



Housing for Wounded Warriors

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ABSTRACT

The treatment of veterans with disabilities has a long history. Contemporary American practices reflect a mix of traditional policies, demands of an all-volunteer army and new paradigms in community integration. The U.S. military encourages soldiers with disabilities to remain in active duty by providing job accommodations, including accessible housing. The Wounded Warrior Home Project built two demonstration homes in Fort Belvoir, Virginia to learn how universal design strategies could improve housing for these service members. Guided tours and semi-structured interviews were used to assess the effectiveness of the designs and identify shortcomings. Based on the interviews, recommendations were made to improve the design of future homes for active duty soldiers with disabilities and their families. Reflections on the origin, implementation and impact of the project offer new insights into housing for soldiers and veterans with disabilities and universal design as currently conceived.

Keywords: universal design, veterans, accessible housing, architecture, soldiers

INTRODUCTION

Soldiers have played an important role in disability history. From the time of Ancient Greece, Western societies have given special treatment to wounded soldiers, including the provision of health care, housing and prosthetic devices (Gerber, 1994). These policies reflect the view that a soldier who obtains a disability in action is owed something for their sacrifice. These provisions also foster loyalty and commitment by reducing the impact of injuries sustained in service.

Despite these supportive policies, social attitudes toward veterans with disabilities have often been ambivalent. On the one hand, the loss of function and the experience and appearance of damaged bodies presents a psychological challenge to the individual. On the other hand, the ill-adjusted veteran is often perceived as a potential threat to society (Gerber, 1994). These perceptions can create barriers to developing and sustaining interpersonal relationships, affect job performance and indirectly impact life satisfaction. They also can include threats to society such as the Bonus Army civil demonstrations of 1933 that upset the relationship between veterans and government and domestic terrorism like the actions of Timothy McVie, a Gulf War veteran who suffered from delusions, who blew up the Federal Building in Oklahoma City in 1995, and beligerant actions of so called "militias" that have veterans in their membership.

Rehabilitation, a practice that began as a means to return workers with an injury back to productive work, was introduced as part of veterans' policy during and after World War I. Williamson (2019) argues that rehabilitation of soldiers was focused on making them whole and restoring their agency. "Prosthesis," which she views as a designed intervention, plays an important role in the rehabilitation process. In common usage, we tend to think of prostheses as artificial limbs. However, other forms of prosthesis include the provision of assistive devices to aid in dressing, bathing and food preparation, adaptive equipment for cars and the provision of grants to build accessible homes; all these interventions help individuals be independent and complete social roles of spouse, parent and productive worker (Williamson, 2019).

Contemporary Issues in Veterans Housing

Since 2001, United States combat involvement in Iraq and Afghanistan has impacted the lives of approximately two million U.S. service members and their families (Hosek, 2011). Although many soldiers return from combat with long-term physical disabilities, even more have endured psychological trauma during their service. Of those individuals deployed since 2001, 52,317 soldiers returned home wounded (Hosek, 2011). But, this estimate does not account for psychological wounds. Whereas physical wounds are easily identifiable, psychological wounds caused by traumatic brain injuries (TBIs) and post-traumatic stress disorder (PTSD) are imperceptible until they cause observable behaviour changes. The impact of these conditions emerges through changes in brain function, hormonal systems, and immune systems (National Council on Disability, 2009). A 2015 Congressional Research Service report estimated that since 2000, there have been nearly 140,000 cases of PTSD and over 320,000 instances of TBI among service members (Fischer, 2015).

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The experience of disability is not unique to soldiers wounded in combat. There are other causes of disability among those in active duty, including job related injuries outside of combat like motor vehicle accidents or training accidents, and also non job related disabilities like sports injuries, chronic disease, etc. While the term “wounded warrior” implies that an individual has been injured in combat, it has also been used more broadly in reference to soldiers and veterans with disabilities in general. In this paper, we will use “wounded warrior” only when referring to programs using that term, and, in particular the program that is the subject of this paper. It is important to note here, however, that the estimates above reflect only disabilities resulting from combat injuries, and, thus, underrepresent the actual numbers of soldiers with disabilities in active duty and discharged. Regardless of the cause, service members with disabilities face unique challenges during active duty and after they are discharged from the service. The Veterans Administration and voluntary organizations respond to their needs by offering financial, social and health-oriented programs and other forms of support. Some of these efforts specifically address housing for “wounded warriors” but others provide housing for the broader population of soldiers, and, particularly veterans with disabilities. With the advent of an all-volunteer army, which requires constant recruitment, and the high cost of training, the military wants to retain all qualified personnel. Thus, the services now allow soldiers with disabling conditions to remain in active duty service, if they are still able to contribute. Although military housing is covered by disability rights laws and must have accessible units, this shift in policy initiated an effort to improve the quality of accessible housing on military bases to help retain qualified personnel and support their productivity as service members.

To assess previous research on this topic, two databases, the University at Buffalo Libraries database and Google Scholar database were searched for the following terms: military housing, accessible military housing, on-base accessible housing, “wounded warrior” housing, and soldier accessible housing. Although there are documents that establish the rights that soldiers and veterans with disabilities have as a result of the Fair Housing Act, there is limited information on the ways that home design might be based on the unique needs of soldiers with disabilities. There is also no peer reviewed research on the impact of “wounded warrior” housing initiatives, either for discharged veterans or active duty soldiers with disabilities. This article provides a case study of an initiative to build a demonstration of housing for the latter group but it also provides insights on housing for the former as well. It is hoped that it will spur further research into this topic.

History of Military Housing in the U.S.

Until 1941 the Quartermaster Corps was responsible for providing supplies to active duty troops and construction and maintenance of housing for military service members and their families in the U.S. However, the Corps did not have the capacity to effectively construct and maintain homes in the U.S. To address concerns about the quality of homes provided to

U.S. service members, maintenance efforts were shifted to the Army Corps of Engineers in 1941 (Arnold and Wiener, 1989). But, the Army Corps of Engineers viewed their inherited housing stock as a burden on their resources and believed it was the Quartermaster Corps’ responsibility to maintain the houses they constructed (Fine, 1972).

Military personnel get a housing allowance that can be used to pay for housing on military bases or in the private sector. Programs intended to manage the distribution of housing allowances, however, have been criticized because they do not always provide sufficient allowances to pay for the cost of reasonable off-base housing (Scott and Hauge, 2009).

The Military Housing Privatization Initiative of 1996 allowed private companies to build, repair, and maintain military housing. The goals of this initiative included reducing the time lag to address maintenance issues, helping to keep up with an increasing demand for on-base housing, addressing long waiting lists for base housing and improving the quality of life for service members and their families who live in military housing (Facilities Investment & Management – Military Housing Privatization Initiative, 2016). However, tenants are not yet satisfied with homes provided in return for their housing allowance. Thus, in 2020 the U.S. Department of Defense issued the Military Housing Privatization Tenant Bill of Rights (U.S. Department of Defense, 2020). This document put more pressure on the services to improve housing for service members.

This history highlights the strategic importance of building a housing stock that responds to the current and future needs of military service members, including housing that accommodates people with disabilities. Currently, 43% of on-base housing, or 58,000 units, are classified as old and in need of repair (Facilities Investment & Management - Military Housing Privatization Initiative, 2016). Poor quality housing creates stress and dissatisfaction that could impair the readiness and completion of a soldier's mission. And, in an all-volunteer army, quality of life issues play an important role in the decision to enlist or re-enlist (Lancaster et al., 2013).

From Accessibility to Universal Design

There are two general strategies used in the construction of accessible housing. The first is to build custom homes or modifications on demand for people with disabilities. This strategy was adopted by the Veterans Administration to provide accessible housing for veterans with disabilities after World War II. The second strategy is to build a degree of accessibility into houses from the start. This strategy was initially implemented in federal law through the Barrier Free Design Act of 1968. It mandated that buildings constructed with federal funds had to be accessible. The Rehabilitation Act and Title II of the Americans with Disabilities Act extended this mandate to privately owned buildings in which government financed activities take place, e.g. contracted services. Thus military housing, including projects built and operated by private developers must include a level of accessibility. But, the regulations for these laws require that only 5% of units meet

specific minimum standards of accessibility. The Fair Housing Act of 1988 applies to projects built with both public and private funding. It requires *all units* in multifamily buildings equipped with elevators and *all ground floor units* in walk up apartment buildings to meet less stringent accessibility standards.

These policies do not ensure that households with members who have disabilities will be able to find an accessible unit when and where they need one, especially single-family homes which are not covered by the Fair Housing Act. Further, the minimum standards accommodate only the needs of some people with disabilities. For example, there are no standards that explicitly address cognitive conditions, severe burns, respiratory conditions or mental health issues. Limited attention is given in these standards to sensory conditions like blindness and deafness. And, although the standards primarily address wheelchair access, they do not accommodate a significant proportion of those people who use wheeled mobility devices because they were based on the wheeled mobility technology available in the 1970's and have not been updated sufficiently (Steinfeld et al., 2010).

In response to the shortcomings of regulations, the concept of universal design emerged in the 1980's. The most widely cited definition of universal design is: "The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design" (Mace, 1985). But this definition has some major limitations. First, it does not address health and wellness issues like prevention of disability, health promotion and mental health. Second, it does not address social participation, including avoidance of stigma, social integration and cultural values. Third, it does not recognize the agency of the people who use products and environments. And fourth, it does not explicitly address the fact that people with disabilities may also be members of other populations with unique needs, e.g. low income, LGBTQ+, racial minorities, etc. Thus, we define universal design as "a process that enables and empowers a diverse population by improving human performance, health and wellness, and social participation" (Steinfeld & Maisel, 2012, p. 29).

Practicing universal design means adopting a more inclusive approach that extends consideration beyond the average user to address the needs of different populations (Steinfeld & Maisel, 2012). Although most approaches to accessible housing focus on design for wheelchair users, universal design takes a broader approach. Applying universal design to housing for military bases implies that designers not only respond to the wide variety of needs among wounded soldiers but also other members of the household such as spouses, pregnant women, children, other household members and visitors (Levine, 2003, p. 9).

A universal design approach also considers the psychological and social impact of housing for the individual and the household. For example, service members and their families are generally relocated every two to three years, which means there is a constant rotation of occupants in the homes, each with their

own family dynamic. Further, the demographics of the military services in the U.S. reflect the great diversity of the U.S. population. Thus, universal design makes very good business sense for this population because it can help to ensure that homes will address the needs of the hundreds of residents that a home might have over the course of its life cycle.

The Wounded Warrior Home Project

The Wounded Warrior Home Project at Fort Belvoir, Fairfax County, Virginia was envisioned when Clark Realty Capital (CRC), a private partner of the Department of Defense, neared the end of an initial period of re-development of housing on the base. Fort Belvoir lacked the required number of accessible homes (5%) as mandated by the Uniform Federal Accessibility Standards (UFAS), CRC questioned whether code compliant military housing adequately addresses the needs of soldiers with disabilities and their families. A group of active duty soldiers with disabilities were consulted in the conception stage. They agreed that meeting minimum standards would not be adequate. The company then reached out to experts to learn how to build a state-of-art model of accessible housing. From what they learned, CRC then sought to introduce this new model at Fort Belvoir based on the concept of universal design. Two houses were planned as model homes. CRC recruited a collaborative team of advisors from the fields of rehabilitation and universal design, including the IDEA Center, to develop goals for the project. As part of our participation, the IDEA Center completed an evaluation of the projects when they were completed.

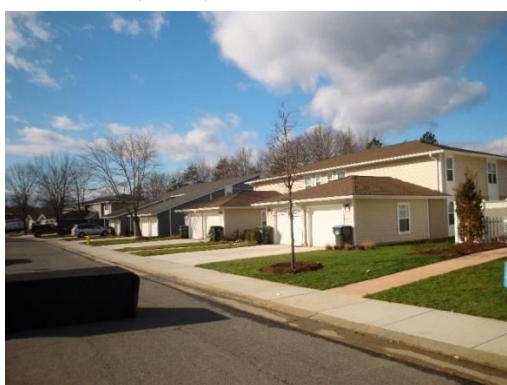
The collaborative team developed goals to guide the development of the Wounded Warrior Home Project. The goals included:

- Introduce the concept of universal design to military housing and reinvent accessible housing for "wounded warriors" and their families.
- Design a home anyone would want to live in, regardless of ability level.
- Demonstrate implementation of universal design concepts and products and provide people with an opportunity to experience them first-hand.
- Demonstrate new design concepts, construction methods, technology, decorating ideas, and conveniences in support of universal design.
- Create an easily replicable, cost effective universal design home model.
- Demonstrate the value of universal design to all people, not only those with disabilities.

CRC hired Michael Graves Architecture and Design to design two demonstration homes in the development. Michael Graves, now deceased, was a world-famous architect who had an illness that severely damaged his spinal cord necessitating the use of a power wheelchair. As a prominent architect living with a disability, CRC believed he could provide insight and creative ideas for the home. The collaborative team provided reviews and ideas as the designs for the homes evolved. After the homes were constructed in 2011, the IDEA Center used federal grant funding to conduct the post occupancy evaluation that is described here.



Figure 1. The Wounded Warrior Home Project site, a. Freedom Home, b. Patriot Home, c. Woodlawn Village Clubhouse, d. Community garden (left). The Neighboring house to the Patriot Home (below).



The Design of the Homes

The two model homes are located on opposite sides of a street in a base housing development in Fort Belvoir. A local street leads off a ring road to form a T shaped intersection. The street ends at the ring road so the two homes are on opposite corners and each has one side on the ring road and another on the local street. There is a community garden on the opposite side of the ring road from the homes and a new recreation centre down the block. Most of the homes in the immediate neighbourhood are duplex or quadraplex buildings built in the 1970's, some recently remodelled (See Figure 1). The model homes are single story and much larger and therefore more expensive to build. One of the model homes fits on a lot as large as two of the older homes. The model homes are distinctive shapes and painted bright colors while the surrounding base housing is uniform and has slight variations of earth-tone colors.

The Patriot Home has two wings and a central core with a floor plan in the shape of an "H". The "public" living and dining room make up the central core with private (bedrooms and bathrooms) and semi-private (kitchen, family room, and utilities) spaces in wings on either side of the core. The circulation paths provide ample space to maneuver a wheelchair throughout the home. The hallway in the bedroom wing is wide enough for a wheelchair user to pass by another family member.

The organization of the spaces creates two semi-private patios for outdoor gatherings, one off the ring road, set behind columns like a porch, and the other on the most private side of the lot. The driveway, garage and side entry are on the local street side, and the formal "front" entry is on the ring road (see Figures 2 and 5).

The Freedom Home has a linear plan with public spaces and a garage in the front of the side street and private spaces behind. The kitchen and utility rooms create a buffer between the public and private areas of the home. In this home, all the rooms are located off a wide hallway that is large enough for two wheelchair users to pass each other. The plan leaves the outdoor private spaces exposed to the ring road and adjacent lots (see Figs. 3 and 6).



Figure 2. Patriot Home Floor Plan (Clark Realty Capital LLC)

Post-Occupancy Evaluations

Members of the research team from the IDeA Center conducted the evaluation of the homes over a two-year period. The research team used two research methods: guided tours and semi-structured interviews. The former introduced research participants who were not residents of the homes to the universal design features and the second provided an opportunity to obtain in-depth information about the participants' reactions to the design. All interviews were digitally recorded and subsequently transcribed. The study research design and protocols were approved by the University at Buffalo Institutional Review Board.

The team engaged 8 participants, including residents of the homes and other soldiers who were brought on tours. As it turned out, only one of the households living in the two demonstration homes had an active duty service member with a disability; the other households had family members with disabilities, so they were included in the sample to obtain broader insights. Brief descriptions of the participants are shown in Figure 4.

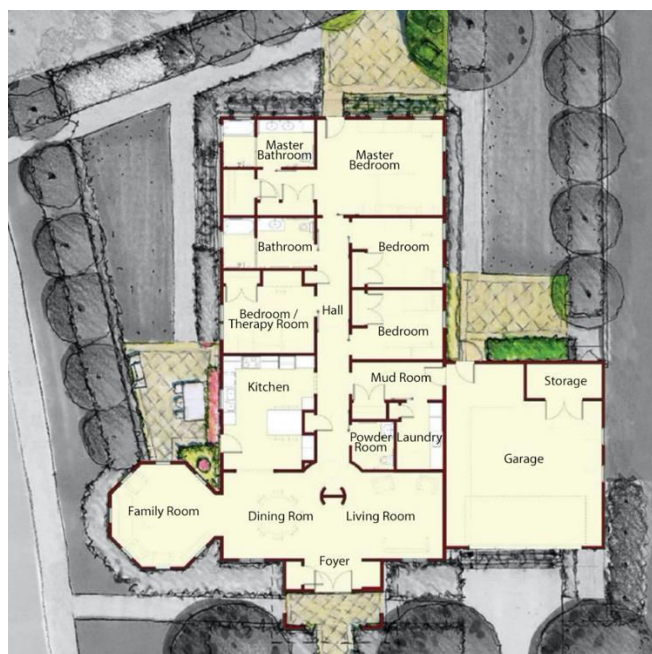


Figure 3. Freedom Home Floor Plan (Clark Realty Capital LLC)

The soldiers who did not live in the homes could not visit the Freedom home because it was occupied by a family at the time. They were taken on a guided tour of the Patriot home and allowed to explore it at their own pace. Participants who were residents of the homes only commented on the home in which they lived. The soldiers were encouraged to freely inquire about the overall design and particular features or products. A research team member interviewed each participant about the soldier's background, injuries and limitations, and to obtain perspectives on the design of the home related to aesthetics, overall design/layout, and individual features/products. For the participants who were not residents of the homes, the guided tour preceded the interviews.

Interviews were also conducted with four members of the design team including individuals representing Michael Graves Architecture & Design and Clark Realty Capital LLC. Participants were selected based on their in-depth knowledge and key roles in the development of the Wounded Warrior Home Project.

The interviews were recorded and transcribed for analysis. Due to the small sample size, the data analysis was qualitative. Positive and negative comments were identified and categorized by topic, which included general design issues, room types and building system.

RESULTS

Analysis of the interview transcripts revealed many positive responses to the homes by all the groups interviewed. The homes generally provided good support for residents with disabilities and their families. The appearance of the homes was viewed positively as well. The key findings are reported here.

Flexibility. The research identified that flexibility was a priority for military households. Since active duty soldiers and their families are re-stationed every two to three years, homes must be designed in a way to accommodate a wide range of household needs. An open plan can provide flexibility by allowing households to use the space in different ways (see Figures 2 and 3). Participants appreciated that there were no columns in the homes because it made maneuvering between spaces easier and accommodated a variety of furniture layouts. Another approach to flexibility is a plan with several similar sized rooms to allow variation in how functions are allocated. Both homes had a suite of bedrooms of the same size. These provided some flexibility in uses that could be assigned to them, e.g. children's bedroom, home office, playroom, etc.

Noise Control. Uncontrolled noise is unpleasant for a soldier who has high sensitivity due to PTSD or TBI. An open plan is likely to cause some uncontrolled noise but separating shared (public) spaces, such as the living room and kitchen, from personal (private) spaces, such as bedrooms and bathrooms can ameliorate that problem. This separation allows different activities to take place in different parts of the home simultaneously without conflicts, for example, when a parent on a night shift needs to sleep while their children are playing. Both home plans were designed to separate the bedroom areas from the living areas. In open plans, sliding partitions and large doorways with French doors can be used to increase privacy and reduce noise transmission. In the Patriot Home, bi-parting sliding doors were installed at the entry to the bedroom wing and in the Freedom Home, a built-in bookshelf provided a visual barrier at the hallway to the private sections of the home.

"I really like the separation of public and private space. I like that when I put my youngest down for a nap, I can close off that area and it can be nice and peaceful while I am with the other kids in the rest of the house." -Participant

Aesthetics. Most feedback from interview participants about the aesthetics of both homes was very positive. Residents and other service members used words like "beautiful," and "gorgeous" to in their responses. One soldier remarked, "...did not look like a house that a person with a disability would live in." But residents and several of the soldiers expressed concern regarding the exterior colors. Residents felt the distinctive colors (bright red and yellow) drew unwanted attention to the home and their family in the neighborhood (see Fig. 5 and 6). One said that "These homes....just stick out like sore thumbs..." due to their bold colors that contrasted with the prevailing color palette of the neighbourhood. Interviewees suggested selecting colors with pastel hues or in the same color palette as the surrounding homes.

"There was some discomfort for me. Everyone else is living in a different home. I am not one that likes to stand out. It is beautiful, though. It would be nice if the whole neighborhood looked like that." -Participant

Identification	Household	Disability	Interview Method
Patriot – 1	Soldier, wife, 2 children	Soldier: Below the knee amputation – uses crutches and wheelchair	On-site guided tour and semi-structured interview
Patriot – 2	Soldier (single)	Soldier: Severe arm injury, burns on hand	On-site guided tour and semi-structured interview
Patriot – 3	Soldier, wife, 1 child	Soldier: Left knee injury (awaiting replacement), PTSD	On-site guided tour and semi-structured interview
Patriot – 4	Soldier (single)	Soldier: Limited mobility, PTSD, TBI	On-site guided tour and semi-structured interview
Patriot – 5	Soldier, wife, 2 children, mother-in-law	Wife: Multiple Sclerosis Mother-in-law: Multiple Sclerosis	Semi-structured interview
Patriot – 6	Soldier, wife, 3 children	Child: Brain damage, Cerebral Palsy	Semi-structured interview
Freedom – 1	Soldier, wife, 4 children	Soldier: Double above-the-knee amputation, severe back pain, TBI – uses a wheelchair	On-site guided tour and semi-structured interview
Freedom – 2	Soldier, wife, 3 children	Child: Paraplegic – uses a wheelchair	Semi-structured interview

Figure 4. Summary of Participants and Households

Site Selection and Design. The demonstration homes' location near a park and other public spaces in the community were viewed positively, but interviewees identified the corner locations and proximity of the homes to the street as a drawback. Interviewees with children were concerned about their children's safety from passing traffic. Also, the limited front yard on the corner was often used by children as a shortcut, which affected residents' sense of privacy and security. These concerns can be alleviated by better streetscape design and siting. Features like reduced curb radiuses, on-street parking, narrower streets, and bulb-outs can slow traffic and help reduce both the perceived and actual risk to children. Street trees, landscaping and wider planting strips can increase privacy. Further, mixed-use neighbourhood planning could allocate corners for small apartment buildings, leaving the interior lots for single family homes.



Figure 5. Patriot Home (above) and Freedom Home (below)



Exterior Spaces. Interviewees described the rear patio at the Freedom Home as a place they liked to be but pointed out that improved site design could reduce the pooling of water in the backyard. The residents of the Patriot Home thought that the front patio was too visible to the public. They also said they

were unable to tend to the front yard because the only hose bib is in the back. Overall, the site should be designed to accommodate appropriate grading and landscaping to mitigate maintenance. And the exterior should have access to water and storage to care for the property easily. The large size of the homes reduced the available space in the back yards. While small private spaces may be suitable for urban settings, in suburban locations, residents expect larger yards to accommodate children's play.

"For someone with small children, there is not a lot of room to play in the backyard because it is completely landscaped. That is one thing about the yard that I dislike. All the landscaping, it makes the yard look beautiful, but it becomes non-functional for kids to play in." -Participant

Entries. The corner lots made identifying the location of main entrances confusing. Interviewees noted a lack of confidence in determining which entrance to use to enter the homes, something also experienced by visitors. The inclusion of a distinguishing characteristic on the front entrance of the home, particularly when the home is located on a corner lot, was suggested in order to increase understanding of which entrance of the home is meant to be used as the public entrance. Although the Patriot Home had a monumental "front entry" on the ring roadside, it did not seem to communicate that it was the formal main entry, perhaps because there were no other nearby homes with a front entry on that street. The private patio on the ring roadside of the Freedom Home may have mistakenly been perceived as a main entry due to its exposure to the street. In today's suburbs, houses often have main entries immediately next to garages or a short distance from driveways. In older neighborhoods, the private spaces are almost always located in the rear. The two homes did not follow these general patterns and had unusual forms, which may have confused the research participants.

"We don't use the front door. We mostly use the side door because it is facing all of our neighbors." -Participant

Home Automation Systems. Home automation systems were included in the two demonstration homes. Although designed to

increase convenience and security, alarms and alerts caused anxiety, especially for soldiers who tend to be hyper-vigilant. In design for soldiers with disabilities, it is important that residents have the ability to disable such features easily or customize them to eliminate the perception of imminent danger. Families and maintenance staff also need adequate training to program and operate home automation features.

“We had young kids when we moved here so for my wife, it was a great sort of security thing so that she knew when the doors were opening.[...] I think it's a great feature, especially for someone with young children.” -Participant



Figure 6. Bathroom spaces in model homes (above & below)



Bathrooms. Bathrooms were fully equipped with grab bars and folding seats in showers (see Fig. 6). Showers and bathrooms were oversized, much bigger than the minimum standards required. These features were appreciated by those that needed them and their caregivers. In universally designed housing, it is important to provide enough space for wheelchair maneuvers and for caregivers to assist family members. Products that serve dual purposes, such as grab bars designed to also function as towel bars, can be used. Users that require grab

bars for transferring or stability would be able to use them as intended, while others who do not require grab bars will find them useful for other reasons. Conventional grab bars and shower seats as used in the homes appear institutional. Although these accessibility features were appreciated by this group of participants, others may feel stigmatized by them. More attractive products are also on the market that have decorative qualities and do not look so institutional (see Fig. 7).

“I like the bathrooms the best. To be able to shower my son in the big, open shower space is a life changer.” -Participant



Figure 7. Bathroom from a home that embraces universal design.

Kitchen. Most responses about the aesthetics of the kitchen were positive, including the use of translucent glass in the cabinets that allow users to perceive the contents without opening the doors. The participants also appreciated the adjustable height counter that allowed all members of the family to use it (see Fig. 8). A removable cabinet allows residents to remove a section to provide knee clearance for working at the counter while seated in a wheelchair or chair (see Fig. 9). Although this feature was admired by respondents, they thought that using it would result in losing valuable storage space. A removable counter or cabinet should be accompanied by additional storage. An alternative solution would be to add space to the kitchen with a lower counter designed for seated work (See Fig. 10)

“The breakfast bar is great because we could lower it to the level my mother-in-law needed in her wheelchair. We could sit down and eat dinner with her.” -Participant

Windows. The homes had large windows with low sills, full height glazing in some living spaces and high round windows all around in the octagonal room of the Freedom Home. Low sills provide good views out for wheelchair users. And, large amounts of glazing provide better views and natural illumination, which is generally desirable in housing. But, individuals with heightened vigilance dislike being highly exposed to the outside. This finding demonstrates that a feature



Figure 8. Built-in eating area is adjustable in height to accommodate people with different needs and of different sizes.



Figure 9: A removable section of cabinets makes it easier for a person in a wheelchair or someone who has low stamina to use the sink.



Figure 10. Kitchen in LifehouseTM, a home that embraces universal design.

that seems, on the surface, to be a good idea, if viewed through the lens of a person who has seen combat, may have a different significance. Creative solutions are needed to address heightened vigilance without sacrificing views and natural light. These could include the use of interior shutters that can close off the lower part of windows when desired, and improved security around the outside of the home to help residents feel less vulnerable. Windows that have unusual shapes, like the round “portal” windows should come equipped with window treatments because service members do not have the resources to pay for custom-made solutions.

“I wish there were blinds over the windows in the octagonal room because at night we wonder if people can see in.” - Participant

Design Team Response

In addition to interviewing residents of the homes, the research team conducted semi-structured interviews with four members of the design team, including the real estate management director, project director, and two project architects. When asked about their previous experience related to universal design, only half of the design team had heard of the term, and no one interviewed had actually developed or designed a universally designed home. This makes their input particularly helpful because their perceptions provide useful information on the barriers to the adoption of universal design among building industry professionals.

“I may have heard the term universal design but did not know they had been doing this.” -Design team member

Some members of the design team expressed concern over the differences they noticed between the construction of these homes in comparison to others. They found the overall construction to be very similar to most homes. However, some of the unique features, such as the height-adjustable kitchen sink and stove are unfamiliar and require unusual installation methods. The design team also found that the contractors priced these “specialty” items high, likely due to uncertainty about how to install them. The contractors were also curious about the reasons behind some of these differences. The team agreed that contractors should be included early in the design process. This would allow the designers to address their concerns in advance and understand the goals of the project.

“There was an education process with the builder in order to make the process more smooth and efficient. We should have included the construction team on planning phases and at focus group meetings with the families.” -Design team member

Design team members also viewed some features as good ideas that need more improvements. For example, there was a concern that the flexible drain plumbing in the adjustable-height sink could cause problems in the future.

“The drain, segment of counter that moves up and down, etc. still need to be worked through because they could be a problem in the future.” -Design team member

The two homes were quite expensive, in comparison to the surrounding homes on the base. The cost of the Patriot Home was about \$850,000 and the cost of the Freedom Home was about \$650,000, not including land and infrastructure like sewers and electricity. CRC reported that future universally designed homes must be much less expensive to make it feasible to scale up adoption of universal design.

DISCUSSION

Private sector organizations like CRC now play an important role in conceiving, building and managing military housing construction for the Department of Defense. The goal of the privatization policy was to achieve greater responsiveness to the housing needs of service members and their families, including improvements in the supply of housing and quality of life of service members; this goal seems to be affirmed by this project. From their initial engagement of service members, CRC recognized the need for a new approach to accessible housing in the military and adopted the philosophy of universal design from the private sector. CRC also sought to improve the quality of life of their occupants beyond mandated minimum levels of access and the feedback obtained from residents and visitors to the homes indicates that they did. But, there were also important lessons learned that can inform universal design practices in military housing and in general.

An important goal of universal design is supporting social integration in the neighborhood (Steinfeld and White, 2010). The appearance of houses play an important role in communicating the identity of the residents. Although the appearance of the two homes were generally viewed in a positive light, some participants thought that the bright colors of the homes made the Wounded Warrior Homes stand out too much. As one of the respondents noted, distinctive design features will not draw unwanted attention if all homes in a neighbourhood have some uniqueness to them. It is interesting to note that the two homes had more unique features than just bold colors. They were much larger, had unusual roof forms and windows, and very different types of entries than the other homes in the neighbourhood. Participants appreciated these features and did not voice any concern about them.

Taking a universal design perspective to base housing, uniqueness can be achieved by introducing variety in home types, materials, colors, and roof forms in any new development or large scale renovations. Such a strategy would treat the differences in form due to accessibility, e.g. one story vs. two story, as just another variation among many. Uniqueness can also be achieved through the agency of the individual resident through personalization. Examples that support personalization with disability in mind include raised garden beds, accessible space for hobbies and leisure time pursuits, and counters that can be adapted for seated work in kitchens. These are features that would be received positively by any household.

Another important research finding was the mixed response to the large windows. The windows contributed to the positive response to the interior design because they filled the homes

with natural light and provided good views of the outdoors. But, soldiers with PTSD were uncomfortable with them due to security concerns. Heightened vigilance is a characteristic behavior for people who have undergone trauma in warfare. Although the homes had security systems, physical exposure still made these participants uncomfortable. This finding suggests that housing for service members and veterans, many of whom may have PTSD, needs to include window treatments that can help residents feel secure, fences and privacy screens, while incorporating surveillance technology that can provide evidence that the residents are safe, e.g. webcams.

The response of soldiers with PTSD raises an important question...what disabilities should be the focus of design for “wounded warrior housing”? Despite the universal design approach, the design features put an emphasis on mobility issues. This may have been due to the fact that key change agents had mobility impairments themselves. Housing for soldiers with disabilities, however, would benefit from attention to the whole body, not just the lower and upper extremities. The impact of traumatic brain injury, PTSD and severe burns clearly need to be addressed. These injuries demand attention to lighting, thermal comfort, acoustics, surfaces, views through windows, landscape features, siting, and other features, and account for many of the concerns that service members and their families identified in our research.

We also learned that soldiers were not the only residents with disabilities in the families that occupied the two homes during the research period. While the Wounded Warriors Home Project was conceived as a means to improve housing for “wounded warriors”, grandparents, children and spouses may be the ones who need the accessibility features. The involvement of soldiers with disabilities and experts definitely helped to promote a greater degree of accessibility and usability in the homes but the developers and design team need to expand their awareness of who uses homes on military bases and what implications this may imply, e.g. accessible playgrounds, different types of grab bars for elders, etc.

The types of housing provided must be considered as well as the features of the homes. Many service members with disabilities will be single and will not need or want a large single family home. The fact that military personnel are relocated often is an important fact to acknowledge through design. This implies that flexibility and ease in adaptation for different uses should be important design goals for the interior and that site selection, site design and the relationship of the home to its surroundings are important to foster rapid friendship formation. Non-traditional forms of housing might also be explored. For example, design for three generations or caregivers might be a good option for families in which service members are often deployed in war zones and house sharing may be a very good alternative for single individuals with disabilities.

To build universally designed homes on a larger scale or for discharged wounded veterans, serious attention to affordability will be needed. But, the high cost of these homes should not be viewed as inevitable in the practice of universal design. Rather,

it can be attributed to their very large floor area and ceiling heights and expensive features like mechanically adjustable counters and cabinets, large sliding doors, skylights and large windows, smart home features and unusual roof and window shapes. To build on this first step, more modest home prototypes are needed that provide a similar level of functionality and aesthetic appeal. The large “footprint” of the one-story homes also resulted in reduced outdoor private space on the lots. And, some features, like the unusual roof forms and windows, did not have a good return on investment. The evaluation provided some directions for the future that could result in cost savings as well as improvements in the design, thereby advancing the effort to create systematic change in military housing, one of the stated goals of the initiative.

The project clearly adopted the paradigm of “returning the soldier to normality,” a theme of 20th century rehabilitation. Universal design was perceived to have more potency as a restorative intervention than traditional accessible design, a stronger medicine if you will. Examples of restorative features include very wide doors, raised toilets, grab bars, very wide corridors and mechanically adjustable counters. Critics might argue such a restorative approach is hypocritical in that it cannot really restore a person completely and that it brings more attention to the damaged body. In this project, we found no evidence that the emphasis on restoration led to negative interpretations. These features are a very visible confirmation that the DoD made an effort to improve the quality of life for soldiers with disabilities.

Nevertheless, it is important to study the opinions of a broader group of service members, veterans and their families. Not all people with disabilities might appreciate the features that are explicitly associated with disabilities that they do not have. In fact, there are ways to design a home to be adaptable, so that the home can be added or modified when needed (Steinfeld and White, 2010). For example, work surfaces for both seated and standing work can be provided without mechanical “gizmos and gadgets” (Williamson, 2019). Grab bars do not need to be installed unless residents want or need them. While larger clearances are needed for wheelchair access, these two homes exceeded what is actually necessary and the room sizes were all quite extravagant. In fact, many middle class households would find it challenging to furnish such large rooms.

As noted earlier, the original conception of universal design focused primarily on usability, and that is still a pervasive aspect of most applications of UD. Steinfeld and Maisel (2012) propose a broader agenda by expanding the scope to wellness and social participation. The research results support this new paradigm. The project reflected an awareness that design contributes to mental health as well as physical health. The homes are distinctive and attractive, spacious, light and airy and filled with luxury features like high ceilings, expensive hardware and smart technology. These features were noticed and appreciated by the participants and thus contribute to good morale and feelings of belongingness for both soldiers and their

families. The reaction to the bold colors, the discovery that soldiers themselves were not always the household member with a disability, concerns about the safety of children's play, and the concern about security by soldiers with PTSD, point to the importance of social issues like the dynamics of three generation households, perceptions of others, and parenting responsibilities that were not well understood at the beginning of the project.

One aspect of social integration we could not study was site selection since the location on a base housing development was a given. But, the selection of sites for “wounded warrior homes” for discharged veterans, will have an impact on social integration. The location of such homes should take into consideration where veterans want to live. In this case, the neighbourhood was inhabited by age and class peers...other soldiers and their families. Friends can be made more easily where neighbors share interests and experiences. And, the development was convenient to work sites. It would be unfortunate to build a great home and not be able to find a family that desired to live in it due to its location and demographics. For example, a development far from job opportunities or inhabited by mostly retired people would probably not be the ideal location for a young family with children.

With respect to contemporary issues in disability studies, the Wounded Warrior Home Project offers some interesting perspectives. In the early stages of innovation diffusion, early adopters often modify the original innovation to fit with local contexts and to address resistance to adoption. It takes a while for a consensus to emerge and clarify the innovation (Rogers, 2003). Hamraie points out that the original concept of universal design, as articulated by Mace and Lusher, both of whom had mobility disabilities, foregrounded disability while at the same time recognized that people with disabilities share an affinity with other “spatially excluded populations” (Hamrie, 2017, p. 184). But she also argues that the emphasis on disability was reduced as the concept of universal design was further articulated to appeal to the design professions and business interests, distancing it from the activist politics of disability rights. Williamson refers to this development as the “commercial version of Universal Design” and notes that it was used to sell products without even referring to disability (Williamson, 2019, p. 150). Addressing the aesthetics of these products, she describes them as an attempt to “smooth away difficult object encounters” with a form of “late twentieth century streamlining”.

Hamrie argues that this commercialization reflects “post-disability” ideology, which, like “post-racial” ideology, reflects a “neoliberal” set of values and practices that could repress the achievement of social justice for this marginalized group. Both Williamson and Hamrie contrast smooth, uncluttered and highly finished UD products with early examples of accessibility that were rough, sometimes crude and had forms associated strongly with a disability like ramps, oversized handles and jury rigged solutions, often developed by people with disabilities and

family members rather than professional designers. Hamraie argues that, in contrast, UD submerges or sanitizes the powerful aesthetics of design for disability emerging from the disability rights movement.

The Wounded Warrior Home Project was initiated and led by a commercial enterprise, CRC. But, it did not "smooth over", submerge or sanitize accessibility. The aesthetics of the two homes, from the flat, single level plan, the on grade entry, the wide circulation spaces, grab bars, wide sliding doors, knee spaces under sinks, etc, obviously communicate "wheelchair accessible". The wheelchair symbols placed on floor mats (see Fig. 6) are the most obvious example of the purposeful approach to aesthetics of disability in the project. The essence of universal design in contemporary design practice is using the difference to inspire form making. Far from repressing the advancement of disability rights, it is a vehicle for pushing the boundaries beyond the grudging mandates of public policies for minimum levels of accessibility.

Hamraie and Williamson focus their arguments on highly prominent visual forms like ramps and oversized handles. As the homes demonstrate, the forms resulting from UD are quite powerful when compared to conventional practices although their appearance is much more subtle. In fact, they may not be visible at all. But, they remove the source of resistance in the environment that led to accessibility aesthetics in the first place. Consider a ramp in comparison to an on-grade entry. The ramp is a powerful dynamic form so it evokes a strong image. But, the on-grade entry is invisible and eliminates the need for the ramp entirely. Although it is not as prominent perceptually and easily overlooked it is an even more powerful statement about cultural change than elevating the home above grade and adding a ramp to achieve access. And, it is even less expensive than the cultural norm of raised entry.

The same argument can be raised about the language of universal design. Hamraie and Williamson use words like "sanitize" and "submerge" to describe the lack of the word "disability" in definitions of universal design. The framers of the UD concept in the U.S. and the Design for All Europe (EIDD) organization in Europe were leaders in the field of accessible design. In framing the language of universal design, they sought to free it from the cultural stereotype of disability. They knew, from practical experience, that just the mention of disability would typecast the new paradigm as a synonym for specialized design for people with disabilities and create perceptual barriers to adoption on a widespread basis.

Developers, manufacturers, marketers and designers all have preconceptions that accessibility adds cost but benefits only a small number of people, and, due to their knowledge of grassroots solutions (which they view as ugly and of poor design quality), would not embrace the new paradigm if it was too closely associated with disability or accessible design. Further, they recognized the importance of "intersectionality" before it became a popular term in social justice literature (Crenshaw, 1989). Thus, the definitions they crafted were not focused on design for disability alone but addressed broader

design goals of usability, safety, health and social participation. These are all outcomes that are universally desired. This does not mean, however, that design for disability cannot be a focus of the universal design, as in the case of the Wounded Warriors Homes Project. In fact, the two homes suggest an interesting direction for a universal design that could be explored further...restorative design as applied to the whole person. It might be impossible to restore physical function beyond some limits but a greater focus on design for mental health and social life would do much to overcome the gap. In this time of the Covid 19 pandemic, restorative design sounds like a good idea for the design world to embrace.

Rather than focusing a spotlight on disability, the framers of the universal design idea believed that all social justice movements in design share common outcomes and that design for disability could not advance beyond minimum standards until broader and more aspirational goals were addressed. This is a powerful idea that does not submerge or cancel out disability but rather views it as a basic aspect of human experiences like race, class, sexual orientation, gender and age. It recognizes that no one is defined by disability alone.

CONCLUSION

This study provides evidence that the Wounded Warrior Home Project at Ft. Belvoir achieved four of the original six goals:

- The project introduced the concept of universal design to housing for soldiers with disabilities and "re-inventing" accessible housing for this group.
- The homes were received well by all the participants, including residents and visitors with different types and severity of the disability.
- It provided a hands-on demonstration of universal design. It demonstrated design concepts, construction methods, technology and decorating ideas that were new, at least to military housing.

The project stopped short of an "easily replicable, cost effective universal design home model." That goal has not been abandoned, however. A follow up project is underway to build more affordable models. The project also did not "demonstrate the value of universal design to all people, not only those with disabilities," because of the need for accessible housing on the base. Only households with members who had disabilities lived in the homes during the two-year study period. Although there was an open house, once residents moved into the homes, they could not be visited by the public. A more widespread application to base housing could address that goal by providing an opportunity to assess the responses of more diverse households to universally designed homes.

The homes can be viewed as showcases for the state of the art in universal design at the time of their construction. But the research demonstrated that we do not know everything there is to know about the needs of active duty service members with disabilities. We learned that contemporary warfare and disability policy in the armed forces has resulted in novel

usability issues. The project also identified the importance of exterior appearance, siting, neighborhood context and household demographics as factors in the success of universal design applications in housing.

From the perspective of disability theory, it verified the value of adding wellness and social participation alongside usability as key aspects of universal design thinking. Further, it demonstrated that universal design does not preclude foregrounding disability. And, in fact, it offers an interesting slant on the historical perspective of accessible housing as part of an overall “restoration” project for soldiers with disabilities. Rather than thinking about housing only as restoring function, with a focus on body parts, the research suggests that restoration of social roles, mind and spirit are additional important goals. Design cannot heal bodies and make them whole. But it can make everyday life easier and more pleasant and help people be more productive in their work. With respect to military housing, we think that universal design can reduce the stress that is inevitable in military service for all service members and their families. Further, the idea of restorative design is one that has resonance for many other contexts.

Several specific lessons summarize the takeaways for application in future “wounded warrior” projects or any project seeking to build houses for soldiers or veterans with disabilities:

1. *Do not base design for “wounded warriors” on preconceived notions of accessible houses.* Conventional accessible solutions do not account for the challenges faced by service members and veterans with disabilities. The research uncovered several examples of unexpected design issues but there may be a lot more that are still unknown.
2. *Engage residents from the start; experts are not a substitute.* Representatives of the target groups can be engaged, even if they are not the actual people who will live in the homes. Some of the design limitations identified by the participants may have been addressed had a wider range of soldiers with disabilities been consulted. Family members are additional stakeholders who should be involved. It is important that resident populations be engaged *throughout* the design process, not just at the beginning. This requires a good method to communicate the design details to people who are not familiar with architectural drawings, e.g. improved visualizations like virtual walkthroughs and perspectives of the exterior and alternative formats for people with visual impairments.
3. *Consider diverse family situations.* Many different types of homes should be developed to accommodate the wide range of possible residents and their unique circumstances. The differences in needs are not only related to specific disabilities and related issues but are also related to the assigned mission of soldiers, household composition, and other social factors like officer or enlisted status. As we discovered, even active duty soldiers without disabilities may need accessible housing because they have family members with disabilities.

4. *Integrate homes into the community socially and physically.* It is important to ensure that homes do not draw unwanted attention to their occupants through a radically different appearance but a distinctive appearance can have benefits for morale and presentation of self. Integration does not mean sticking to pedestrian design. Rather, it means using contextually appropriate solutions. Providing basic accessibility to other homes in the community can obviously support friendship formation. We did not explore differences related to class and education. This may play out in terms of differences between officers and soldiers in the non-commissioned ranks.
5. *Improve the existing stock of homes as well as building new homes.* Universal design does not have to be relegated to new construction. New homes are expensive to build. Some universal design features can be implemented in existing homes at a much lower cost, especially when the campus is undergoing major renovations to upgrade the quality of the housing stock. Some families who suddenly find they need an accessible home may be more interested in staying where they are than moving, due to existing social networks. Depending on the unit design, renovation may be a more affordable and desirable alternative to building new.
6. *Engage contractors in the design process and explain the project fully to them.* Understanding the goals of the project and getting their feedback on unusual features will help to reduce problems in construction and, perhaps help to identify better solutions.

This study clearly has some significant limitations. The most obvious is its small scale. It only focused on two homes in one development and had a small number of research participants. Yet, this small study discovered so much that it begs the question: What could be learned from a more extensive and systematic program of evaluation? More research on the housing needs of active duty soldiers with disabilities can corroborate these findings and identify other unmet needs. Such research could also be expanded to housing for veterans with disabilities who are no longer on active duty. Throughout the country, charitable efforts have sought to provide better housing for veterans with disabilities. Are these homes meeting their needs?

The Ft. Belvoir project inserted two new homes within an existing neighborhood. But the services are also constructing new developments. In such projects, attention to universal design should extend to the entire development (Steinfeld and White, 2010). In addition to land use planning, site design and streetscape details, consideration should be given to the accessibility of all housing in the neighborhood. The concept of “visitability” supports visiting by neighbors, friends, and relatives with disabilities and also recuperation from an injury or illness (Steinfeld and White, 2010). Visitable homes have four basic features that are very low cost to provide: 1) at least one no-step entry, 2) doors wide enough for wheelchair access, 3) an accessible bathroom or half bath on the first level, and 4) at least one sleeping space on the accessible level. Such homes

are amenable to renovation for long-term occupancy by a person with a disability. Visitability is a universal design strategy for a neighborhood, but it should not replace the provision of homes that are more suited for long term occupancy by people with disabilities right from the start and custom adaptations for specific needs.

This study only addressed base housing for service members on active duty. The findings clearly have relevance to “wounded warrior” projects for discharged service members. But, it should be recognized that not all service members have routine discharges. One study reported that approximately 15% of discharges are for misconduct. These veterans are at high risk for incarceration, homelessness, and suicide due to high rates of serious chronic health issues (Brignone et al. 2018). While charitable efforts are understandably directed to those who have had routine discharges, those who were discharged for misconduct are also in need of attention, especially since they are not likely to be the target population of charitable organizations serving “wounded warriors”. It is important to note that a mis-conduct discharge may have been triggered by maladaptive responses to injury in combat, substance abuse or anger management issues. Thus, the design of affordable housing in general, housing targeted for homeless populations, and housing for people with mental health conditions, would likely benefit from research on veterans’ issues since many of their occupants may have been soldiers who obtained a disability in the service.

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