Published in final edited form as:

J Hous Elderly. 2011 January 1; 25(3): 258–273. doi:10.1080/02763893.2011.595612.

A Descriptive Study of Home Modifications for People with Dementia and Barriers to Implementation

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Abstract

This study describes home environmental features, safety issues, and health-related modifications in a community dwelling sample of 82 elderly people with dementia. Main barriers to the accessibility of the homes were steps, both inside and outside the house. The majority of the caregivers had made home modifications, which pertained mainly to physical limitations. Home modifications to support cognitive deficits were made to a lesser extent. The main barrier to the implementation of home modifications to accommodate the care recipient's memory loss was skepticism about their usefulness. Regarding the removal of physical barriers, financial constraints were most frequently mentioned.

Introduction

Aging in place, meaning continuing to reside in one's home in the community, is a consistent wish and expectation of middle aged and older adults (AARP, 2003). This does not seem to change with the development of dementia, since it is estimated that about 73% of all older adults with dementia are cared for in their own home (Wimo et al., 2007). In 2002, the prevalence of dementia among individuals aged 71 and older was 13.9% and comprised 3.4 million individuals in the USA (Plassmann et al., 2007). With the "graying of America," these numbers will increase and result in a growing demand for suitable housing.

In a recent review, empirical evidence for a relationship between home environments and disability-related outcomes for older adults was identified (Wahl et al., 2009). The presumption that improving home environments enhances functional ability outcomes was also supported. However, inconsistencies in findings across the studies, the limitation to cross-sectional designs and, to some extent, insufficient research quality were critically noted.

A vast array of practical recommendations on how to implement home modifications in the homes of elderly people is available in guide books, leaflets, websites, etc. However, the majority of this guidance does not extend to the care of people with dementia in their homes. An exception is the work by Warner (2000; 2006), which might not be widely known and used by caregivers yet. Dementia specific research on home modifications has been conducted (Gitlin & Corcoran, 1996; Gitlin et al. 2002; Pynoos & Ohta, 1991) and has shown benefits of a dementia-specific adapted environment and the use of assistive devices for both the caregiver and care recipient (Gitlin et al., 2010a; Gitlin et al., 2010b). However, detailed descriptive information on the actual home environment of people with dementia and what modifications are being implemented organically is scarce.

In Maximizing Independence at Home (MIND at Home) Phase 1, a pilot study of the needs of persons with dementia living in their own homes in the community, environmental safety was found to be one of the most prevalent areas of need (Johnston et al., 2011). While some of the environmental interventions associated with positive outcomes in the long term care literature may be applied in home care settings, potential environmental modifications in homes will likely require more creative and lower cost alternatives. To better understand how home environments are being adapted in the context of caring for community-living persons with dementia currently, this study aims to provide a description of home environmental features, safety issues, and health-related modifications observed among a sample of elders with dementia being cared for in a home in the community. Specifically, we aim to describe:

- common environmental features that present safety issues or barriers to mobility of the home-residing dementia care recipient;
- care recipients' behavior, orientation, and risk of adverse events such as falls in the context of the home environment;
- common home modifications, including use of assistive technology, that caregivers have implemented or would consider implementing in the care recipients' homes.

Materials and Methods

We report cross-sectional data derived from an ongoing randomized controlled trial, Maximizing Independence (MIND) at Home Phase 2, designed to evaluate the effectiveness of a dementia-oriented care coordination intervention on unmet needs and ability to age in place among a cohort of community-dwelling elders with cognitive disorders. A detailed description of the trial methodology will be forthcoming. In brief, the full sample consists of 303 elders living in one of 28 contiguous zip code areas in North/Northwest Baltimore. Participants were recruited from aging services providers, local public and private social service agencies, community centers and day programs, clinics, and senior housing. Supplemental recruitment notices also appeared in local media sources and recruitment efforts were also made at local community health seminars and fairs to provide background promotion of the study. The inclusion criteria for participants were as follows: (1) participant resided in the identified catchment area, (2) was aged 70+, (3) met DSM-IV-TR criteria for any type of dementia or cognitive disorder not otherwise specified (Cognitive DO NOS), and (4) had a reliable study partner available to serve as a proxy informant (i.e.

someone who knows the participant, who interacts with him or her regularly, and is willing to participate in the study). Individuals were excluded if (1) they were non-English speaking, (2) the situation at the time of referral involved a crisis with risk of danger to the individual or others, or (3) medical morbidity or substance use could not be ruled out as a cause for cognitive impairment. The current analytic sample is a subset of this cohort comprised of 82 participants who were enrolled in the study and received in-home assessments between August and December 2009 by a PhD architect trained in home environment assessment (GM).

All study procedures were reviewed and approved by an Institutional Review Board at the Johns Hopkins School of Medicine. Oral consent was obtained from participants in the telephone screening stage and written consent was obtained during the initial in-person visit. In cases where capacity to consent was compromised, consent was obtained from a legally authorized representative (LAR) using the Maryland Health Care Decisions act as a guide, and written or oral assent was obtained from the participant.

The study enrollment process consisted a two-stage screening process for eligibility. First, trained research assistants conducted a 15 minute telephone screening for cognitive impairment using the Telephone Interview for Cognitive Status (TICS) (Brandt et al., 1988) and the Informant Questionnaire for Cognitive Disorders in the Elderly (IQCODE) (Jorm & Jacomb, 1989). Both measures have good reliability and validity (Jorm & Jacomb, 1989; Ferucci et al., 1998). A positive screen was defined as a TICS score of <31 and an IQCODE score of >52 . Next, those who screened positive were asked to participate in a comprehensive in-home clinical assessment to determine the presence of dementia or cognitive DO NOS, along with an assessment of 15 dementia-related needs across multiple domains (Black et al., 2008). The clinical assessment team was overseen by a geriatric psychiatrist (DJ) and performed by a research nurse experienced in dementia care. The initial in-home clinical assessment included a narrative medical and neuropsychiatric history, a mental status and neurological exam, and a medication review to determine diagnoses. Information was gathered from the participant, a study partner, and from medical reports, when available. If found eligible, baseline quantitative outcome measures were completed, followed by computer randomization to one of two groups, care coordination or augmented care as usual (control). A written summary evaluation of unmet needs and potential interventions was sent after the randomization to all participants and/or their LAR, and to their primary care providers. Routine follow-up assessments for all participants were completed or planned at 4.5, 9, 13.5, and 18 months by blinded assessors. While interrater reliability was not measured formally, the research team met with the principal investigator weekly to review data collection procedures and discuss questions that arose related to consistency of study procedures and administration of standardized measures. Further, the research team was observed periodically by the principal investigator during study visits.

For the 82 participants in these analyses, home environment was assessed at Baseline ($n=57$) or at the 9-month study visit ($n=25$). All 82 home environments were assessed by an architect (GM) experienced in environmental design for dementia, using an assessment developed specifically for this study. The assessment included observation and a simple house plan sketch of the home environment (layout of the rooms, design of the entrance and the interior stairs, implementation of bathroom safety features, presence of excessive furniture and clutter, spatial indications of where falls had occurred), as well as a questionnaire administered to the participant's caregiver. This 8-item questionnaire included information on environmental modifications that had been made, if caregivers had made these modifications based on consultations with professionals, and whether these modifications were made due to the care recipient's memory disorder or because of physical health limitations. Also included were questions on the use of spaces, and on behavioral

issues such as wandering and wayfinding abilities of the person with dementia. We asked if care recipients were able to find 4 places (bedroom, bathroom, living room/den, kitchen) within the home independently, if they needed some cueing to get there, or had to be taken all the way. Further, caregivers' wishes for environmental modifications and their perceptions of barriers and facilitators to adapting the environment to the needs of the person with dementia were explored. To assess which modifications caregivers would like to make to the care recipient's home regardless of financial or spatial constraints, we asked them to "make a wish" and recorded their responses. The home environment walkthrough and questionnaire took approximately twenty minutes to administer.

Of note, all participants had received a visit from the clinical study team during eligibility screening, and some may have received verbal advice on environmental hazards such as the need for reduction of clutter and removal of fall risks, prior to data collection. Also, 25 participants whose homes were assessed at the 9-month MIND at Home visit, had received a written letter of recommendations that may have included advice on environmental hazards. Some of these participants may have also been randomized to the intervention group and thus were receiving ongoing advice on potential home modifications. We specifically asked all participants whether the home modifications they reported were related to advice from the study team and report the results below. Data were analyzed using SPSS 17.0.

Results and Discussion

Among the 82 participants that comprise this sample, 50% lived in single-family homes, 28% in apartments and 22% in townhouses. Participants' mean age was 84.5 years. The majority (62%) of participants were female. 62% of participants were married, 29% were widowed, 6% divorced and 3% never married. The racial composition of the sample was 77% Caucasian and 23% African American. 73% of the participants lived with a caregiver, 13% lived alone and 13% lived with someone else. The study partners were mainly spouses (44%), or children of the participants (37%). The majority (96%) of the study partners considered themselves to be the participant's caregiver. All participants met the criteria for dementia with a mean score of 19 on the Mini-Mental Status Examination (MMSE; Folstein et al., 1975) ranging between scores of 0 and 30. Assigning stages of dementia (Perneckzy et al., 2006), 44% of the participants (n=36) were in a mild stage of dementia (MMSE score 21 and above), 38% (n=31) in a moderate stage (MMSE score 11–20) and another 17% of the participants (n=14) in a severe stage (MMSE score 0–10).

Identified physical environmental obstacles and safety

Entrance and interior stairs—Steps to get inside the house constituted a major physical obstacle within the sample's homes. The steps often lacked safety railings. Almost half (44%) of home outdoor steps had no railing at all. Of the remaining homes, 46% (n=28) had a railing on only one side, with only 10% of the steps (n=6) featuring a railing on both sides. In 10% of the homes (n=6) with steps at the front entry, a wheelchair ramp had been incorporated to make the home accessible, and in 8% of the homes (n=5), an evenly leveled rear entry was available.

Stairs that connected different floors in homes formed another major barrier. Only 40% of the homes in the sample (n=33), mainly the apartments, had no interior stairs. In homes that had interior stairs, 29% of all stairs (n=14) were winding and a stair lift was found in 20% (n=10) of homes with steps.

Bathroom Safety—It appeared that modifications to the bathrooms that included either a walk-in shower, handheld showerhead or a shower seat were made in nearly 50% of all homes visited. 57% had grab bars installed. A modified bathroom that featured at least three

important safety features - grab bars, a walk-in shower and a shower seat - was found in only 23% (n=19) of homes in the sample. However, these modifications were made with varying quality. In some bathrooms, grab bars and non-skid bathmats were utilized after consultation with a physical or occupational therapist. In others, grab bars from hardware stores were installed to the caregivers' best knowledge.

Physical barriers to mobility: Furniture and Clutter—Varying amounts of furniture and other items such as stacks of newspapers, boxes etc were observed within homes which may become an obstacle to both the care recipient's mobility and cognition: To use mobility aids, such as walkers and wheelchairs, adequate space for safe and successful maneuvering is needed (ADA Standards for Accessible Design). Finding items and managing tasks can become very difficult for people with dementia in cluttered homes (Corcoran, 1992). 50% of the homes in the sample (n=41) were rated as being very structured and providing sufficient space for moving about safely. 38% (n=31) were rated as somewhat cluttered but still offered clear paths to move about. Notably, 12% of the homes (n=10) were rated as very cluttered and did not allow for moving safely about the place.

Mobility around the home and fall risk

Moving about the home—Ten percent of the care recipients in this sample always needed personal assistance by a caregiver to move about the home. Another 28% were reported to hold tight to furniture and walls when moving about. However, use of interior railing or grab bars, specifically designed for added stability, was only observed in one home, excluding use in bathroom areas. This modification is rarely addressed in the home modification literature and needs further research and trial. About 40% of all participants used a mobility aid, (i.e. a cane, walker or wheelchair) in or outside the home as shown in Table 1.

Falls—In this sample, 57% of the care recipients (n=47) reported at least one fall in their home within the last two years. Since extensive research has been conducted on the occurrence falls (such as Stevens et al., 2001; Härlein et al., 2009; Iwarsson et al., 2009), we limited our focus on the places where the falls had happened in the home. Bedrooms accounted for most of the falls (26%), followed by the living room or den (17%) and the bathroom (12%). Another 12% of the reported falls occurred at the entrance or in the hallway near the home entrance, and 11% occurred on steps.

Behavior and Orientation in the Home Environment

Wandering within the home—Wandering behavior is a symptom of dementia, slightly more prevalent in patients with Alzheimer dementia, patients with dementia of longer duration, and patients with more severe dementia (Klein et al., 1999). In this sample, wandering was reported in 12 cases, about 15% of the care recipients. We found no typical routes or any hints on spatial settings that would promote or inhibit wandering. The caregivers seemed to cope well with this behavior. In only two cases were safety concerns expressed and only one caregiver was upset by the wandering.

Wandering away from home—Spatial disorientation and episodes of getting lost are among the symptoms of dementia in the early stages of the disease, when mild cognitive decline first manifests (Rosenberg, Johnston, and Lyketsos, 2006). In familiar settings people with dementia often maintain their ability to find their way about for a long time but episodes of people getting lost and even being fatally injured are repeatedly being reported (Silverstein et al., 2006). Therefore wandering away from home is a threat to the safety of elderly people with dementia living in the community. The prevention of wandering by environmental modifications and other strategies, as well as preparations for a wandering

episode is comprehensively addressed in the literature (Silverstein et al., 2006; Warner, 2000; 2006). In this sample, we found that being able to walk outside the home alone as well as being able to return home declines with dementia severity. While in the beginning stages most care recipients still walk outside the home by themselves, the numbers decrease with advancing dementia. Most caregivers were not aware of environmental interventions that could prevent wandering as they are discussed in the literature; such as “hiding” the doorknob by a curtain or adding door chimes as an auditory alert that the door has been opened (Day et al., 2000). However, exit control seemed to become important in the moderate stages of dementia when 39% of caregivers locked the doors or used some kind of auditory alert. In the severe stages when mobility was more impaired, exit control seems to have become less important, with only 21% of caregiver reporting use of some kind of exit control at this point.

Wayfinding and spatial orientation within the home—As expected, wayfinding was related to dementia severity. All care recipients with mild dementia (MMSE >20) were able to find their way unaided. 96% percent of care recipients in moderate stage dementia could find their way unaided. In severe dementia, only 42% of care recipients found their way independently, another 42% needed some cueing and 17% were completely dependent on others for navigation. These findings correspond to those from long term care settings (Marquardt & Schmieg, 2009). However, research there also showed that even in severe dementia the ability to find one’s way can be supported by the nursing home’s architectural design. Future research on home modifications for people with dementia could focus on environmental interventions to enhance wayfinding in severe dementia.

Implementation of home modifications, consultations and wishes

Seventy-two percent of caregivers (n=59) reported that they had made at least one modification to the care recipients’ home, 21% (n= 17) had not made any changes, and 7% of caregivers (n=6) were unable to provide that information. 51% of caregivers (n=30) said they had initiated home modifications, 39% (n=23) followed recommendations on the basis of a consultation from a professional, such as an occupational therapist (OT), a physical therapist (PT), or a recommendation from the MIND at Home study team. 10% could not identify the reason.

Reasons for Home modification implementation—37% of the care givers (n=25) reported they had made no changes to the home to adapt it to the care recipient’s physical limitations. The home modifications implemented in the remaining 42% of homes (n=51) that were ascribed to the care recipients’ physical limitations are shown in Table 2, with the most common modifications made to enhance bathroom safety.

57% of caregivers (n=47) reported that they had made no changes to the home due to the care recipient’s memory loss. The home modifications that were implemented in 36% of the homes (n=29) are listed in Table 3. Use of signs and labels was the most common modification to accommodate the individual’s memory loss.

Regarding the caregiver’s relationship (spouse or child) to the care recipient, there was very little difference in the implementation of home modifications in general, or pertaining to either the physical or cognitive limitations of the care recipient, to be found.

Caregiver wishes for modifications—6% (n=5) did not feel they were in the position to wish for changes, 38% (n=31) had no wish at all, and out of the 56% of caregivers (n=46) with one or more wishes we found the results presented in Table 4.

With 67%, caregivers who were children of the care recipient wished more often for modifications to the care recipient's home than care giving spouses, with 57%. The main wish for a bigger or adapted bathroom was not associated with their relationship and ranked most mentioned in both groups.

Use of Assistive Technology—The use of assistive technologies was very rare. Devices used did not comprise newer technologies but rather established items such as emergency call buttons (26%) and baby monitors (4%).

Acceptance of suggested changes

During the home visits in this study caregivers were asked if they would consider implementing modifications to their home: Whether they would use signs and labels to support the care recipient's cognition and if they would make changes pertaining to the physical limitations. Results are shown in Table 5. The strongest objection, as caregivers would think the modification would not be necessary or not helpful, was observed towards the use of signs and labels to support the care recipient's cognition. Suggestions on modifications pertaining to physical limitations were generally more accepted, but lack of financial resources was often a barrier to their implementation.

Conclusions

Based on data from this sample, physical environmental obstacles are a fairly common safety issue in homes in which elders with dementia are being cared for. The most prevalent physical obstacles observed in these homes were steps, both inside and outside the home and lack of handrails. When considering new building and renovations to existing buildings, this suggests that architects, developers, city planners, etc. should consider the accessibility of homes in their designs as well as mobility within the home. Not only do the elderly benefit from a barrier free design but so do families with small children, using strollers and other equipment. Similarly, inside the homes with more than one floor, the availability of a bathroom on the ground floor, or at least the provision of all necessary fixtures and a floor plan design that allows for the installation of a bathroom at a later point, should be considered.

In addition to changing the structural design, other low cost modifications may be helpful in the care of those with dementia. We noted that misplaced or abundant furniture and clutter presented physical obstacles to moving about as well as possible fall risks. Assuming these are recognized by the caregiver as potential problem issues, relocating and decluttering areas would be a simple, low tech intervention. We also found that over a quarter (28%) of the sample used inanimate objects such as furniture that may not provide the necessary degree of stability for moving about the place. Modifications such as installation of handrailing in hallways and judicious placement of grab bars in rooms beyond the bathroom may be an inexpensive way to increase safety.

In terms of recommendations for modifications, we found that those already in place in the homes often came about as a result of a professional recommendation from an OT or PT. This finding supports the utility of home safety and environmental evaluations as previously addressed in the literature (Mathieson et al., 2001; Stevens et al., 2001). Furthermore, even though our home assessment and questionnaire was targeted toward environmental features and modifications that relate to memory disorders, almost three times more modifications were attributed by caregivers to physical limitations rather than to memory loss. A likely reason for this is the caregiver's lack of knowledge about the symptoms of dementia and how these differ from physical disability. This lack of awareness is an important point since insight on how impaired cognition changes the way in which one interacts with his/her

environment is likely important in choice and, ultimately, the effectiveness of the types of interventions implemented. For instance, a personal emergency response device may be useful in an elder at increased fall risk due to physical disability, but is likely ineffectual in a person with moderate to severe dementia who would forget to activate it in an emergency.

We found that the adoption of assistive technology is largely absent, though a number of interventions are currently marketed for dementia, and range from simple and inexpensive products like door chimes, sensors and alarms to more advanced technologies such as heat sensors and automatic cut-off switches for stoves, telemedicine systems, and fall monitoring systems. Of course, further study of these products is needed to determine their relative value and how they can best match the patient and caregiver needs and abilities. Further research that addresses the barriers to caregivers using assistive technologies is also urgently needed

In general, major barriers towards the implementation of home modification seem to be rooted in caregivers' acceptance of the suggestions – which they often perceive as “not necessary” or that they “wouldn't work” in their situation (Sheldon & Teaford, 2002). Another issue that needs further investigation is how to involve the care recipient into the process of modifying the home. About one third of all caregivers reported that the care recipient would react with confusion or irritation to changes within the home. This seems to decrease slightly with the progression of dementia, but it can be hypothesized that home modifications in early stages, implemented in agreement with the care recipient would be the most beneficial. Further research is needed to understand how caregivers perceive and prioritize needs related to the physical environment to alleviate dementia symptoms that will allow for the design of supportive interventions.

Limitations

The generalizability of the findings may be limited as this study reports on a “convenience” sample of participants referred to the MIND at Home Phase 2 study rather than a randomly selected cohort. Their caregivers' interest in participation in the study could be correlated with a higher awareness of the care recipients' needs that might lead to more home modifications already implemented or to a greater openness toward the suggested changes. Also, the initial study visit by the MIND at Home team may have resulted in recommendations for environmental interventions regarding some of the issues later assessed in the home environment visit, such as removing fall hazards. Therefore, the number of home modifications implemented in this sample might be higher than in the general population. However, it should be noted that the overall use of home modifications was still quite low.

This study suggests that it is widely known among caregivers that care recipient safety and independence can be supported by modifications to the home. The main interest of the caregivers seemed to be modifications to the bathrooms. The awareness of other possible modifications, especially pertaining to the care recipient's cognitive limitations, needs to be increased. There also seem to be barriers towards the implementation of home modifications. From the home visits and the discussions with the caregivers we assume that adapting the home to personal deficits means not only to accept them for themselves but also that they become visible for everyone visiting in their home to see. This warrants further research on ways of increasing the acceptance of home modifications by both care givers and care recipients. In general we identified a need for informing caregivers about the possible scope of home modifications.

Acknowledgments

We are grateful to the MIND at Home study team for their fieldwork in evaluating participants. We thank study participants and their families for their willingness to volunteer for the study. We also would like to thank Mr. Leroy Hoffberger and THE ASSOCIATED Jewish Community Federation of Baltimore, for their dedication and assistance in the development and implementation of the study, and The Harry and Jeannette Weinberg Foundation, the Leonard and Helen R. Stuhlman Charitable Foundation, The Hoffberger Foundation, Hoffberger Family Fund, David & Barbara B Hirschhorn Foundation, The Irving and Lois Blum Foundation, Leonor and Marc Blum, and the Meyerhoff Charitable Foundations for their financial support. Finally, we would like to thank the JOHNS HOPKINS Alzheimer's Disease Research Center (NIH Grant P50AG051456).

References

- AARP. These four walls... Americans 45+ talk about home and community. 2003.
- Black, B.; Johnston, D.; Handel, S.; Morrison, A.; Robbins, B.; Rye, R., et al. Manual for the Johns Hopkins Dementia Care Needs Assessment (JHDCNA). Baltimore, MD: 2008.
- Corcoran M. Dementia management: An occupational therapy home-based intervention for caregivers. *The American Journal of Occupational Therapy*. 1992; 46(9):801. [PubMed: 1514566]
- Day K, Carreon D, Stump C. The Therapeutic Design of Environments for People With Dementia. A Review of the Empirical Research. *The Gerontologist*. 2000; 40(4):397–416. [PubMed: 10961029]
- Ferrucci L, Del Lungo I, Guralnick J, Bandinelli S, Benvenuti E, Salani B, et al. Is the telephone interview for cognitive status a valid alternative in persons who cannot be evaluated by the Mini Mental State Examination? *Aging (Milano)*. 1998; 10(4):332–338. [PubMed: 9825025]
- Folstein M, Folstein S, McHugh P. Mini-Mental State. A Practical Method for Grading the State of Patients for the Clinician. *Journal of Psychiatric Research*. 1975; 12:189–198. [PubMed: 1202204]
- Gitlin LN, Corcoran MA. Managing Dementia at Home: The Role of Home Environmental Modifications. *Topics in Geriatric Rehabilitation*. 1996; 12(2):28–39.
- Gitlin LN, Schinfeld S, Winter L, Corcoran M, Boyce AA, Hauck W. Evaluating home environments of persons with dementia: interrater reliability and validity of the Home Environmental Assessment Protocol (HEAP). *Disability and Rehabilitation*. 2002; 24(1–3):59 – 71. [PubMed: 11827156]
- Gitlin LN, Winter L, Dennis MP. Assistive devices to help manage behavioral symptoms of dementia: What do caregivers use and find helpful? *Gerontechnology*. 2010a; 9(3):408–414.
- Gitlin LN, Winter L, Dennis MP, Hodgson N, Hauck WW. Targeting and managing behavioral symptoms in individuals with dementia: A randomized trial of a nonpharmacological intervention. *Journal of the American Geriatrics Society*. 2010b; 58(6):1465–1474. [PubMed: 20662955]
- Härlein J, Dassen T, Halfens RJ, Heinze C. Fall risk factors in older people with dementia or cognitive impairment: a systematic review. *Journal of Advanced Nursing*. 2009; 65(5):922–933. [PubMed: 19291191]
- Iwarsson S, Horstmann V, Carlsson G, Oswald F, Wahl HW. Person–environment fit predicts falls in older adults better than the consideration of environmental hazards only. *Clinical Rehabilitation*. 2009; 23(6):558–567. [PubMed: 19403554]
- Johnston D, Samus QM, Morrison A, Leoutsakos JS, Hicks K, Handel S, Black BS. Identification of community-residing individuals with dementia and their unmet needs for care. *International Journal of Geriatric Psychiatry*. 2011; 26(3):292–298. [PubMed: 20658473]
- Jorm AF, Jacomb PA. The Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE): socio-demographic correlates, reliability, validity and some norms. *Psychological Medicine*. 1989; 19(4):1015–22. [PubMed: 2594878]
- Klein DA, Steinberg M, Galik E, Steele C, Sheppard JM, Warren A, et al. Wandering behaviour in community-residing persons with dementia. *International Journal of Geriatric Psychiatry*. 1999; 14(4):272–279. [PubMed: 10340188]
- Marquardt G, Schmieg P. Dementia-friendly Architecture: Environments that facilitate wayfinding in nursing homes. *American Journal of Alzheimers Disease & Other Dementias*. 2009; 4(24):333–340.

- Mathieson K, Kronenfeld JJ, Keith VM. Maintaining Functional Independence in Elderly Adults. The Roles of Health Status and Financial Resources in Predicting Home Modifications and Use of Mobility Equipment. *The Gerontologist*. 2001; 42(1):24–31. [PubMed: 11815696]
- Perneczky R, Wagenpfeil S, Komossa K, Grimmer T, Diehl J, Kurz A. Mapping Scores Onto Stages: Mini-Mental State Examination and Clinical Dementia Rating. *American Journal of Geriatric Psychiatry*. 2006; 14(2):139–144. [PubMed: 16473978]
- Plassman KM, Langa GG, Fisher SG, Heeringa DR, Weir MB, Ofstedal JR, Wallace RB. Prevalence of Dementia in the United States: The Aging, Demographics, and Memory Study. *Neuroepidemiology*. 2007; 29(1–2):125–132. [PubMed: 17975326]
- Pynoos J, Ohta RJ. In-Home Interventions for Persons with Alzheimer's Disease and Their Caregivers. *Physical & Occupational Therapy in Geriatrics*. 1991; 9(3–4):83–92.
- Rosenberg P, Johnston DJ, Lyketos CG. A clinical approach to mild cognitive impairment. *American Journal of Psychiatry*. 2006; (163):1884–1890. [PubMed: 17074938]
- Sheldon M, Teaford M. Caregivers of People with Alzheimer's Dementia: An Analysis of Their Compliance with Recommended Home Modifications. *Alzheimer's Care Quarterly*. 2002; 3(1):78–81.
- Silverstein, NM.; Flaherty, G.; Tobin, TS. *Dementia and Wandering Behavior*. New York: Springer; 2006.
- Stevens M, D'Arcy J, Holman C, Bennett N. Preventing Falls in Older People: Impact of an Intervention to Reduce Environmental Hazards in the Home. *Journal of the American Geriatrics Society*. 2001; 49(11):1442–1447. [PubMed: 11890581]
- Wahl HW, Fänge A, Oswald F, Gitlin LN, Iwarsson S. The Home Environment and Disability-Related Outcomes in Aging Individuals: What Is the Empirical Evidence? *The Gerontologist*. 2009; 3(49):355–367. [PubMed: 19420315]
- Warner, ML. *The complete guide to Alzheimer's Proofing Your Home*. West Lafayette, Ind: Purdue University Press; 2000.
- Warner, ML. *In search of the Alzheimer's wanderer: a workbook to protect your loved one*. West Lafayette, Ind: Purdue University Press; 2006.
- Wimo A, Winblad B, Jönsson L. An estimate of the total worldwide societal costs of dementia in 2005. *Alzheimer's & Dementia*. 2007; 3(2):81–91.

Table 1

Use of mobility aids by the care recipients

Use of Mobility Aid	Inside the home		Outside the home	
	N	Percentage	N	Percentage
None	52	63.4%	49	59.7%
Cane	13	15.9%	9	11.0%
Walker	10	12.2%	11	13.4%
Cane and walker	6	7.3%	5	6.1%
Wheelchair	1	1.2%	8	9.8%
Sum	82	100%	82	100%

Table 2

Home modifications implemented due to care recipients' physical limitations

Modification made	N	Percentage
Enhanced bathroom safety	37	48.7%
Secured / took away rugs, fixed tiles etc.	19	25.0%
Installed a stair lift	6	7.9%
Put a railing on steps	4	5.3%
Moved the bedroom downstairs	4	5.3%
Modified steps to better get into house	2	2.6%
Kitchen workplace modifications	1	1.3%
Made more space by moving furniture	1	1.3%
Miscellaneous others	2	2.6%
Sum of all modifications	76	100%

Table 3

Home modifications implemented due to care recipients' memory loss

Modification made	N	Percentage
Put up signs & labels	10	35.7%
Installed additional lights (day or night, also automatic)	6	21.4%
Moved or rearranged furniture	5	17.9%
Changes to the locks (removed and / or added locks on doors)	3	10.7%
Took away objects that were dangerous or that CR might misplace or hide	2	7.1%
Installed alarm system	1	3.6%
Increased stove safety	1	3.6%
Sum of all modifications	28	100%

Table 4

Caregivers' wishes for changes to the care recipients' homes

Wish	n	Percentage
Have a bigger or an adapted bathroom	14	21.5%
Improve stove safety, kitchen adaptations	8	12.3%
Move elsewhere	7	10.8%
Have another bathroom close to where CR spends most time	6	9.2%
Have private space for the CR	5	7.7%
No steps in the house, everything on one floor	4	6.2%
Install a stair-lift	3	4.6%
Have safer steps	3	4.6%
More space to move about, wider door widths, less furniture	3	4.6%
Own or more space for care giver him/herself	2	3.1%
Have a safe outdoor space for CR	2	3.1%
Move the bedroom downstairs	1	1.5%
Miscellaneous other wishes	7	10.8%
Sum of all wishes	65	100%

Table 5

Care givers' responses to suggested modifications to the care recipients' homes

Acceptance of suggested modifications	Due to CRs cognitive decline		Due to CRs physical limitations				Install a stair lift		Additional / bigger / safer Bathroom		Miscellaneous safety features	
	Use Signs and Labels		Sum		Move bedroom downstairs		N		N		N	
	N	Percent.	N	Percent.	N	Percent.	N	Percent.	N	Percent.	N	Percent.
Care givers' responses												
CR doesn't need it / not necessary	17	29.8%	7	10.3%	2	13.3%	4	15.4%	1	5.0%	0	0
CG doesn't think it would be helpful	14	24.5%	1	1.5%	0	0	0	0	0	0	1	14.3%
CG would do it if he/she knew how	7	12.3%	2	2.9%	0	0	0	0	0	0	2	28.6%
CG doesn't accept it	6	10.5%	2	2.9%	0	0	0	0	1	5.0%	1	14.3%
Will do it as soon as necessary	6	10.5%	13	19.1%	5	33.4%	0	0	7	35.0%	1	14.3%
CG does everything for CR	3	5.3%	0	0	0	0	0	0	0	0	0	0
CG doesn't think PT would accept it	2	3.5%	13	19.1%	2	13.3%	5	19.2%	6	30.0%	0	0
CR should be challenged	1	1.8%	0	0	0	0	0	0	0	0	0	0
CG tried it, but didn't work	1	1.8%	0	0	0	0	0	0	0	0	0	0
Too expensive	0	0	17	25.1%	3	20.0%	9	34.6%	5	25.0%	0	0
CG would rather move	0	0	3	4.4%	2	13.3%	1	3.9%	0	0	0	0
CR doesn't use part of the house bc. of steps anymore	0	0	8	11.8%	1	6.7%	7	26.9%	0	0	0	0
CG didn't have the time to do it yet	0	0	2	2.9%	0	0	0	0	0	0	2	28.6%
Sum	57	100%	68	100%	15	100%	26	100%	20	100%	7	100%