirrors placed in front of doors can lead to: 1. Reduced behavior (Dickinson & McLain-Kark, 1998; Dickinson, McLain-Kark, & Marshall-Baker, 1995; Feliciano, Vore, LeBlanc, & Baker, 2004; Namazi, Rosner, & Calkins, 1989; Roberts, 1999) 2. Less door testing (Hewawasam, 1996; Hussian & Brown, 1987; Kincaid & Peacock, 2003; Mayer & Darby, 1991)				Camouflaged and silent electronic door locks can lead to: 1. Improved well-being - fewer depressed residents (Zeisel et al., 2003)

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