Taylor & Francis
Taylor & Francis Group

Disability and Rehabilitation

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/idre20

Home modifications and repurposing: perspectives on the accessibility, affordability, and attractiveness

Linda R. Struckmeyer, Nichole Campbell, Carlyn Ellison, Sherry Ahrentzen & Sherrilene Classen

To cite this article: Linda R. Struckmeyer, Nichole Campbell, Carlyn Ellison, Sherry Ahrentzen & Sherrilene Classen (2022) Home modifications and repurposing: perspectives on the accessibility, affordability, and attractiveness, Disability and Rehabilitation, 44:17, 4619-4628, DOI: 10.1080/09638288.2021.1910866

To link to this article: https://doi.org/10.1080/09638288.2021.1910866

Published online: 17 Apr 2021.

Submit your article to this journal

Article views: 1111

View related articles

View Crossmark data

Citing articles: 1 View citing articles

Full Terms & Conditions of access and use can be found at
https://www.tandfonline.com/action/journalInformation?journalCode=idre20

DISABILITY AND REHABILITATION
2022, VOL. 44, NO. 17, 4619–4628
https://doi.org/10.1080/09638288.2021.1910866

Taylor & Francis
Taylor & Francis Group

RESEARCH PAPER

Check for updates

Home modifications and repurposing: perspectives on the accessibility, affordability, and attractiveness

Linda R. Struckmeyer[a], Nichole Campbell[b], Carlyn Ellison[a], Sherry Ahrentzen[c] and Sherrilene Classen[a]

[a]Department of Occupational Therapy, University of Florida, Gainesville, FL, USA; [b]Interior Architecture Department, Ohio University, Athens, OH, USA; [c]Shimberg Center for Housing Studies, University of Florida, Gainesville, FL, USA

ABSTRACT

Purpose: Society has progressed in universal design guidelines and assistive devices for individuals with disabilities yet challenges due to affordability and attractiveness concerns remain to incorporate them into existing residences. Repurposing (i.e., replacing or adapting problematic fixtures or spaces, with others not originally intended for that purpose) may be the action to address the concerns of consumers. The purpose of this study was to elicit information on problems and solutions regarding home modifications and identify ways that consumers and professionals implement repurposing, that residents deemed accessible, affordable, and attractive.

Methods: This convergent parallel design study consisted of focus groups who rated images of repurposed spaces. The focus groups included consumers with functional mobility and visual limitations ($n = 8$); and professionals who devised or recommended home modifications ($n = 8$). Participants reviewed three images of home modification solutions and completed a Likert-scale rating based on accessibility and attractiveness.

Results: Focus group data indicated that high contrast, heights of fixtures, doors, and flooring – all pose threats to accessibility in the home. Consumers placed more value on attractiveness than professionals. Participants were aware and receptive to repurposing as a home modification technique but focused their discussion on adaptations.

Conclusion: Overall, adoption and implementation of home modifications promote accessibility, but professionals need to consider individualized needs and preferences, before suggesting modifications.

ARTICLE HISTORY
Received 14 August 2020
Revised 14 March 2021
Accepted 27 March 2021

KEYWORDS
Activities of daily living; environment; focus groups; aging in place; home modifications

➤ IMPLICATIONS FOR REHABILITATION

- Repurposing existing spaces, features, and fixtures can serve as a method of home modification.
- Consumer home modification recommendations are perceived to be more effective when collaboratively and individually developed with professionals.
- Data gathered through focus groups can be valuable for informing practice and research in home modifications.

Background and study purposes

Introduction

While individuals may be challenged with functional limitations at any age, advanced age increases the likelihood of acquiring a physical disability. Ambulatory disability, for instance, is found among 5.1% of the U.S. population between the ages of 18 and 64 but increases up to 22.5% for the 65 and over group [1]. In addition to mobility difficulties, estimates indicate 1.3 billion people worldwide have visual impairments with the majority of those affected being older than 50 years of age [2]. As the prevalence and incidence of functional mobility and visual limitations increase with age, a corresponding need exists among those with such declines to be accommodated with housing supportive features.

As the need to accommodate physical challenges in the built environment expand, researchers are making substantial progress in examining universal design guidelines, pattern books (i.e., book depicting architectural designs), and assistive devices to benefit persons with disabilities and/or functional limitations [3–6]. Despite research progress focusing on increased usability – the current spatial, structural, and other constraints in residences still present many challenges. While only 5% of the current housing stock in the USA offers accessibility for moderate mobility difficulties, less than 1% is wheelchair accessible [7]. The criticality of addressing accessibility needs within the home is therefore urgent.

Due to spatial and structural constraints, barriers remain in incorporating affordable and attractive home modifications into existing residences [8,9]. To facilitate participation in one's home environment, vital for health and well-being [10], affordable and attractive home modification solutions must be addressed. For example, participation in the home environment is often decreased due to vision loss. Persons with visual impairments

CONTACT Linda R. Struckmeyer lstruckmeyer@phhp.ufl.edu Department of Occupational Therapy, College of Public Health and Health Professions, University of Florida, P.O. Box 100164, Gainesville, FL 32611-0164, USA

This article has been corrected with minor changes. These changes do not impact the academic content of the article.

© 2021 Informa UK Limited, trading as Taylor & Francis Group

experience in-home challenges related to lighting, contrast, organization, and glare [8]. Researchers have proposed compensation strategies to address these issues [8], however little research exists on how to modify the built environment to accommodate these concerns.

One direction for addressing accessibility, affordability, and attractiveness of home modifications is through the concept of repurposing. Repurposing is operationalized as replacing or adapting problematic fixtures or spaces, with others not originally intended for that purpose. Repurposing is akin to the concept of adaptive reuse in which existing buildings are used for a purpose other than what they were originally designed for [11,12]. An example of repurposing is utilizing a dresser with feet as a bathroom vanity cabinet. In this way, a wheelchair may be more successful and not be restricted by the standard kick-plate height of the cabinet.

Surprisingly, only one study addressed repurposing [13]. This paper provided suggestions on how to ensure sharing a sleeping space between the client and their partner, while also meeting the client's physical needs. The limited amount of discussion on the topic of repurposing spaces or features and identifying accessible, affordable, and attractive home modification solutions prompted the researcher to examine:

a. Perspectives of individuals with functional mobility and visual limitations on addressing challenges and solutions related to home modifications.
b. Ways consumers and professionals implement repurposing strategies to ensure individuals with functional mobility and visual limitations deemed them accessible, affordable, and attractive.

Researchers accomplished these study aims by conducting focus groups with individuals who had functional mobility and visual limitations; as well as professionals working in design or healthcare. The researchers examined how repurposing fixtures and rooms, in the home, are accomplished in an accessible, affordable, and attractive way to meet the needs of people with functional mobility and visual limitations.

Theoretical background

The conceptual framework driving this study is the Person-Environment-Occupation (PEO) model that views persons with varying functional abilities or limitations (physical and visual capabilities) from a holistic perspective [14]. Within this framework, the *person* component includes an individual's motor, sensory, and cognitive abilities. The *environment* represents the physical and social aspects of the home including family, friends, and caregivers. *Occupations* include activities a person needs, have and/or wants to do in the home (e.g., cooking or cleaning). A recent study used the PEO model as the basis to develop a design and construction protocol to support the home modification process for aging-in-place for persons with disabilities. The findings indicated that collaboration between building professionals and occupational therapists was a key part of a systematic home modification protocol [15]. The model provides a comprehensive view of an individual's occupational performance, within the environmental context, allowing the research team to target the home environment. To guide the process of data collection, the research team considered questions that would provide insights on aspects of each component of the PEO model. Additionally, the researchers utilized the model in data interpretation to address each component of the interaction between the person, their environment, and their occupation.

Home modifications and repurposing literature

Home modifications are adaptations to the home environment that are intended to increase use, safety, security, and independence [16]. As physical abilities decline, these modifications become increasingly necessary to perform activities of daily living, enable independent living, and ensure quality of life. Home modifications can range from the removal of safety hazards, such as throw rugs, to the complex redesign and remodeling of bathrooms or other spaces [16].

Regardless of the complexity of accommodating the person with physical mobility or visual limitations home modification strategies improve accessibility and offset functional declines [17,18], prevent falls [19], and increase participation in home activities [17,20]. Stark and colleagues identified that home modifications potentially delay institutionalization of older adults [20]. However, despite supporting health, well-being, and quality of life of clients, home modifications have substantial financial implications [21,22]. As such, based on professional recommendations for home modifications, both financial and community resources (e.g., community referrals) must be considered before proceeding with the actual modifications [22].

Further, accessibility modifications can invoke an institutional appearance rather than a preferred aesthetic [22]. Similarly, in examining home modifications, Granbom *et al.*, found that participants were concerned about how modifications (i.e., accessibility and aesthetics) may impact their home's financial value [23]. After the modifications were completed, Granbom *et al.* found the changes did not negatively impact how homey participants felt their houses were [23]. While perceived hominess has not been established to be correlated with a home's financial worth, this does suggest there is emotional value in modifications being deemed appealing both for current as well as future residents. Further, the cost of home modifications will directly impact the financial gain or loss for the owner, upon the future sale of a house. Therefore, individuals with functional mobility and visual limitations may more favorably consider home modifications if they are affordable and attractive.

Repurposing may be an effective strategy in home modification. While anecdotal evidence points to repurposing, little empirical evidence supports its application, use, and benefit to homeowners. Consequently, this study intends to begin addressing this gap.

Methods

Compliance with ethical standards

Institutional Review Board (IRB) approved the study's methods and intent. At the start of each focus group, the researchers obtained informed consent from each participant. Confidentiality of participants' information was maintained throughout the study. To support participant privacy, each participant was assigned a number to serve as an identifier during discussions and Likert-scale responses were de-identified. As each focus group entailed moderated discussions, the participants encountered no greater risks than those associated with discussion in everyday life. Each participant received a gift card valued at $25 USD for participating. Additionally, no conflicts of interest existed for any of the study's researchers.

Table 1. Focus group discussion questions for consumers and professionals.

Group	Questions
Consumers	1) Which home modification challenges in the bedroom, bathroom or kitchen area have been the most difficult to resolve? a. Why are those issues particularly hard to resolve? b. What were the obstacles you faced in finding a solution for that home modification challenge? 2) Tell a story about how you or someone has helped you adapt a fixture or room to make it work for you.
Professionals	1) What is the most common home modification challenge you are asked to resolve? a. Are there ways that it could have been done cheaper or by repurposing features or rooms? 2) Which home modification challenges related to the kitchen or bedroom to bathroom transition are most difficult to resolve? a. Why were those difficult to resolve? b. What were the obstacles you faced in finding a solution for that home modification challenge? 3) Tell a story about innovative solutions your client has found for a home modification challenge to a home fixture or room? a. Did you think it was successful? Accessible? Affordable? Attractive? b. What were the challenges in resolving the issue?
Both*	How attractive do you think this solution is? How accessible do you think this solution is?

Note. * Researchers asked consumers and professionals to respond while the researchers presented identical images of home modification solutions.

Design

Utilizing a convergent parallel design, this study's primary data were collected *via* two focus group discussions.

Procedure

The research team consisted of academic experts in many areas including: occupational therapy, building architecture and design for special populations, building construction, and public health. Each 90-min focus group was formatted as follows: Initially, the moderator explained the pre-established ground rules. Ground rules included confidentially of information shared, giving everyone an opportunity to speak, and explaining the moderator would keep the discussion flowing and on time. Next, researchers introduced participants to the study and obtained informed consent. Then, participants completed a demographic survey. For 70 min, participants engaged in a moderated group discussion around predetermined questions (Table 1). During the last 10 min of the session, to further explore the perspectives of focus group members, participants assessed three images of repurposed spaces (see, "Focus Group Images"). In response to the images, participants commented on and rated, *via* a Likert-scale, the home modification design's attractiveness and accessibility. Due to the sample size ($N = 16$), the survey's purpose was not to collect data for statistical analysis but rather to provide further insight into the participants' opinions. Additionally, participants were able to use assistive devices (e.g., glasses or magnifiers) while assessing the images.

Setting

The local Center for Independent Living hosted the focus group sessions. The center is compliant with ADA standards for accessibility and as such benefitted the participants with functional mobility limitations. Likewise, a combination of artificial and natural light promoted accessibility for participants with visual impairments. The private room, in combination with the respectful demeanor of the research team and welcoming introduction to the focus group, created an atmosphere conducive to participants freely sharing their opinions and experiences.

Participants

Researchers recruited participants for the two focus groups: consumers and professionals. Based on a preliminary literature review, comments from the project team's advisory board, and feedback from the larger research team, we included participants with functional mobility and visual limitations. For the professional group, the researchers included participants from the design, building, and healthcare professions.

Recruitment

The target group for recruitment was individuals with functional mobility [10] and visual limitations [18] who experienced significant challenges with accessibility in the home. For convenience of the participants, the research team recruited individuals living within driving distance of the focus group interview location. Individuals were recruited from suggestions made by the: advisory board, local Center of Independent Living, local home care agencies, and local interior designers.

The criteria for participant inclusion were: 18–90 years of age and the ability to write, read, and speak the English language proficiently. Additionally, for the consumer group, researchers included participants with self-reported functional mobility and/or visual limitations. Examples of such conditions among participants included quadriplegia and/or low vision. This study defined low-vision as having impaired, yet functional, travel vision. For the professional group, participants had self-reported experience in devising or recommending home modification solutions to help clients with functional limitations. Participants represented professions such as occupational therapy, physical therapy, and/or construction – as such a multi-disciplinary group of professionals.

Sampling

The researchers utilized purposive sampling, inviting participants from various settings, and producing a non-probability sample [25], such that 10–12 participants were recruited per focus group. More specifically, the research team contacted prospective participants *via* phone or e-mail, utilizing the university's secure e-mail server, and enrolled participants accordingly.

Focus group questions

The moderator posed focus group questions to the participants – verbally, in print, and by digitally projecting the written questions from PowerPoint slides (Table 1). The multiple methods of presentation ensured accessibility for all participants. As an example of how the questions were addressed, the moderator asked the group to identify specific challenges in their experiences related to kitchen activities or bedroom-to-bathroom transitions. With this, the moderator prompted participants to use storytelling to describe their encounters with such challenges. Participants who did not provide an initial response were prompted for input. As

Figure 1. Bedroom-to-bathroom featuring sliding door. Adapted from Johnson, T. (n.d.). Maple Grove Wheelchair Accessible Bathroom [Digital image]. Retrieved September 18, 2019 from https://www.houzz.com/photos/maple-grove-wheelchair-accessible-bathroom-modern-minneapolis-phvw-vp~23606789.

Figure 2. Converted first-floor studio. Adapted from FaceBook [Digital image]. (2010, August). Retrieved September 18, 2018 from https://www.facebook.com/106185369416028/photos/a.139721266062438/139723122728919/?type=3&theater.

such, strategies were employed to encourage active participation among all participants.

Focus group images

The multi-disciplinary research team vetted and refined the images of innovative home modifications (Figures 1–3) prior to the presentation. All images depicted features or spaces in the home repurposed to address the accessibility needs of individuals with functional mobility and visual limitations. The researchers projected the images onto a screen at a large scale and, on a smaller scale, provided a hard color copy in print for each participant. For each image, the participants were asked how attractive and accessible the solutions appeared. The first image shown to the participants depicted a potential innovative home modification solution for the bedroom-to-bathroom transition featuring a sliding door (Figure 1). Participants also examined an image of a

Figure 3. Kitchen with a transparent door on the refrigerator. Adapted from IDesignArch. (n.d.). Ergonomic Italian Kitchen Design Suitable for Wheelchair Users [Digital image]. Retrieved September 18, 2018 from https://www.idesignarch.com/ergonomic-italian-kitchen-design-suitable-for-wheelchair-users/.

living room area of a two-story townhome converted to a first-floor studio (Figure 2). Additionally, participants examined an image displaying modifications specific to the kitchen including a transparent door on the fridge (Figure 3).

Data collection

One researcher audio recorded and transcribed, verbatim, in real-time, the focus group discussions. The audio recordings enabled researchers to capture the data in context then further refine the transcripts after the sessions. Another researcher took fieldnotes to ensure a relevant context for the transcriptions. An additional researcher performed a timekeeping role to ensure adequate time was allocated for each topic during the focus group discussions. This design optimized accuracy of data collection.

After completing the main focus group discussion, participants answered two questions for each of the images presented. Responses to images were captured on a five-point Likert scale. Specifically, the participants indicated their level of agreement with how attractive or accessible they found each image to be. A rating of one indicated that the participant "strongly disagreed" and a rating of five indicated that the participant "strongly agreed" with the statements. Although the researchers asked verbally about attractiveness and accessibility of each image, they also included these questions in the form of a large-print paper survey, to allow all participants the opportunity to further express their opinions in quantitative terms.

Data management and analysis

Data management included a comparison of the audio recordings to the verbatim transcript. The research assistant completed the necessary edits to the verbatim notes. To ensure rigor, all transcripts were verified and cross-checked with the research team members who attended the sessions. The transcripts were also verified by an additional research team member who was not present during the focus groups for researcher triangulation – an approach commonly used to enhance the validity of the data collection process [24].

For the qualitative analysis, the researchers utilized NVivo 12 software (QSR International Pty Ltd. Version 12, 2018). Specifically, the researchers utilized keywords counts and an open coding method to initially obtain emerging themes [25]. Then, keyword-in-context analysis was used to understand underlying meanings. The PEO model served as a framework to address the many components of functional limitations that would impact the need for home modification solutions. To increase the rigor of the findings, the researchers presented the initial themes to the entire research team and to the college's qualitative research colloquium for peer debriefing [26]. This approach allowed the researchers to receive feedback and refine their themes to help reduce bias.

For the quantitative analysis, the researchers managed Likert-scale responses (e.g., indicating level of agreement from "no" to "strongly") with SPSS Statistics 25 (IBM Corp. Version 25, 2017). Descriptive statistics were used to obtain the frequency of participants' selection for each category of the Likert-scale and to summarize the demographic information.

Results

Participants

A total of 16 individuals participated in the two focus groups. Each of the two groups had eight participants: one with consumers and the other with professionals. The focus group consisting of consumers with functional mobility and visual limitations included participants representing a variety of challenges. For example, 62.5% indicated they used a form of mobility-assistance equipment at home and half indicated they used adaptive equipment to assist with vision at home (Table 2). A range of professional fields, experience, and education was represented in the professionals focus group (Table 3).

Table 2. Demographic characteristics of consumer group participants ($N = 8$).

Demographic characteristics	*n*
Age	
18–24	1
25–44	1
45–64	4
>65	2
Mobility equipment*	
None	3
Cane	3
Wheelchair	1
Other: furniture**, a bag or purse [to move objects], a wall, rolling cart stool, bath chair	2
Vision equipment*	
None	4
Magnifiers	4
Other: glasses**, husband [to interpret visual cues], hand rails in shower, color coordinated items to show contrast	3

Note. [ ] indicate an explanation of a participant's words. *Participants could check more than one option, other: blank box used to self-report more than one option. **Self-reported twice by two separate participants.

Table 3. Demographic characteristics of professional group participants ($N = 8$).

Demographic characteristics	*n*	%
Profession		
Occupational therapist	3	37.5
Physical therapist	1	12.5
Housing consultant	1	12.5
Architect	1	12.5
Nonprofit home renovator	1	12.5
Chief financial officer for developer/builder	1	12.5
Years in profession		
≥5	2	25.0
6–20	3	37.5
> 20	3	37.5
Education		
Undergraduate	3	37.5
Some graduate	1	12.5
Master's	2	25.0
Doctoral	2	25.0

Note. Some of these fields do not require a graduate degree.

Theme one: accessibility

Accessibility concerns dominated the conversation among participants in both groups as issues with accessibility affect independent living and quality of life in the home. Each group also offered solutions to guide others attempting to rectify the current limitations of their homes or the homes of their clients.

A participant in the consumer group noted that a proposed solution was "… great, but for me I can't do it because I can't take the steps." This statement indicates that solutions that may be deemed appropriate by some for accessibility may be limiting to others align with how individuals may have different functional limitations impacting the person component of the PEO model.

High contrast

One of the most discussed aspects of accessibility for individuals with visual impairments was the need for high contrast. Consumers discussed high contrast 18 separate times while the professionals discussed high contrast twice. In this context, high contrast refers to the need for different surfaces to be indicated by a distinct contrast in color in order to differentiate one surface from another. In particular, high contrast was valued as an indicator of surface level change (i.e., change in floor level height) as well as to serve as a marker to assist in organizing household items for easier access. One example of this organization is the use of tape to create different-colored edges. In this way the tape indicated item types located on each shelf that can more easily be distinguished than when it is not marked. The use of the tape as a visual cue is an example of a repurposed solution as the participant changed the intention of the tape from something that holds items together to a visual reminder.

High-contrast markings also served as a warning for potential hazards. For example, in the words of one participant:

> Most of the time my family does this, but sometimes [my family] will leave a cabinet open and I don't realize it until I run into it.

In other words, since the participant's family sometimes left cabinet doors open, distinguishing the cabinet door edges with a strip of contrasting color tape was a useful warning to avoid the opened door-edge upon approach. Participants also suggested duct tape or nail polish, when applied to corners edges and thresholds, as a way to enhance visibility.

Participants offered other strategies that did not incorporate repurposing such as how high contrast can be enhanced through other means besides varying color hues or light versus dark. In one instance, shape (e.g., different shaped containers for kitchen items) helped the user distinguish, by sight or by touch, one container from another. Participants offered other strategies to support high contrast including the use of open shelving, lighting, and modifying accessories used in these spaces (e.g., the use of a colored-cutting board to distinguish from a pattered countertop) to compensate for the shortcomings of fixed features in their homes. Participants agreed that high contrast can also be enhanced through patterns or the lack thereof. For example, participants preferred plain, solid-colored countertops to maximize item visibility. By comparison, busy-patterned countertops tended to camouflage the items the individual was working with on the counter surface.

Height

The height of fixed items in the home was addressed as a concern throughout focus group conversations. Participants described the height of the kitchen and bathroom counters, kitchen table, and kitchen cabinets as being a challenge for accessibility. Regardless of whether the participant reported these as being too high or too low, the height of these fixed items concerned participants because these may be a potential barrier for consumer independence in activities of daily living. Another challenge for participants was the height of surfaces for transfers. For example, a wheelchair and the shower seat at the same height were discussed as an ideal option. With that, one consumer explained that "[his] kitchen table is fine, but other kitchen tables' height – can't get in without help from [caregiver]." Therefore, height of fixed items impacts participation in their home environment.

Doors

A common theme related to accessibility was a narrow or heavy door. Removal of the shower, bathroom entry, or cabinet doors in the kitchen (for visibility) was frequently stated as helpful, examples of adaptation. Before the researchers showed an image of a sliding door on a wall-mounted overhead track (Figure 1), one consumer group participant suggested sliding doors, commonly referred to as "barn doors," as a useful solution for room entries.

While consumers also offered suggestions to enable easier door operation, professionals more commonly suggested an adaptation, the complete removal of a door to enhance accessibility. The following explanation is offered by an occupational therapist:

> … just removing the door all together into the bathroom and many of the bathtub shower combinations with the sliding doors, just getting rid of that or the walk-in shower. Same thing, just removing the frame and getting rid of the door …

When the moderator asked the participant about privacy concerns for consumers, an occupational therapist responded, "So usually it's a question of, 'do you want to use this bathroom or not?'" The participant suggested a repurposed solution in which individuals could use a "shower curtain" and "cheap shower rod" to alleviate the privacy concern. The shower curtain would be repurposed from a barrier for water while taking a shower, to a solution as an easier access doorway. As such, doors often pose barriers to accessibility.

Flooring

Consumers and professionals contributed a fairly equal amount of discussion to the accessibility of floors. Consumers raised this issue 10 times and professionals 12 times. Some participants identified that tile or wood floors allowed them to move more freely. This was especially true for those who used wheelchairs and those repurposing a wheeled office chair (or stool) for mobility throughout the home rather than at a desk. Individuals with functional limitations explained that certain types of flooring, such as wood floors, can pose a hazard to transferring. For example, a participant discussed the use of a long rubber mat to keep his wheelchair from slipping during transfers as follows:

> … but as far as slipping, I use those long rubber mats when I'm transferring with my chair 'cause we have wood floors all throughout, so out from under me, it kind of just holds it in place.

Rather than wood, a housing consultant from the professional group preferred carpet to potentially offset the impact of a fall and she noted, "I opted for carpet, and I understand the difficulty of doing a wheelchair on a carpet. However, I was more concerned about falling on a hard surface and breaking a bone."

Thresholds were also a part of the discussion pertaining to flooring. Participants preferred flooring without thresholds or flooring with no lip. When thresholds/lips were present, color contrast was identified as a means to see thresholds. For example, highlighting a threshold using duct tape or using lighting to illuminate a surface change were favored solutions.

In considering the needs of individuals with visual impairments, participants discussed the desire for floor surfaces to contrast in color with other surfaces such as the bed, counter, and toilet. A consumer explained that she utilizes "different color rugs so [she] can tell a difference where the shower is in comparison to the toilet." Clearly flooring, including carpets and thresholds, can promote or hinder accessibility.

Theme two: affordability

Participants noted how the affordability of home modifications served as a potential barrier for many individuals. Due to the expense of home modifications, both consumers and professionals expressed these concerns. An occupational therapist discussed offering less expensive options, even if the aesthetics are less appealing, in addition to standard solutions to help consumers offset cost. More specifically, alternatives to more costly grab bars that require supportive backing underneath the wall finish were discussed. Those included less expensive adaptive options such as installing grab bars into studs of the wall; adding a 2×4 on top of the wall's surface to support the grab bar; or using medical-grade, suction cup bars, rather than those needing to be permanently affixed. The following quote from an occupational therapist illustrates this point:

> It's cheaper than the installing of actual grab bars that require kind of that backing, but it's just an option I provide them in case they can't afford that route.

Another solution, offered by a housing consultant, for dealing with the costs of home modifications, is to begin taking incremental steps towards making modifications in the home:

> They don't have the, ya know, the 60 to 200 thousand dollars to be in a nursing home or assisted living so what is it going to take to be able to stay in the home? Then they need to start making those modifications to the home now. Do one each year. Put the grab bars in this year, get a raised toilet in next year, just if they're going to stay at home then go ahead and bite the bullet and do it piece by piece.

Professionals suggested first identifying and prioritizing modifications, then planning to implement these in manageable chunks, as a way to manage the high cost of home modifications. Therefore, the expense of home modifications often resulted in participants identifying lower cost options or delaying implementation of home modifications.

Do-it-yourself

The participants offered many solutions to address the financial constraints of individuals seeking home modifications. Most of the solutions involved a "do-it-yourself" (DIY) approach. For example, as mentioned during the results focused on doors, one consumer participant demonstrated how she could close doors with traditional doorknob hardware by attaching a ribbon to the doorknob to pull the door closed behind her. The ribbon offered an accessible way for her to close the door without having to turn her body around or twist the doorknob.

Consumers reported utilizing armchairs or stools with wheels to serve as a tool for navigating the home. Professionals indicated that while they have observed others utilizing armchairs or stools with wheels, they do not recommend this due to safety concerns. Specifically, an occupational therapist shared a solution that, while not being entirely safe, allowed their clients to navigate through their house easier:

> I know we have taken the rims off the wheelchairs … where the patients are just now literally propelling on the tire, on the wheelchair tire itself but removing the rims that leads to allow you to just scrape through the doorway, there's you know, sanitary things we have to think about with hands on the wheels but …

By this, the participant indicated that implementing less-than-ideal solutions were necessary at times for people needing home modification who lack the financial resources for optimal design solutions.

In all, consumers and professionals reported utilizing adaptations, such as repurposed household items, to meet their needs or the needs of the client. Such adaptations may result in consumers choosing affordable options over safety. By optimizing affordable options clients are enabled to maintain their use of the space and their independence.

Theme three: attractiveness

Participants underscored the attractiveness related to home modifications. For example, both groups discussed using towel bars that also functioned as grab bars, so it was not apparent that accessible features were in use. A consumer participant indicated attractiveness drawbacks to some solutions:

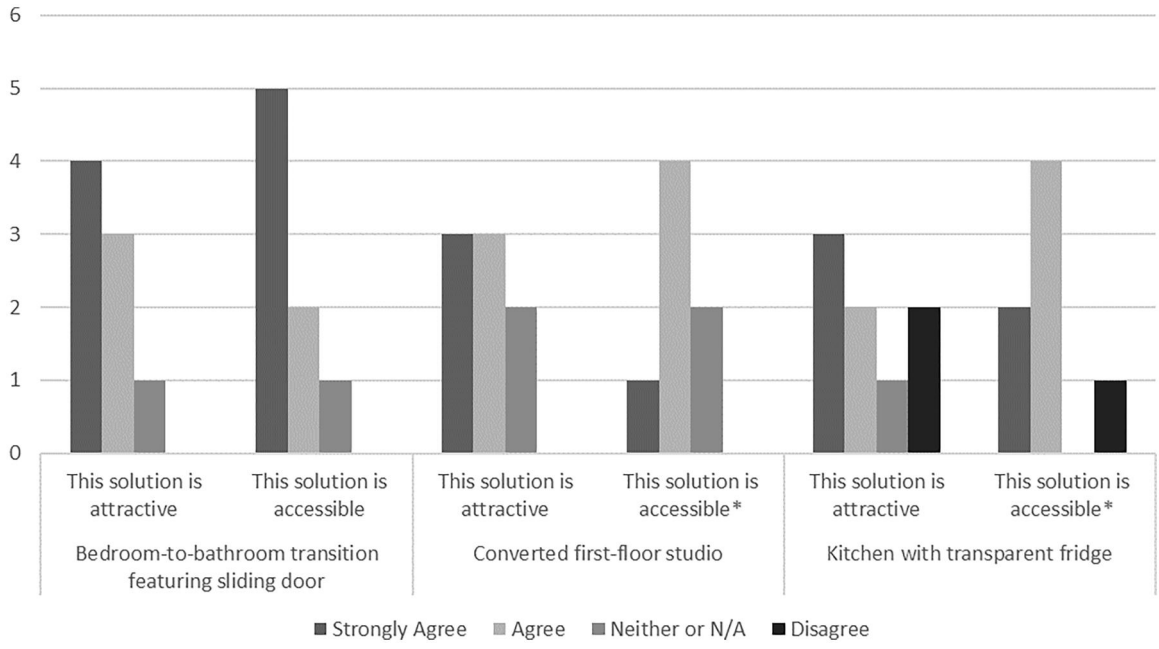

Figure 4. Consumers' responses ($N = 8$) on attractiveness and accessibility of solutions pertaining to identical images shown during the focus groups. Note. *N = 7 as participants could choose not to answer. "Strongly Disagree" was an option for participants to select but was not a response given by any participant.

> One thing that I don't like is I don't like glass doors in general because I can't see them well unless I do the tape, but it's kind of like, I kind of want my home to look nice without having duct tape everywhere, you know?

While tape served as a functional high-contrast marker to increase a glass door's visibility, the participant was concerned tape would detract from the home's aesthetic appeal and could stigmatize the resident to visitors. When discussing repurposing towel bars as grab bars, another consumer echoed the desire for less overt home modifications which were less stigmatizing by stating "…I have found that a lot of people don't want a handicap."

On the other hand, an architect's statements displayed less concern with attractiveness:

> One of the things that she did in the kitchen that I think makes perfect sense but, you know, it has not been accepted by the taste, taste-makers [individuals that deem what is attractive] is that she got rid of all of the doors on the lower cabinets… maybe again we should consider some of this.

Professionals indicated that attractiveness is subjective and based on an individual's personal characteristics and preferences, as one occupational therapist stated: "Yeah, I was thinking that whether or not you think it's attractive may also be based on your age." Thus, the attractiveness of home modifications was highly client-centered, and for some individuals, such modifications were tied to stigma.

Likert-scale responses

Participants rated *via* 5-point Likert-scale responses three images, shown in the focus groups, which depicted numerous accessibility solutions. Figures 4 and 5 illustrate both consumer and professionals' responses to each topic and image. Most participants agreed or strongly agreed with the statements "this solution is attractive" and "this solution is accessible." None of the participants responded with "strongly disagree" regarding the attractiveness and accessibility of each of the three images. As such, the responses from both groups were positive about the repurposed solutions presented in the images. Given the small sample size, inferential and comparative statistics were not undertaken.

Discussion

This study aimed to examine the challenges and solutions encountered by consumers and professionals. Additionally, this study sought to identify solutions that involve repurposed fixtures or spaces. Specifically, the participants demonstrated how repurposing could be utilized for individuals with functional mobility and visual limitations that resulted in accessible, affordable, and attractive solutions. The researchers examined challenges and solutions within a group of consumers with functional limitations and who could articulate their experiences with home modifications. Likewise, opinions were also solicited from an interdisciplinary group of professionals who provided their perspectives.

Focus group data indicated improving contrast (e.g., using duct tape or lighting to define surface changes) and decreasing visual distractions are important to persons with low vision for independence and safety in their home environment. The importance of contrast and visual distractions is consistent with the findings from a study ($N = 22$) of interviews with persons with visual impairments [18]. The discussion of high contrast was more robust in the consumer group than among the professionals. Four of the consumer participants reported the use of magnifiers; therefore personal experiences of the consumer group participants likely accounted for the frequency of high contrast problems and solutions.

Along with high contrast needs, participants from both groups expressed that doors, flooring, and height of fixtures all pose threats to accessibility in the home. Home modifications that addressed these threats ranged from replacing the door with a shower curtain to remodeling a little at a time to manage cost. As a result, client-centered or individualized solutions are

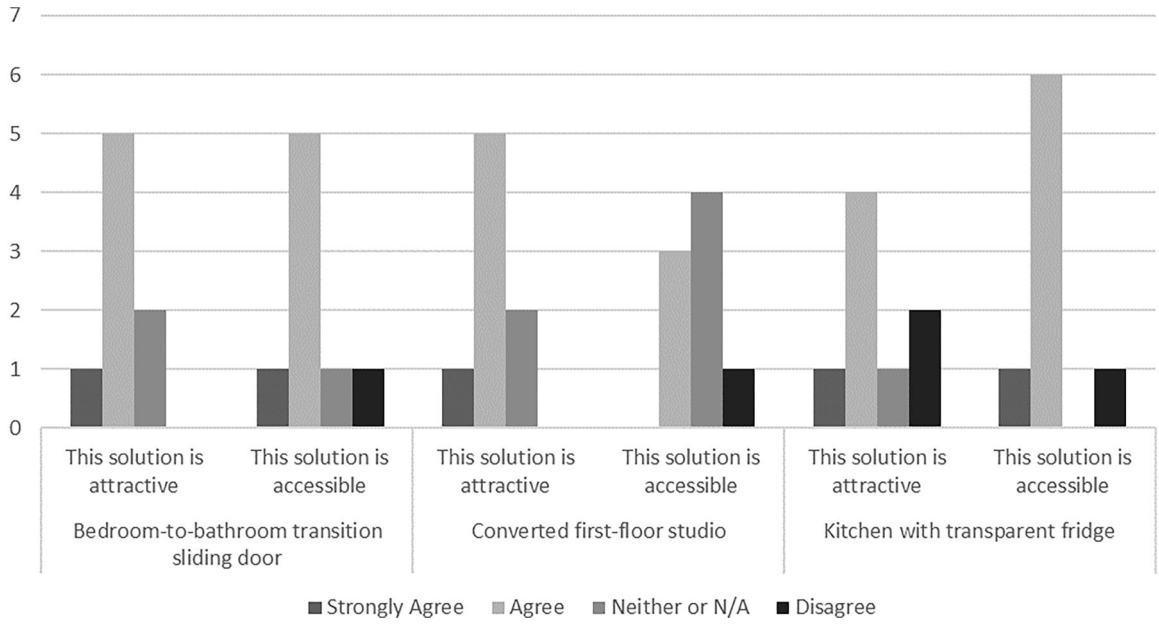

Figure 5. Professionals' responses ($N = 8$) on attractiveness and accessibility of solutions pertaining to identical images shown during the focus groups. Note. "Strongly Disagree" was an option for participants to select but was not a response given by any participant.

recommended to meet the needs and wants of consumers – also aligning with previous research [20,22,27]. Professionals from multiple disciplines, such as therapists and builders, may consider understanding their clients' goals in order to recommend or implement client-centered and tailored solutions.

However, in reviewing the images of repurposed spaces participants expressed agreement in preferences. Likert scale results were all positive related to attractiveness and accessibility of the images. Participants of both groups preferred solutions that were cost-effective and easily implemented by the consumer or someone who could assist with implementing the solution. Repurposed solutions may help achieve quick, cost-effective home modification solutions. Perhaps invented out of necessity, the consumer group offered many examples of low-cost DIY solutions created to improve their functioning within their homes. Such practices are consistent with the findings of Bridge and colleagues [27] who suggested a large number of DIY home modifications are implemented without governmental assistance. The Likert-scale results further identified participants' receptiveness to repurposed solutions, and thus this study supports that many DIY solutions may be aligned with the concept of repurposing. The qualitative analyses also revealed DIY solutions that were functional/accessible but not very attractive for example statements about tape.

Professionals claimed to prioritize safety and function over attractiveness. Professionals indicated that DIY solutions could be problematic as well as useful and reported needing to balance affordability and safety with maintaining an individual's autonomy. Results from professionals were consistent with a previous study of home modifications that identified the value of function and safety over appearance [22]. Somewhat differently, consumers often chose cost-effective, functional solutions over safer and more attractive solutions. Thus, both groups in this study prioritized different aspects of home modifications with the attractiveness of solutions having the least importance.

While the research team specifically asked for solutions incorporating the concept of repurposing, the participants mostly contributed responses that aligned more with adaptation. There were few successfully repurposed examples that people use or have seen, compared to adaptations. Another interpretation could be that adaptations are more accessible and attractive compared to repurposed ones. As a result, it is clear that the idea of repurposing is still not clearly defined and/or understood by consumers and professionals.

Strengths and limitations

This is one of the first studies to consider "repurposed" home modifications: people's examples of such; and their reactions to such. Self-reported data were utilized in both focus groups. Only two focus groups were conducted – and as such, the investigation cannot claim saturation. The same researcher moderated the discussion for both focus groups. With a PhD focused on supporting health and well-being in the built environment specifically for older adults and individuals with physical challenges, the moderator has over a decade's experience leading focus groups for academic research. The study benefitted from having both consumer and professional perspectives, although the findings lack generalizability to other groups of consumers or professionals not represented by the study demographics. Additionally, individuals with functional mobility and/or visual limitations were grouped together which may limit the understanding of needs of those with different limitations. Future studies may expand upon our findings by identifying other repurposed solutions not addressed in this study. Future research may also address the balance between the benefit of repurposed solutions, e.g., low cost of everyday items used and the limitations, such as safety.

Conclusion

This study contributes to understanding perspectives on repurposing fixtures and spaces for accessibility, affordability, and attractiveness. Consistent with other research results indicated a preference for client-centered or individualized solutions to address home modifications. However, some findings were quite notable: (1) high contrast for many people with visual impairments, and many used the same repurposed strategies of colorful tape; (2) qualitative results indicated that there may be more

value placed on attractiveness among consumers than among professionals, when there are trade-offs to be made; (3) while participants were cognizant and receptive to the idea of repurposing as a home modification technique, their discussion was dominated more by adaptations. Some repurposed solutions may be appropriate to meet the needs of clients regarding accessibility, affordability, or attractiveness. Findings suggest that repurposed solutions were already being utilized prior to the focus groups, by both consumers and professionals. Overall, the findings contribute to the evidence of people-environment relations and in-home modifications, as perceived by consumers with functional mobility and visual limitations and professional participants representing a multi-disciplinary group.

Disclosure statement

The authors have no conflict of interest to declare.

Funding

This work was supported by the U.S. Department of Housing and Urban Development (H 21672 CA).

ORCID

Linda R. Struckmeyer http://orcid.org/0000-0002-9558-9828

References

[1] Kraus L, Lauer E, Coleman R, et al. 2017 Disability Statistics Annual Report. A Publication of the Rehabilitation Research and Training Center on Disability Statistics and Demographics [Internet]. Institute on Disability, University of New Hampshire. Institute on Disability, University of New Hampshire; 2018 [cited 2020 Jun 24]. Available from: https://eric.ed.gov/?id=ED583258

[2] World Health Organization. Vision impairment and blindness [Internet]. [cited 2020 Jun 24]. Available from: https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment

[3] John Clarkson P, Coleman R. History of inclusive design in the UK. Appl Ergon. 2015;46:235–247.

[4] Edwards C, Harold G. DeafSpace and the principles of universal design. Disabil Rehabil. 2014;36:1350–1359.

[5] Imrie R, Luck R. Designing inclusive environments: rehabilitating the body and the relevance of universal design. Disabil Rehabil. 2014;36:1315–1319.

[6] Preiser WFE, Smith KH. Universal design handbook. 2nd ed. New York (NY): McGraw-Hill; 2011.

[7] Bo'sher L, Chan S, Ellen IG, et al. Accessibility of America's housing stock: analysis of the 2011 American housing survey (AHS). SSRN Journal [Internet]. 2015 [cited 2020 Jun 24]. Available from: https://www.ssrn.com/abstract=3055191

[8] Fletcher V, Bonome-Sims G, Knecht B, et al. The challenge of inclusive design in the US context. Appl Ergon. 2015;46 Pt B:267–273.

[9] Helle T, Iwarsson S, Brandt Å. Validation of housing standards addressing accessibility: exploration of an activity-based approach. J Appl Gerontol. 2014;33:848–869.

[10] Hammel J, Magasi S, Heinemann A, et al. Environmental barriers and supports to everyday participation: a qualitative insider perspective from people with disabilities. Arch Phys Med Rehabil. 2015;96:578–588.

[11] Yung EHK, Chan EHW. Implementation challenges to the adaptive reuse of heritage buildings: Towards the goals of sustainable, low carbon cities. Habitat Int. 2012;36:352–361.

[12] Bullen PA. Adaptive reuse and sustainability of commercial buildings. Facilities. 2007;25:20–31.

[13] Sakellariou D. Home modifications and ways of living well. Med Anthropol. 2015;34:456–469.

[14] Law M, Cooper B, Strong S, et al. The person-environment-occupation Model: a transactive approach to occupational performance. Can J Occup Ther. 1996;63:9–23.

[15] Russell R, Ormerod M, Newton R. The development of a design and construction process protocol to support the home Modification process delivered by occupational therapists. J of Aging Res. 2018;2018:1–13.

[16] Siebert C, Smallfield S, Stark S. Occupational therapy practice guidelines for home Modifications. Bethesda (MD): AOTA Press; 2014.

[17] Allen S, Resnik L, Roy J. Promoting independence for wheelchair users: the role of home accommodations. Gerontology. 2006;46:115–123.

[18] Barstow BA, Bennett DK, Vogtle LK. Perspectives on home safety: do home safety assessments address the concerns of clients with vision loss? Am J Occup Ther. 2011;65:635–642.

[19] Keall MD, Pierse N, Howden-Chapman P, et al. Home modifications to reduce injuries from falls in the home injury prevention intervention (HIPI) study: a cluster-randomised controlled trial. Lancet. 2015;385:231–238.

[20] Stark S, Landsbaum A, Palmer J, et al. Client-centered home modifications improve daily activity performance of older adults. Can J Occup Ther. 2009;76:235–245.

[21] Care NRC (US) C on the R of HF in HH. The physical environment and home health care [Internet]. The Role of Human Factors in Home Health Care: Workshop Summary. National Academies Press (US); 2010 [cited 2020 Jun 24]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK210046/

[22] Stark SL, Somerville E, Keglovits M, et al. Clinical reasoning guideline for home modification interventions. Am J Occup Ther. 2015;69:6902290030.

[23] Granbom M, Taei A, Ekstam L. Cohabitants' perspective on housing adaptations: a piece of the puzzle. Scand J Caring Sci. 2017;31:805–813.

[24] Patton MQ. Qualitative research & evaluation methods: integrating theory and practice. Thousand Oaks (CA): Sage publications; 2014.

[25] Saldaña J. The coding manual for qualitative researchers. Los Angeles (CA): Sage; 2015.

[26] Creswell JW, Creswell JD. Research design: qualitative, quantitative, and mixed methods approaches. Thousand Oaks (CA): Sage publications; 2017.

[27] Bridge C, Carnemolla P, Maalsen S, et al. DIY home modifications: what information is required at point-of-sale? Final Report. 2016;6:25.