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The Environmental Audit Screening Evaluation: Establishing Reliability and Validity of an Evidence-Based Design Tool

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Abstract

Background and Objectives: Current assessment tools for long-term care environments have limited generalizability or ability to be linked to specific quality outcomes. To discriminate between different care models, tools are needed to assess important elements of the environmental design. The goal of this project was to systematically evaluate the reliability and validity of the Environmental Audit Screening Evaluation (EASE) tool to better enable the identification of best models in long-term care design to maintain quality of life for persons with dementia and their caregivers.

Research Design and Methods: Twenty-eight living areas (LAs) were selected from 13 sites similar in organizational/operational commitment to person-centered care but with very different LA designs. LAs were stratified into 3 categories (traditional, hybrid, and household) based primarily on architectural/interior features. Three evaluators rated each LA using the Therapeutic Environment Screening Scale (TESS-NH), Professional Environmental Assessment Protocol (PEAP), Environmental Audit Tool (EAT-HC), and EASE. One of each type of LA was reassessed approximately 1 month after the original assessment.

Results: EASE scores were compared against the scores of 3 existing tools to evaluate its construct validity. The EAT-HC was most closely related to the EASE (r = 0.88). The PEAP and the TESS-NH were less correlated to the EASE (r = 0.82 and 0.71, respectively). Analysis of variance indicated that the EASE distinguished between traditional and home-like settings (0.016), but not hybrid LAs. Interrater and inter-occasion reliability and agreement of the EASE were consistently high.

Discussion and Implications: Neither of the 2 U.S.-based existing environmental assessment tools (PEAP and TESS-NH) discriminated between the 3 models of environments. The EAT-HC was most closely aligned with the EASE and performed similarly in differentiating between the traditional and household models, but the dichotomous scoring of the EAT-HC fails to capture environmental nuances. The EASE tool is comprehensive and accounts for nuanced design differences across settings.

Keywords: Environmental assessment, Household model, Long-term care, Nursing home, Person-centered care

Translational Significance: To date, no published U.S.-based environmental assessment tools differentiate between traditional medical model design features and those reflecting person-centered care and household design. The Environmental Audit Screening Evaluation tool aims to represent an important step forward in describing the environment in effective and consistent ways to better understand the impact of the designed environment on outcomes for residents (e.g., clinical, behavioral, and well-being), staff (e.g., satisfaction and burden), and the organization (e.g., census, costs, retention, etc.).

A growing body of research addresses the quality and potential impacts of the designed environment of nursing homes, assisted living, and memory care settings on residents who live in these settings. Many of these studies, however, lack scientific rigor, in part because the built environment is comprised of a significant number of variables that make planning controlled experimental designs particularly challenging. A significant portion of the research in this field is single-site case studies or cross-sectional studies with small and homogenous samples (Chaudhury et al., 2017), which

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have limited generalizability and/or often fail to adequately measure the environmental conditions pre- and postintervention, relying on the generalized description.

At the same time, the long-term care field has experienced tremendous changes as increasing numbers of care communities seek to move away from the traditional medical and staff-centric model of care (and design) and adopt person-centered care (PCC) (Cohen & Weisman, 1991; Talerico et al., 2003). PCC is a set of values that can be adopted in myriad ways and to a greater or lesser extent. It includes policies, practices, systems, and the designed environment (Grabowski, Elliot, et al., 2014; Grabowski, O'Malley, et al., 2014; Shier et al., 2014; Hermer et al., 2018b; Kaup et al., 2020; White et al., 2008). At its most extreme expression, new care communities are designed to reflect a house in terms of scale (8–12 residents) with familiar residential spaces (functional residential kitchens, living rooms with fireplaces, a majority of private rooms with ensuite bathrooms, and direct access to outside spaces). The Green House project has largely spearheaded this movement, with their first Green House homes opening in 2003 in Tupelo Mississippi (Rabig et al., 2006) though there are also many variations referred to as small house or household models, which are often created as significant renovations within traditional care homes.

There is a great desire on the part of providers, designers, and the government to understand the impacts on care, well-being, cognitive status, and quality of life of residents, as well as family satisfaction, staff satisfaction and burnout, and organizational outcomes (e.g., census, infection control, and costs) of different building designs. A significant challenge to conducting the type of research needed to compare more traditional settings from the newer household models (and all the permutations in between) is the lack of appropriate, validated environmental assessment measures.

This article reviews the development and validation of the Environmental Audit Screening Evaluation (EASE) tool, which was specifically derived from the research literature on long-term care environments and settings for people living with dementia. In this sense, it is dementia inclusive, not dementia exclusive. This is important, given the significant proportions of individuals with some level of cognitive impairment in both nursing homes (61%) and assisted living communities (42%–70%; Alzheimer's Association, 2019; Lepore et al., 2017; Zimmerman, Sloane, & Reed, 2014). The EASE is also specifically designed to account for variations in overall design, from traditional medical models to the newer household model.

Literature Review

Nursing home architecture has been evolving in some notable ways over the past 20 years as new approaches to long-term care services for older adults have been implemented (e.g., Eden Alternative, Planetree Model, Pioneer Network Culture Change; Lustbader, 2001; White-Chu et al., 2009; Winzelberg, 2003; Zimmerman, Shier, & Saliba, 2014). There are now two clear ends of the spectrum for nursing home settings. At one end are nursing home environments that continue to reflect the institutional architecture of hospital layouts promoted and constructed between 1960 and 1990 (Aryina & Goldman, 1980; Hiatt, 1991; see Figure 1). The environmental characteristics of these buildings focus primarily on the staff role in the delivery of a "traditional" medical model of care (Schwarz, 1996; Vladeck, 2003). One of the most defining features of this institutional design is long, double-loaded corridors that lead to a nurse station where procedures such as charting and medication distribution happen in a public setting. Social spaces such as dining rooms and lounges are large and sized to be used and shared by all residents in the nursing home.

At the other end of the spectrum are small household designs that support "person-centered" models of care (Ahmed et al., 2019; Kaup, 2015; Rabig et al., 2006). The architecture and interior features are scaled down and designed to focus primarily on replicating a residential environment with the goal of resident autonomy and quality of life (Abushousheh et al., 2011; Proffitt et al., 2010; see Figure 2). Households (HHs) are defined as a small group of residents who live together in a clearly defined setting that has a front door and contains a functional kitchen, a dining room, and a living room (Ahmed et al., 2019; Carnemolla et al., 2021; Shields & Norton, 2006). The composition of these living areas (LAs) can vary but one of the first distinctions as a HH (beyond the small size of 10–12) is the proximity of resident bedrooms to the social spaces (Kaup, 2003). Another defining feature of the HH model is the departure from the double-loaded corridors that dominate the traditional nursing home environment. (Elliot et al., 2014; Kaup, 2015; Rabig et al., 2006).

In the HH model of care, there is growing evidence that there are observable benefits to residents and staff that are expressed in the dynamic relationship between the design of the spaces and the behaviors that are afforded through physical attributes (Ahmed et al., 2019; Fleming et al., 2016; Grabowski, O'Malley, et al., 2014; Kane et al., 2007). There is also growing recognition that PCC interventions are multifactorial and comprise combinations of elements of the built environment (Brownie & Nancarrow, 2013). However, which specific elements, alone and in combination, may positively affect residents and staff is not yet clearly understood in generalizable ways.

The clear distinctions between traditional and HH models begin to blur for nursing home settings that capture selected parts of the HH characteristics but continue to maintain some of the distinct features of the traditional model of care (see Figure 3; Kaup, 2003). These "hybrid" settings raise additional important questions. What are the *most* important features of the HH model that work together, either individually or collectively, to afford the best outcomes for residents and staff? It is also important to note that some providers who have traditional types of buildings are working to adopt more PCC practices, but they are likely to fall short of creating many of the experiences of resident autonomy or a home-like environment because the design of physical spaces does not support these affordances (Kaup et al., 2020).

The designed environment is an important, some would argue critical, component of the model of PCC. Over five decades of research demonstrates the impact of the designed environment on individuals living with dementia. The earliest research project sought to evaluate a total environmental set of changes, and the researchers concluded that the independent variable was "distressingly gross" as it subsumed the total care environment (Leibowitz et al., 1979). Some subsequent early research focused on specific environmental elements, such as a display case at the bedroom entrance or views to toilets (Namazi & Johnson 1991; Namazi et al., 1991) which gave insights, but only into how a specific

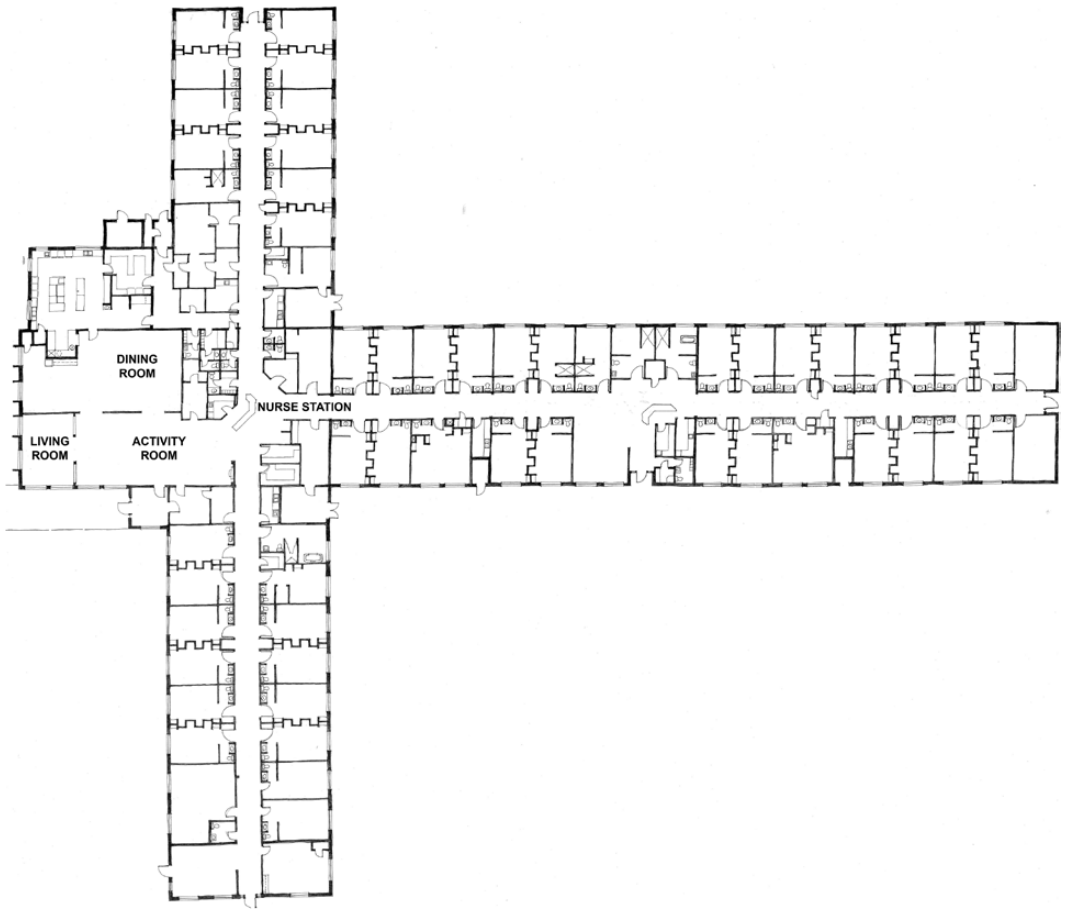

Figure 1. Traditional medical model architectural layout for skilled nursing care.

discrete environmental element affected a single outcome. To address the chasm between the overly broad environment as the independent variable and the exceedingly narrow one, two different environmental assessment tools were developed in the United States in the 1990s to assess long-term care environments: the Therapeutic Environment Screening Scale (TESS-NH; Sloane & Mathew, 1990) and the Professional Environmental Assessment Protocol (PEAP; Lawton et al., 2000; Weisman et al., 1996).

Despite the availability of these tools, subsequent reviews of the research literature on long-term care environments concluded that the quality of the research and the environmental assessment tools available had limited generalizability or ability to be linked to specific quality outcomes. For example, although Chaudhury et al., (2017) and Marquardt et al. (2014) identify evidence from over 170 studies that suggest that both global design issues and specific design details have a measurable impact on the behavior, functioning, and well-being of residents living with dementia, as well as on care partners, the authors argue that the field still suffers from significant limitations. Chaudhury et al. (2017) conclude, "There is a fairly large body of literature on the impact of the physical environment of dementia care settings; however, notable gaps and limitations exist that need to be addressed in future work" (p. e332).

One of those limitations is the lack of a valid and reliable measure of the physical environment, especially one that specifically addresses the newer HH design style and is evidence based. This conclusion is echoed by the findings of the first National Research Summit on Care, Services, and Supports for Persons with Dementia and Their Caregivers, which was held on October 16–17, 2017: A more systematic framework of the core elements of well-being and their environmental correlates should be further developed (Kolanowski et al., 2018). Thus, as PCC and the Green House/small house/HH movement grow in popularity, new assessment tools are needed to address both the significantly different operational and environmental characteristics of these new models. A number of new assessment tools have been developed that specifically focus on the core values of PCC. A few of the more prominent tools include The Preferences for Everyday Living Inventory which assesses the extent to which residents' preferences are assessed and honored (van Haitsma et al., 2013); Artifacts of Culture Change which assesses organizational changes that reflect PCC practices (Bowman, 2006); Culture Change Indicators Survey which also assesses progress toward organizational adoption of PCC values (Institute for Caregiver Education, 2003); and the Eden Warmth Surveys for elders, staff, and families which assess residents, families, and employees' satisfaction with the organization adopting PCC practices (Eden Alternative, 2007). It is worth noting that although these tools assess the core values of PCC, and some of these instruments include some items about the designed environment, none is comprehensive (Calkins et al., 2022). In examining tools specifically focused on the designed environment,

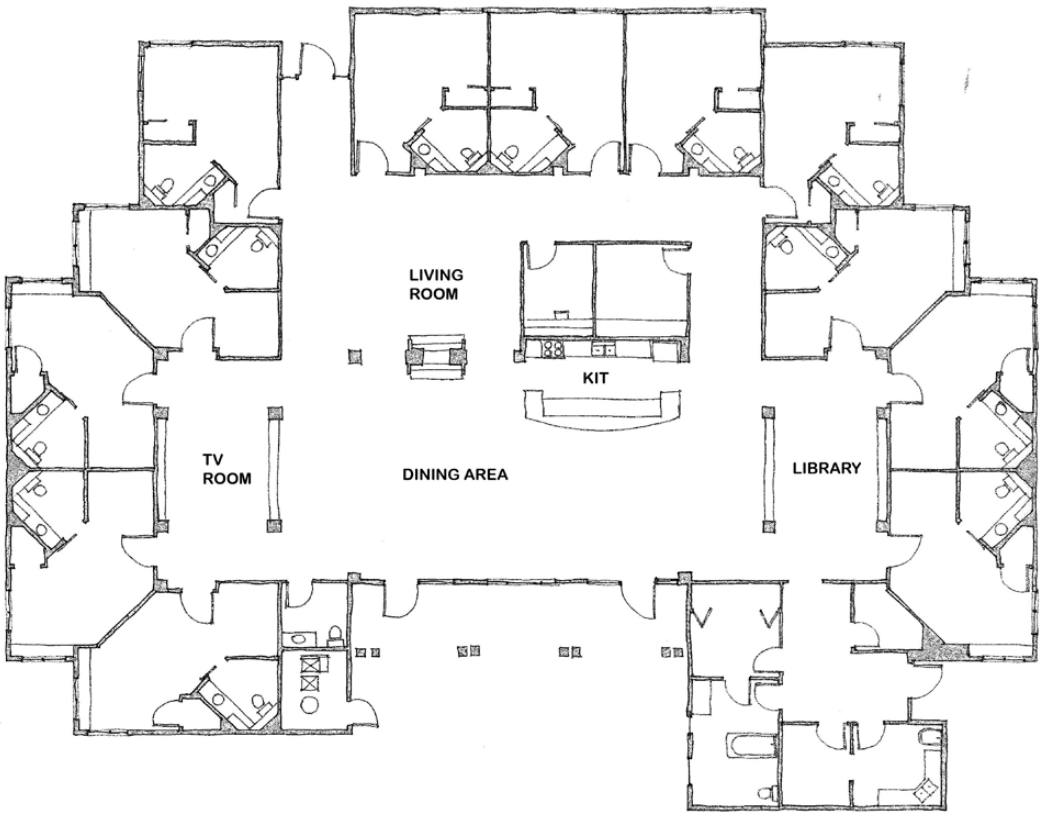

Figure 2. Household model architectural layout for skilled nursing care.

the two U.S.-based tools (TESS and PEAP) were developed prior to the evolution of HH models. There are also some tools developed in other countries, though they have not been used or validated in the United States, so their utility here is unknown (e.g., Sheffield Care Environmental Matrix [Parker et al., 2004] and the Environmental Audit Tool [EAT-HC; Fleming, 2011]).

Statement of the Problem

It is argued here that PCC, in general, and the HH design of long-term care settings, in particular, are interventions that are being implemented for individuals living with dementia and others in long-term care settings. To evaluate these interventions, it is necessary to have appropriate tools to assess the elements of the environmental design of the HH model, which embody the values of PCC (Bozarth & Bradley, 1986; Carnemolla et al., 2021; Fazio et al., 2018). Thus, the proximal goal of this phase of the development of the EASE was to systematically assess the reliability and validity of the tool, which would be followed by a phase deriving the factorial structure of the tool. The ultimate goal is to identify the best models of design in long-term care to maintain quality of life for individuals living in these settings and their caregivers. This project addresses new measures and measurement approaches by assessing the reliability and validity of an evidence-based tool that could then be used to assess the existing environments or be used during the design process to make sure the appropriate elements are being incorporated into the next generation of long-term care settings.

Development of the EASE tool

In 2016, the Winnipeg Regional Health Authority commissioned Robert Wrublowsky, an architect in Winnipeg, Canada, to develop an updated design guide, one that was more comprehensive and research based, to address PCC in their new Personal Care Home projects. Wrublowsky primarily used the structure of a comprehensive literature review by Marquardt et al. (2014), which included 169 individual studies (published from 1980 to 2013), to create a framework for the design guide. Marquardt's analysis put evidence from the research articles into a structure that included four main environmental categories (basic design attributes, environmental attributes, ambiance, and environmental information) and seven thematic groups/outcomes (behavior, cognition, function, well-being, social abilities, orientation, and care outcomes; Wrublowsky, 2018). One additional environmental category was added to the design guide: assistive measures to support independence. Individual design elements or features from each of the 169 articles in Marquardt et al., review and from research published since 2013 were then listed individually and linked to the outcomes.

After the design guide was completed, Wrublowsky developed the initial version of the EASE tool. It was comprised of 164 unique items, with a variable response structure: Some items were scored present/not present and others were scored on a 3- or 5-point scale of disagree to agree. This was subsequently shared with one of the authors (M. P. Calkins), who thought it had potential to both guide the design of new care communities and be valuable to researchers looking to evaluate the influence of different elements of the designed environment. The first modification to the tool was to revise

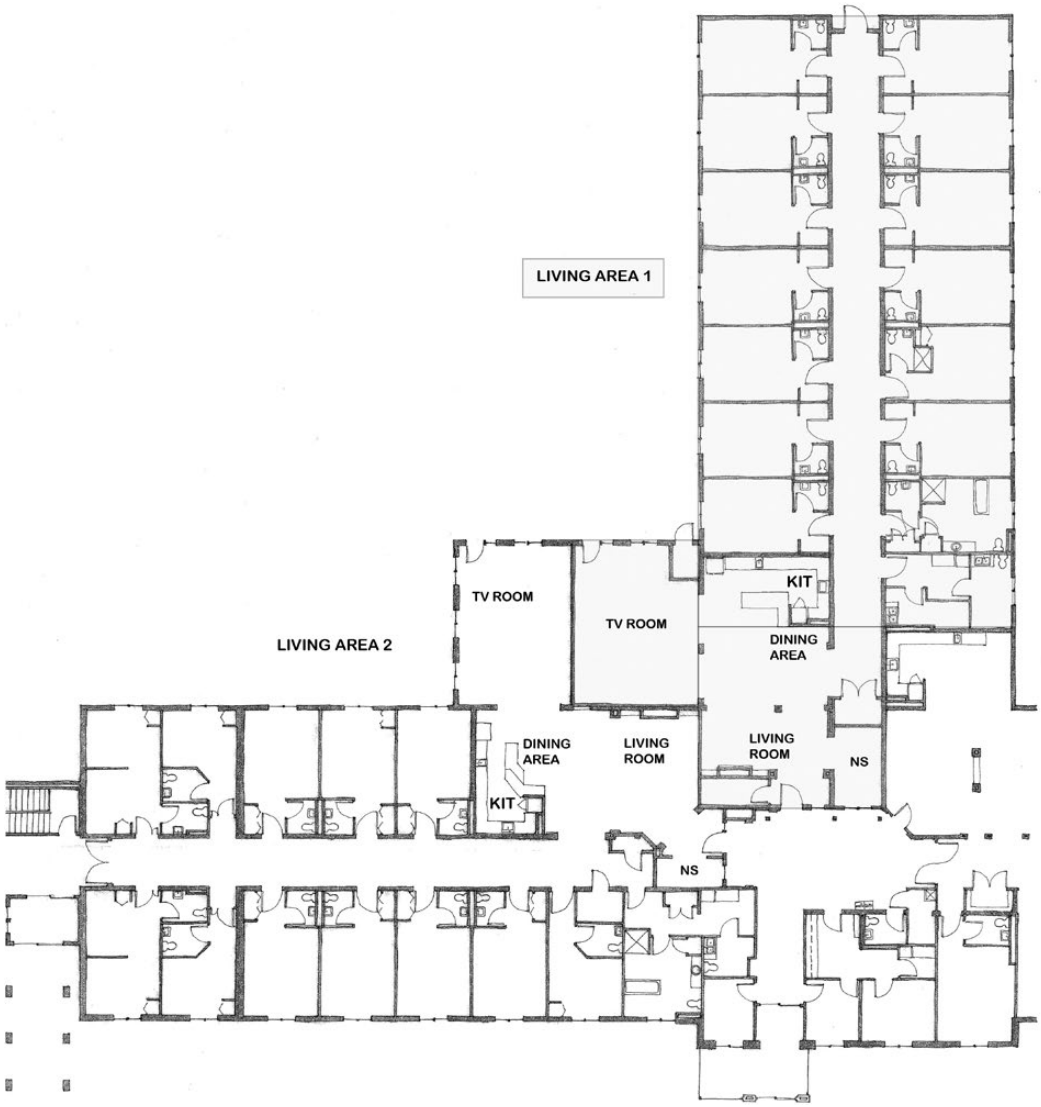

Figure 3. Hybrid living areas that modify the traditional layout.

the scoring, so that each item in the EASE was rated on a 5-point scale, where (1) reflected a traditional medical model approach to design and (5) reflected deep adoption of an HH model. The ratings for each item were also made to be as objective as possible: a few items were interval, the majority of items were ordinal, and a few were nominal. Additional items were added based on a (nonsystematic) review of research published since the 2018 publication of the Design Guide (see Figure 4). This paper reports on two phases of psychometric testing of the EASE: assessment of reliability and assessment of face validity and convergent and criterion-related validity.

Method

Phase I: Face Validity

The first phase assessed the face validity of the EASE by having the tool reviewed by 22 subject matter experts, including 10 architects, 4 interior designers, 3 long-term care planning and design consultants, and 1 state regulator, nurse, occupational therapist, long-term care administrator, and landscape architect. All but two had ≥20 years of experience with senior living, with one having 15–20 years, and one having 5 years of experience. These experts rated each individual item on a 4-point scale from being not important (1) to being very important (4) to person-centered long-term care environments. They were also asked if there were missing items. Most items (85%) had a mean score between 3 and 4, and no items scored below 2 (see Table 1). Each rater also had the opportunity to make comments on the wording of each item and its response options. Every item received at least one comment, and many received multiple. Our procedures followed most of the COSMIN model steps for content validity as relevant for observations made by trained reviewers. Specifically, they assessed items related to (a) the construct of PCC; (b) the study population here is defined as long-term care settings; (c) they rated the relevance/importance and (d) were given the opportunity to identify missing environmental elements (Mokkink et al., 2010). The EASE was subsequently revised, incorporating the reviewers' comments.

Phase II: Reliability and Convergent and Criterion-Related Validity

The next phase of the psychometric testing focused on evaluating evidence for the reliability and validity of the EASE.

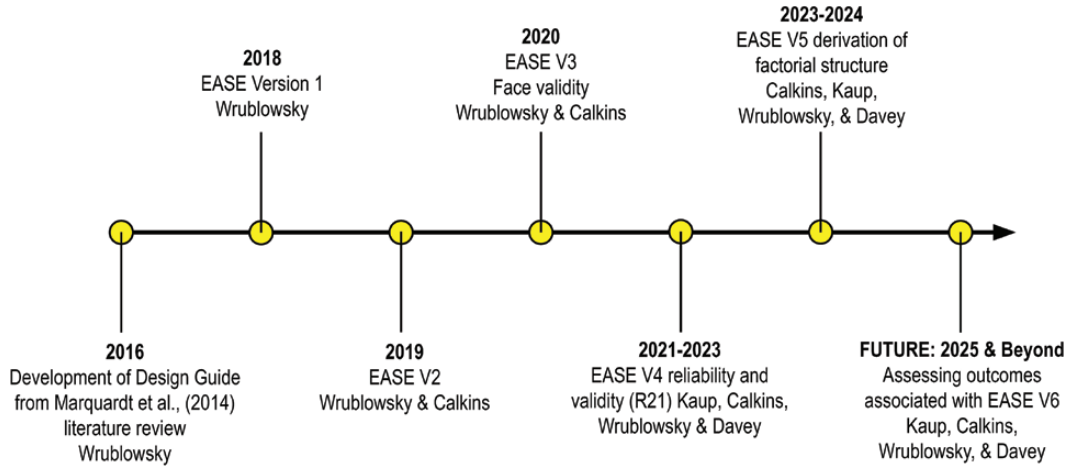

Figure 4. Timeline of EASE tool development. EASE = Environmental Audit Screening Evaluation.

Table 1. Ratings of Item Importance

Ratings	Frequency of items
1.00–1.49	0
1.50–1.99	0
2.00–2.49	4
2.50–2.99	10
3.00–3.49	46
3.50–4.00	39

Regarding reliability, the EASE was evaluated for internal consistency, interrater reliability and agreement, and inter-occasion reliability and agreement. Regarding validity, convergent validity was assessed by evaluating correlations between the EASE, the TESS-NH, the PEAP, and the EAT-HC. Regarding criterion-related validity, we evaluate whether EASE scores differentiate HHs from traditional and hybrid settings.

The first step was to identify the tools against which the EASE would be validated. A detailed analysis of 13 long-term care environmental assessment instruments was conducted (Calkins et al., 2022) and used to determine which tools to compare the EASE to. The TESS and PEAP were selected as comparison tools because they were both developed in the United States to assess special care units and were based on values that were ultimately adopted by the PCC movement. Other U.S. tools were not considered sufficiently comprehensive or person centered. Of the non-U.S. tools evaluated, both the Sheffield Care Environmental Matrix (Parker et al., 2004) and the EAT-HC (Fleming, 2011) specifically addressed aspects of HH models of design. As both are comprehensive and have significant overlap, the decision was made that it was only necessary to include one of these tools. The Sheffield Care Environmental Matrix had been translated and modified to be used in Sweden, and over a third of the items had to be significantly revised or omitted. Thus, the decision was made to include the EAT-HC as the third comparison tool. A brief description of each tool is provided later, and a more complete description which includes more detailed psychometric properties can be found in Calkins et al. (2022).

Therapeutic Environment Screening Survey

The TESS has undergone several iterations, initially having 12 items, then 131, and finally, the most current version, used in this research, has 84 items grouped into 13 constructs (such as maintenance, odors, lighting, and privacy; Sloane et al., 2002). The TESS-NH items have a wide variety of different response formats (Sloane & Mathew, 1990). Some are based on person-centered values (privacy) and some are purely descriptive (odors). This current version has not undergone significant psychometric evaluation, but a previous version had interrater agreement scores that ranged from 42% to 100% with an average of 86%. Test–retest was high for fixed items in the environment (above 80%) and lower for modifiable elements of the environment (lighting). All items in the current version are categorical. For this analysis, each item was converted to a score.

Professional Environmental Assessment Protocol

PEAP was developed primarily as a tool to evaluate environments where individuals with a diagnosis of dementia were segregated from the general nursing home population (early special care units; Weisman et al., 1996). The PEAP provides a global rating on each of nine dimensions that have been shown to be relevant to individuals living with dementia (e.g., safety and security, awareness, and orientation; Lawton et al, 2000). Ratings on the PEAP are completed through categories related to therapeutic outcomes and scores are global (a single score for each category). The PEAP is an evaluative tool that has demonstrated good to very good interrater reliability (ranging from 58% to 92%), with Spearman rho correlation coefficients ranging from 69% to 88%. Studies have demonstrated this tool is able to discriminate between different styles of nursing home environments (Slaughter & Morgan, 2012).

Environmental Audit Tool

EAT-HC was developed in the late 1980s and early 1990s for planning units for the "Confused and Disturbed Elderly" built by the New South Wales (Australia) Department of Health (Fleming, 2011). This tool is comprised of 72 items selected to exemplify a set of design principles that are similar to, but not completely consistent with, the elements of HH design that are emerging in U.S. nursing homes. The EAT-HC is an evaluative tool with interrater agreement scores ranging

from 46% to 100% (overall agreement of 97%; Calkins et al, 2022; Smith et al., 2012).

Recruitment

One of the goals of this project was to determine whether the EASE tool could distinguish different care environments based on their physical characteristics that might be supportive of PCC care. Providers who have HH environments have settings that embody some of these principles through inherent design features. Some providers who have traditional buildings are working to adopt PCC practices, some are not. To reduce the influence of different "models of care" variables, this project sought to improve internal sampling consistency by selecting providers who shared a common understanding and approach to PCC, regardless of the types of LAs they had in their building. Therefore, the sample was drawn from Kansas nursing home providers that are part of the PEAK Program. PEAK is a Medicaid pay-for-performance PCC program implemented by the Kansas Department for Aging and Disability (KDAD) which incentivizes the adoption of PCC practices and worker empowerment (Hermer et al., 2018a; Poey et al., 2017). It is administered through a contract with the Kansas State University's Center on Aging (Hermer et al., 2018a, 2018b).

The PEAK program has a tiered structure for evaluating and recognizing PCC adoption. All homes that participate in PEAK use the same guidelines and definitions of PCC to implement practices. There are five levels in the PEAK program. Determination of the level of adoption is through an external assessment of annual reports provided by the nursing home and confirmation of practices through interviews and visits made by the PEAK team. (For a complete description of the PEAK program, see Doll et al., 2017.) A list of homes and their current levels of PEAK PCC adoption was obtained by the project team and providers were recruited from this list. Providers who have achieved Level 2 or higher have been in the PEAK program implementing at least 8 of the 12 PEAK PCC practices for at least 2 years. Fifteen nursing homes that had achieved at least Level 2 (out of five levels) were recruited to participate. The final sites included in the sample (n = 13) were those that had reasonably similar organizational/operational commitment to PCC, but had different designs of LAs (n = 28) which was the unit of analysis.

Sample Stratification

Drawing on a variety of the best practice design guidelines, a tripartite classification system was developed (traditional, hybrid, and HH) for the purpose of ensuring sufficient diversity of building designs and creating a stratified sample. During the recruitment of homes, floor plans were collected from administrators. Administrators were asked to identify which LAs in their building had the highest proportion of residents who were living with dementia. This could be either an LA that was designated for these services (segregated) or an LA that integrated residents with neurocognitive needs. These floor plans were reviewed by the two PIs (M. K. Kaup and M. P. Calkins), and spaces within the building labeled for use.

An LA was isolated first as an identifiable zone within the nursing home building where a group of continuously adjacent resident rooms (e.g., along a hallway) were in proximity to distinctive space(s) (e.g., a dining area, living room, a nursing desk, etc.; see Figures 1–3). From here, the LAs were then further classified as traditional, hybrid, or HH based on the composition of room use, circulation, and the presence or absence of distinctively identifiable HH features (e.g., size, a noncommercial kitchen with an adjacent dining space, a distinctive entry that impacted circulation into the LA; see Table 2). All nursing home buildings contained multiple LAs, some contained different types of LAs within the same building. All LAs were categorized prior to the site visit.

Data Collection

Data were collected over the course of a 10-week period. To manage the schedule and reduce the disruption to residents and staff in the LAs, data were collected in a single visit with all three assessors individually completing the EASE tool, and individually completing one additional tool (TESS, PEAP, or EAT). Depending on the size of the LA, it would take each assessor 3–4 hr to complete both of their tools. The EASE tool is designed to assess and measure aspects of the designed environment, but it is intended to be easily used by a broad range of professionals working with long-term care settings and services. Therefore, to test the usability of the tool, assessors who did not have a background in architecture or interior design were hired and trained. Experience and knowledge of gerontology and long-term care were a requirement.

Each tool was administered concurrently in the LA that had the highest percentage of residents living with dementia. Evaluators started with a general tour of the building and the targeted LA together with a representative from the community, then each completed their assessments independently. At each site, all three evaluators separately completed the EASE tool to assess interrater reliability. Test–retest reliability of the EASE was assessed by having three sites (one of each type of LA) reassessed approximately 1 month after the original assessment.

All the assessment tools required some interaction/interviews with staff about environment-in-use issues that were not apparent through observation. Examples included policies for residents who want to go outside, how residents could access food/snacks during non-mealtimes, policies for personalizing bedrooms with art and personal artifacts, or where there might be accommodations for overnight visitors. These types of policies should be known by any staff member working on the LA. Each assessor asked the question individually and was not expected to ask the same person. None of the questions were about either the staff or the residents. The project was reviewed and received Institutional Review Board exemption by the Kansas State University Office of Research Compliance (Protocol #10198), though staff were given consent for appropriate project descriptions (signing of consent was waived).

Statistical Analysis

Data preparation and cleaning

Data were collected using paper copies of the tools. Assessors also recorded field notes that supported their scores. After each site visit, each assessor was responsible for transferring their scores for each instrument from the paper-based instruments into Excel files. All paper copies of tools and the associated field notes were then scanned and stored in both physical and digital files. Prior to analysis, all digital files were verified for completion and any entries missed in the transfer from paper copy to the digital files were recorded. Physical files were accessed to retrieve

Table 2. Features and Characteristics of Living Areas

Characteristics[a]	Features of traditional LAs (n = 8)	Features of hybrid LAs (n = 10)	Features of household LAs (n = 10)
Number of residents associated with a designated LA	>16 and/or there is no real designated LAs.	16–22±	<16
Location of dining room in relationship to designated LA	Dining is typically "off" of the immediate LA and is shared with other LAs.	Dining is located within the immediate LA.	Dining is located within the immediate LA.
Type of kitchen area and environmental support that provides access foods and immediate meal support	Only a central kitchen (with no real access beyond standard mealtimes) or modest kitchenette type space not really equipped for "meal alternatives."	Partial to full kitchen space with 24/7 access at least for staff.	Full kitchen space with 24/7 access at least for staff.
Social spaces	Predominantly multi-purpose rooms and these are shared with other LAs.	Access to a mixture of spaces but LA does have at least one other dedicated social area besides dining room.	Residential mix of spaces such as living rooms, dens, sunporches, etc., all within the HHs.
Shared versus dedicated staff	Mainly shared/most staff float between multiple LAs.	At least some staff are dedicated to the LA/some staff may still float between multiple LAs.	Most all staff are dedicated to the LA/select staff (e.g., nurse) may still float between multiple LAs.
Identifiable entrance to LA	Not distinguishable/typically fire-double door entrance often adjacent to bedrooms.	More distinguishable but may still include combination of fire-double door access with modified front door. May still be adjacent to bedrooms.	Recognizable front door that is the main passage to the LA for visitors/generally not immediately adjacent to resident bedrooms.

Notes: LA = living area; HH = household.
[a]Characteristics have been articulated as they reflect the environmental attributes identified in the current literature on skilled care settings. See Review of Literature.

or confirm scores. Evaluators entered their scores into a master file. Prior to analysis, data were carefully screened, including range and variability checks, and ensuring complete data.

Data Analysis

Distributions were evaluated using frequencies, histograms, and summary statistics overall and within subgroups (e.g., HH design, rater, occasion), as appropriate. Cronbach's α (Cronbach, 1951) was used to assess the internal consistency of scales. Interrater reliability was assessed using Pearson's r and Spearman's ρ and interrater agreement was assessed using the intraclass correlation coefficient (ICC) with a two-way random-effects model across sites and raters (McGraw & Wong, 1996). Test–retest reliability was assessed using Pearson's r and Spearman's ρ, and test–retest agreement was estimated using weighted (linear and quadratic) kappa coefficients. Convergent validity was estimated via Pearson's r and Spearman's ρ. Given the intended purpose of the EASE, criterion-related validity was evaluated by comparing scores across setting types using one-way analysis of variance with Welch adjustments to address potential heteroscedasticity concerns. Post hoc comparisons were made using Šidák's adjustment (Šidák, 1967). For all analyses, $\alpha = 0.05$. Analyses were conducted using Stata17.0 (StataCorp, 2021).

Results

We begin by presenting evidence regarding the reliability of the EASE scale.

Reliability

Internal consistency was estimated using Cronbach's α. Coefficient α was 0.94 for the EASE, 0.82 for the EAT, and 0.88 for the PEAP. TESS is estimated using a single total score, and so α was not calculated for this scale.

Interrater reliability and agreement

Each of the 28 LAs was rated by each of the three raters. Pearson correlations on the EASE across the three raters were all $r = 0.97$ (Spearman's ρ all = 0.96) indicating strong rank-order stability across raters. The ICC was 0.94 further indicating a very high level of absolute agreement ($F[27, 54] = 64.98$, $p < .0001$) across raters.

Inter-occasion reliability and agreement

Each rater completed the EASE on two separate occasions, spaced 30–41 days (M = 35 days) apart for one LA of each type. There was strong rank-order consistency across raters and LAs ($0.65 \le r \le 0.96$; $0.65 \le \rho \le 0.96$) with median values of 0.84 and 0.83 for Pearson's r and Spearman's ρ, respectively. Inter-occasion agreement was established using Cohen's kappa with linear and quadratic weighting. Values were generally consistent with high inter-occasion agreement. Using linear weights, $0.52 \le \kappa \le 0.92$ (Mdn = 0.72), and using quadratic weights, $0.65 \le \kappa \le 0.96$ (Mdn = 0.84).

Validity

Next, we consider evidence for the convergent and concurrent validity of the EASE scale.

Convergent validity

To assess convergent validity, correlations (Pearson's r and Spearman's ρ) between the EASE and other tools were estimated overall, and within each type of setting. As can be seen in Table 3, correlations were strong across all scales and settings. Consistent with expectations, EASE total

scores correlated most highly with EAT-HC total scores, followed by PEAP total scores and TESS-NH total scores. All correlations were highly strong ($|r| \geq 0.7$ overall and ≥0.6 within settings), providing support for the high strong convergent validity of the EASE with current established scales.

Criterion-related validity

Results provide preliminary evidence that the EASE successfully discriminates between HHs and other settings ($F[2, 81] = 4.17$, $p = .0188$). Post hoc comparisons indicated that the EASE successfully discriminated between HHs and traditional settings. Post hoc comparisons similarly indicated that the EAT-HC successfully discriminated between HHs and traditional settings ($F[2, 25] = 6.54$, $p = .0052$). In contrast, the PEAP did not discriminate between setting types ($F[2, 25] = 0.59$, $p = .5639$). The TESS-NH also did not discriminate between setting types ($F[2, 25]=0.35$, $p = .7098$).

Discussion

There is a clear need for environmental assessment tools for long-term care settings that better differentiate between different models of care and provide enough discrete items that it could be possible to identify either individual features, or more likely, constellations of environmental features that are associated with different outcomes of interest. Neither of the two U.S.-based environmental assessment tools, the PEAP and the TESS-NH, discriminated between any of the three models of environments, which is not surprising given that they were developed in the 1990s before HH models were common. Although the domains of the PEAP are similar to the EASE, the global rating nature of the PEAP tool makes it unsuitable for identifying specific design features that might be correlated with specific outcomes of interest. The EAT-HC was most closely aligned with the EASE and performed similarly in differentiating between the traditional and HH models.

It is reasonable to ask if the EASE is too redundant to the EAT-HC. The EAT-HC was developed based on a set of Australian principles developed in the late 1980s and early 1990s and there are concepts that have arisen since then that are not included. To give one example, nursing homes that have multiple adjacent LAs should have visually distinctive front door entries so people can identify their own LA (see Figure 5). This is included in the EASE and not in the EAT-HC. Further, the scoring algorithm for the EAT-HC is not consistent. Most of the items reflect a dichotomous 2-point scale (yes, feature is present or no, feature is not present) which can be difficult to answer when different parts of an LA are different (e.g., handrails may be present in some but not all areas, lighting can be different). Some items qualify for an additional point (e.g., if safety features are unobtrusive) and thus have a three-point scale. Some sections of the EAT-HC use ratio-level data (e.g., % of bedrooms with direct view to a lounge) and thus are on a 4-point scale. This makes the weighting of different items unbalanced. Care was taken with the EASE to have every item rated on a similar 5-point scale.

Limitations

There are several limitations to this study. First, the sample size was relatively small, with only 28 LAs in 13 care communities, all in one state. Further, because care communities were pulled from those homes participating in the PEAK program, all had adopted some PCC values and practices, and thus were not a truly representative sample of all nursing homes in the United States. The next phase of the project is to derive a factorial structure for the EASE tool and will include a much broader and representative sample. In addition, the lower

Table 3. Pearson's (Below Diagonal) and Spearman's (Above Diagonal) Correlations Between EASE and Other Scales Overall and by Setting Type

r\ρ	EASE	EAT	PEAP	TESS
Overall ($N = 28$)				
EASE	1.00	0.89	0.88	0.76
EAT	0.88	1.00	0.81	0.73
PEAP	0.82	0.74	1.00	0.75
TESS	0.71	0.74	0.71	1.00
Type: Household ($n = 10$)				
EASE	1.00	0.76	0.94	0.95
EAT	0.83	1.00	0.68	0.73
PEAP	0.85	0.53	1.00	0.87
TESS	0.91	0.75	0.75	1.00
Type: Hybrid ($n = 10$)				
EASE	1.00	0.90	0.91	0.70
EAT	0.83	1.00	0.89	0.70
PEAP	0.87	0.81	1.00	0.73
TESS	0.60	0.68	0.63	1.00
Type: Traditional ($n = 8$)				
EASE	1.00	0.93	0.73	0.83
EAT	0.96	1.00	0.78	0.86
PEAP	0.81	0.87	1.00	0.73
TESS	0.81	0.84	0.78	1.00

Notes: EASE = Environmental Audit Screening Evaluation; EAT = Environmental Audit Tool; PEAP = Professional Environmental Assessment Protocol; TESS = Therapeutic Environment Screening Scale.

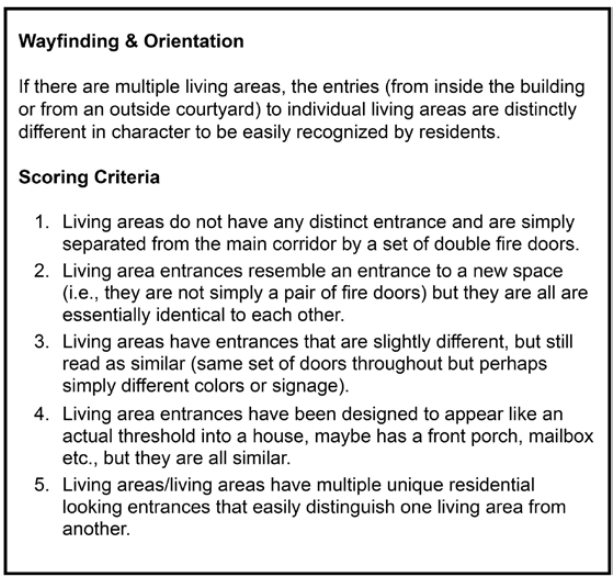

Figure 5. Sample EASE question with scoring criteria. EASE = Environmental Audit Screening Evaluation.

kappa values suggest that training on the tool is critical. A training manual is being developed and will be tested before the next phase of the project.

Implications

The designed environment is extremely important for individuals with neurocognitive challenges such as Alzheimer's disease and related dementias. Tools to plan and assess the physical environment have lagged theory and practice and are particularly deficient regarding best design practices. As noted by Carnemolla and colleagues (2021), "While the quality of the built environment in aged care settings is beginning to be given greater consideration than in the past, little research has been undertaken example the design and the nature of newer aged care settings, including their built environments, and how these affect caregiving practices" (p. 1). The EASE tool represents the next generation of environmental assessment measures that capture an evidence-based approach for PCC priorities in long-term care living settings. The results from this study show that the tool is reliable in capturing quality variables associated with skilled care settings. This tool targets those environmental characteristics that distinguish the values of residential living over institutional routines. Most importantly, this tool demonstrates the capacity to discriminate between distinct setting types (e.g., traditional skilled care LAs and HH models).

To date, there has not been a published U.S./North American-based environmental assessment tool that differentiates between traditional medical model design features and ones that reflect PCC and HH design. As such, the quality of environmental research for senior care settings has been hampered by the lack of a validated, comprehensive, objective assessment tool that is descriptive and quantitative in its design. The EASE tool is comprehensive and accounts for nuanced design differences across settings. Based on the preliminary evidence presented here, the EASE tool appears to be psychometrically sound, showing high levels of internal consistency and agreement across raters and occasions. Additionally, evidence for the convergent and concurrent validity of the EASE is evidenced by its strong correlations with existing validated instruments and its ability to distinguish home-like from other LA settings. As this tool develops further, this could be a major step forward in describing the environment in effective and consistent ways so we can better understand the impact of the designed environment on outcomes for residents (e.g., clinical, behavioral, and well-being), staff (e.g., satisfaction, burden) and the organization (e.g., census, costs, retention, etc.).

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Conflict of Interest

M. L. Kaup is the Co-Principal Investigator on the PEAK Project contracted with the Kansas Department for Aging and Disability (KDADs). KDADs did not have a role in this research.

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