ABSTRACT

Title of Thesis:	BARRIERS OF AGING: THE IMPACT OF HOUSING ON U.S. OLDER ADULT HEALTH
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Today, millions of older adults aged 65 and older, face the challenges of aging. In the past ten years, the number of people aged 65 and older in the U.S. increased from 37.2 million to 49.2 million, and by 2040 an estimated one in five Americans will be age 65 or older (Administration for Community Living & Administration on Aging, 2018; Urban Institute, 2014). Housing is a significant factor in health outcomes for this population because of their increased time spent in the home, which can put them at an increased risk for home accidents (Newman, 2003). Using the Health and Retirement Study, this study explores the association of assistive features being present in one's home on health status and provides evidence to identify the housing needs of the older adult population.

BARRIERS OF AGING: THE IMPACT OF HOUSING ON U.S. OLDER ADULT HEALTH

by

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List of Abbreviations

AARP	American Association of Retired Persons
ADLs	Activities of Daily Living
CMS	Centers for Medicare & Medicaid Services
HRS	Health and Retirement Study
SSI	Supplemental Security Income

Chapter 1: Introduction & Background

Introduction

Today, millions of adults aged 65 and older, face the challenges of aging. In the past ten years, the population aged 65 and older increased from 37.2 million to 49.2 million (Administration for Community Living & Administration on Aging, 2018). Aging comes with many challenges to individuals, their families, and society. Diminished physical ability, social interaction, and income are some of the challenges that can impact an older adult's ability to successfully age. The built environment is also influential in the aging process as it is associated with the spaces, buildings, homes, and infrastructure that can affect a person's health. Most U.S older adults live in homes that are ill-designed for their age-related needs. These homes contribute to adverse health outcomes for the aged 85 and above, such as depression and injury or death from accident (Thomson et al., 2013).

Social environments, which are "the immediate physical surroundings, social relationships, and cultural milieus within which a defined group of people function and interact," are also influential on older adult health (Barnett & Casper, 2001). Social interactions and later-life life cycle stages, such as age-related losses and retirement, can negatively affect health through increasing the risk of loneliness and social isolation (Kemperman et al., 2019). Loneliness and social isolation are associated with several adverse health outcomes, including high blood pressure, obesity, depression, and even death, and significantly affects Medicare, with Medicare spending more than $1,643 per beneficiary annually on socially isolated

older adults compared to those who are socially integrated (Cacioppo & Cacioppo, 2018; Shaw et al., 2017)

While these studies on the social and built environments of older adults and their influence on health outcomes and proposed solutions add to our knowledge, more research is needed to address the health inequities U.S. older adults face related to housing. A few studies investigated adult wellbeing after home modifications and the relationship between home modifications and aging in place, but few have investigated home modifications impact on older adult health (Carnemolla & Bridge, 2016; Hwang et al., 2011).

When using the Health and Retirement Study's (HRS) bibliography search tool to search for literature using HRS data, there were only a few studies that used HRS data to analyze and address health inequities related to housing, and no studies addressed the impact of assistive features (railings, grab bars, ramps) on individual health. The gap in the literature is why this study investigates the association of assistive features being present in-home on health status and provides evidence to support the housing needs of the older adult population.

Background

Amongst the older adult population, housing is a significant factor in health outcomes for three reasons. For older adults, the home is significantly influential on health because of their increased time spent in the home and inability to compensate for inadequate home conditions, increasing their risk for accidents (Newman, 2003). Other aspects of the built environment such as walkability and crime can affect older

adult health by deterring older adults from seeking needed services that can improve their health outcomes.

An AARP survey conducted in 2010 found that 90% of older adults wanted to remain in their homes for as long as possible (Keenan, 2010). This concept is known as “aging in place”, which is an older adult’s decision to remain in their homes or communities as they age instead of relocating to residential care. For this demand to be met, the safety and quality of homes must be considered to avoid the likelihood of adverse health outcomes, with a significant amount of older adult homes having to undergo the process of adding assistive features to ensure they can successfully age-in-place.

Older adult home safety can be improved by installing home modifications which are categorized into four categories depending on the type of modification change. Additive modifications are new supportive features or structural changes that often require professional installation, these modifications are relatively expensive (Pynoos, 2017). Subtractive modifications are less expensive and can usually be implemented by individuals since they involve removing items or hazards (Pynoos, 2017). Transformative modifications include restructuring the existing environment, while behavioral modifications include avoidance or adoption of specific behaviors (Pynoos, 2017).

The addition of assistive features in homes would fall under the home modification categories as an additive or transformative modification. Additive if the features are to accommodate physical changes (grab bars, ramps, etc.) and

transformative if they are to facilitate space use (widening doorways), both of these categories of home modifications are the most costly categories as they are often executed by contractors or remodelers (Pynoos, 2017). These modifications can be an expensive out-of-pocket cost with the average cost of adding assistive features in homes ranging between $700 to $9,000 (Fixr, 2017).

For many older adults, the primary funding method for home modifications is to pay out-of-pocket using savings, assets or income, however, there are public and private options to help fund home modifications (Pynoos & Nishita, 2003). One public program is the Plan for Achieving Self-Support program, where Supplemental Security Income (SSI) recipients can set aside income for home modifications without putting their benefits at risk (Pynoos & Nishita, 2003). An additional program to help fund home modifications for individuals is through the Department of Veterans Affairs. The Home Improvement Structural Alterations grant program provides veterans with disabilities grants for home modifications that improve home accessibility (Pynoos & Nishita, 2003).

Additional resources for home modification funding are Medicaid waivers, Community Block Grants, and Older Americans Act Title III funds, but they are "often unreliable because they vary depending on an individual's geographic area, have different eligibility requirements, caps on funding amounts, and limit the types of home modifications covered" (Pynoos, 2017). One alternative to these resources is funding resources that support aging in place and older adult independence, most of which are under the self-direction health services model.

Self-direction is a service model approach that empowers program participants and their families to have control over their long-term services and supports their choice to live at home (Robert Wood Johnson Foundation, 2009). Self-direction has two forms – employer and budget authority (Robert Wood Johnson Foundation, 2009). The Centers for Medicare & Medicaid Services (CMS) defines employer authority as individuals being able to hire, train, dismiss and supervise individual workers and budget authority refers to participants being provided a flexible budget to purchase goods and services to meet their needs, including home modifications (Robert Wood Johnson Foundation, 2009). For Medicaid-funded care programs, the self-directed service model helps support aging in place and older adult independence while also addressing health and safety needs, but middle-income older adults can't participate in many of these programs to modify their homes due to income eligibility requirements.

Many middle-income older adults may discover that long-term care insurance and older adult housing communities are too expensive, while low-income adults may have even more limited options for finding good-quality, affordable housing (Harvard Joint Center for Housing Studies, 2014). Middle-income older adults face the unique challenge of being too rich to access Medicaid and low-income housing and health services and too poor to have access to private pay housing and health services.

Future middle-income older adults, around 14.4 million, will have lower overall savings and pensions compared to the middle-old and oldest-old seniors now, and as a result of having fewer savings and children, and increased health and

mobility limitations, they will find it difficult to find affordable housing (Pearson et al., 2019a). It is estimated that 20% of future middle-income older adults will fall into the "high needs" category (three or more chronic conditions and one or more limitations in activities of daily living), which will prevent them from remaining independent and in their homes (Pearson et al., 2019a).

Older adults who are a part of a racial minority group, specifically African Americans, may face increased challenges of aging. The poverty rate for some African American older adults is more than twice the rate of older adults overall and three times the rate of White older adults (Johnson & Appold, 2017). One of the main reasons some African American older adults may face housing-related challenges to aging is due to socio-historical issues such as years of housing and labor market discrimination, which made these older adults less likely to have accumulated wealth to invest in needed home modifications and health services, thus increasing their chances of obtaining negative health outcomes (Kenan Institute, 2017).

Existing literature suggests that there are four pathways that help foster the relationship between the built environment and positive health outcomes. These pathways are stability, safety and quality, affordability, and the physical and social characteristics of neighborhoods (Taylor, 2018). The importance of these housing pathways can be examined by analyzing the study's research aims through two of the four pathways: safety and quality, and affordability.

The safety and quality pathway helps to frame the research aim of the prevalence of assistive features in the home, as having assistive features in the home can reduce falls by 39 percent (Taylor, 2018). The affordability pathway also helps frame the research question since a lack of affordable housing can affect an older adult's ability to make other expenses. The lack of affordable housing and limited housing inventory with basic assistive home features will also force millions of older adults to add these features to age in place or forgo them, thus creating a burden for caregivers and older adults. As this population increases, difficulty finding accessible, affordable older adult housing will be widespread and will lead to a greater reduction in quality care, well-being, and life satisfaction (Harvard Joint Center for Housing Studies, 2014).

Housing is an essential component of health as homes can influence physical and mental health. The addition of assistive features in homes can further this influence by allowing older adults to remain independent even longer. This study uses 2018 HRS data to address differences in the built environments of older adults with ADL difficulties to determine if those who have assistive features in the home (ramps, railings, grab bars, call system, etc.) have better health outcomes than those who do not. The significance of this study furthers the literature by investigating trends that are known to be related to the association between the built environment and older adult health (Kenan Institute, 2017; Pearson et al., 2019a).

Chapter 2: Conceptual Framework

The conceptual framework used to guide this study is the environmental press theory, which examines how a person fits into their environment and the role of the environment on the physical health and emotional well-being of older adults (Byrnes et al., 2006). Environment press theory is a theory centered around adaption, meaning an individual will adapt to physical constraints in the environment or the environment will be altered to adapt to the individual (Byrnes et al., 2006). Installing assistive features to help older adults with ADL difficulties is one example of an adaption to the environment to suit the needs of an individual.

In relation to the theory, if this adaption was not met or the environment failed to suit the physical needs of the individual, the theory suggests that the "environment may press upon the individual, or make the physical environment a challenge", which could have a significant impact on the emotional and physical well-being of an older adult (Byrnes et al., 2006). This person-environment relationship is integrated and mutually defining, with the home environment having three modes of experience: the physical home, consisting of the design and layout of the dwelling; the social home, encompassing the relationships within the same physical environment inside and outside the home (relatives, friends, neighbors, community networks); and the personal home, the place of personal control and self-expression (Tanner et al., 2008). This study uses person-environment and environment press theory to explore the relationship between assistive features in the home and older adult health and well-being.

Chapter 3: Research Aims

The aim of this study is to explore whether the housing of older U.S. adults can positively affect health outcomes. Identifying specific factors in the built environment that are the most influential on an older adult's health, such as the prevalence of assistive features, can help understand unique barriers older adults face while aging and provide solutions for improving older adults' health and well-being.

The aims of this study are to:

i. Identify the prevalence of older adults with ADL limitations who live in homes with assistive features

ii. Explore the relationship between having assistive features in the home and health status for adults with and without ADL limitations

Chapter 4: Method

Study Population

This study uses the 2018 Early Core samples of the Health and Retirement Study (HRS) to estimate the prevalence of having assistive features in the home among older adults and to analyze the differences in health status between older adults with and without assistive features in the home. The Health and Retirement Study (HRS), is a national longitudinal survey conducted of people over the age of fifty funded by the National Institute on Aging and administered by the University of Michigan every two years ("Health and Retirement Study 2018 Core Data Description and Usage", 2019).

The survey is comprised of a questionnaire, optional experimental modules, and an LBQ that examines respondents' psychosocial lifestyle and wellbeing. Additionally, HRS oversamples African Americans, Hispanics/Latinos, and Florida residents to increase the number of HRS respondents from each of these groups. This analysis focused on older adults who reported at least one ADL difficulty and answered to the self-reported health status and assistive features questions within the HRS.

Study Design

To explore if having at least one assistive feature in the home is related to having a good or better health status for older adults with ADL difficulties, older adults who met the following criteria were eligible for inclusion: aged 65 years or older, has at least one functional limitation and answered the self-rated health and

assistive home features questions. The final sample consisted of 1512 older adults who had data for each of the criteria.

Measures

Description of Dependent Variable

The dependent variable, health status, will be measured through the self-reported question, “Would you say your health is excellent, very good, good, fair, or poor, and turned into a dichotomized variable; “excellent, very good, and good” self-reported health statuses were coded as 1(good or better health) and “fair and poor” self-reported health statuses were coded as 0 (fair or poor health).

Description of Variables

Prevalence of assistive home features - Measured through two questions, “Does your home have features such as a ramp, railings, or modifications for a wheelchair?” and “How about special features to safeguard older persons or someone with a disability -- does your home have features such as grab bars, a shower seat, or a call device or another system to get help when needed?”, both questions have the same response categories, “yes” and “no”.

Functional limitations - Measured through respondent’s responses to questions about their activities of daily living (ADL). This was derived from the respondent’s report of any difficulty in: walking, dressing, bathing, eating, getting in and out of bed, using the toilet, and getting up from a chair. These responses were then dichotomized with 1 being coded as having difficulties and 0 as having no difficulty.

Sex – Binary variable, coded with male as 1 and female as 0.

Age– Coded as three age groups: 65-74; 75-84; 85+

Marital Status- Coded as four groups: Married; Divorced/Separated; Widowed; Single/Never Married

Insurance Types: Coded as four groups: Medicare only; Medicaid only; Dual enrollment (Medicaid and Medicare); No insurance

Regression Analysis

Logistic regression analysis was used to investigate research aim 2, which identified the relationship between having assistive features in the home and health status. This study used two different populations to answer research aim 2, with the first model focused on a good or better health status outcome between all older adults with assistive features in the home. The second version of the model was used to test whether the effect between assistive features and a good or better health status is unique to older adults with ADL limitations. In this second version I included all variables in the previous model, but the model ran on the subpopulation of older adults with an ADL limitation and excluded older adults without ADL limitations.

ADL limitation was also added because of difficulties with ADLs being reported in the literature as significantly impacting an older adult's health (Lyu & Wolinsky, 2017).The logistic regression equation is shown below. SAS 9.4 was used to compute this analysis.

Regression model for Aim 2

Model 1

$Y_i = \alpha + \beta 1(\text{assistive feature}) + \beta 2(\text{age}) + \beta 3(\text{sex}) + \beta 4(\text{marital status}) + \beta 5(\text{insurance type}) + e$

Chapter 5: Results

Key Findings

Aim 1: **Identify the prevalence of older adults with ADL difficulties who live in homes with assistive features**

Table 1 shows the characteristics of older adults with and without an ADL limitation. The final sample consisted of 1,512 individual observations from individuals who met the sample's inclusion criteria for the 2018 HRS. Due to 2018 HRS data still being designated a work in progress, survey weights were unavailable for 2018, so these characteristics are not proportional to the U.S. population and may be subject to response bias.

Within table 1, 68% of the sample population older adults had at least one assistive feature in the home and 66% were female. Older adults with an ADL limitation also reported higher levels of having assistive features in the home compared to those who do not have ADL limitations (80% vs. 62%). Among older adults with an ADL limitation and who also have an assistive feature in the home, the group with the highest proportion were older adults who had a dressing limitation, while the group with the lowest proportion were older adults who had an eating limitation. Lastly from the sample population characteristics, older adults with an ADL limitation were more often to report a poor or fair health status (62%) compared to older adults who had no ADL limitations (21%).

Table 1. Sample characteristics of older adults by ADL limitation, 2018 HRS

	Total Sample (N=1512)		ADL Limitation (N=535)		No ADL Limitation (N=977)	
	N	Percent	Percent	SE	Percent	SE
Assistive Features						
Yes	1037	68.58	80.37	1.72	62.13	1.55
No	475	31.41	19.63	1.72	37.87	1.55
Sex						
Male	503	33.27	29.72	1.98	35.21	1.53
Female	1009	66.73	70.28	1.98	64.79	1.53
Age						
65-74 years	640	42.33	32.71	2.03	47.59	1.60
75-84 years	605	40.01	40.00	2.12	40.02	1.57
85+ years	267	17.66	27.29	1.93	12.38	1.05
Good or Better Health Status						
Yes	972	64.29	37.76	2.10	78.81	1.31
No	540	35.71	62.24	2.10	21.19	1.31
Housing Arrangement						
Own	809	58.29	52.78	2.26	61.24	1.62
Rent	444	31.99	35.46	2.17	30.12	1.52
Live Rent Free	86	6.20	8.87	1.29	4.76	0.71
Other	44	3.17	2.68	0.73	3.43	0.61
Marital Status						
Married	554	36.64	27.85	1.94	41.45	1.57
Separated / Divorced	301	19.91	20.38	1.74	19.65	1.27
Widowed	588	38.89	46.35	2.16	34.80	1.52
Never married / Single	69	4.56	5.42	0.98	4.09	0.63
Health Insurance Type						
Medicare only	1288	85.19	80.37	1.72	87.82	1.05
Medicaid only	6	0.39	0.19	0.19	0.51	0.23
Dual enrollment	202	13.36	17.94	1.66	10.85	1.00
No Insurance	16	1.06	1.50	0.52	0.82	0.29

Unweighted; Source: HRS 2018

Aim 2: **Explore the relationship between having assistive features in the home and health status for adults with and without ADL limitations**

For aim 2 the logistic regression model was used to compare the odds of having a good or better health status and having assistive features present in the home. The first version of the model explored if having assistive features increased the odds of having a good or better health status among all adults in the sample population (Table 2). In this version of the model, older adults without assistive features in-home were more likely to report a good or better health status (OR=1.63). Additionally, this version also explored that older adults with Medicare (OR=5.785) were more likely to report a good or better health status and those with dual enrollment in both Medicare and Medicaid (OR=2.682) were also more likely to report good or better health status.

This version of the model also explored that those who were 65-74 years old (OR=1.215) and 75-84 years old (OR=1.049) were more likely to report a good or better health status than older adults aged 85 and above. A similar pattern of reporting a good or better health status was found for older adults who were married (OR=1.163) and separated or divorced (OR=1.036) compared to older adults who were never married or single. Housing arrangement also had an impact on older adult's reporting a good or better health status. Older adults who rent (OR=0.736) or live rent free (OR=0.682) were less likely to report a good or better health status compared to those who own their homes (ref.) or have another housing arrangement (OR= 1.501).

Table 2. Logistic Regression of Good or Better Health Status among All Older Adults, 2018 HRS

	Odds Ratio	Std. Err.	*P*
Assistive Features			
Yes		Ref.	
No	1.63	0.0683	0.0003*
Sex			
Male		Ref.	
Female	0.932	0.0653	0.5874
Age			
65-74 years	1.215	0.0911	0.2116
75-84 years	1.049	0.0814	0.685
85+ years		Ref.	
Housing Arrangement			
Own		Ref.	
Rent	0.736	0.2263	0.7179
Live Rent Free	0.682	0.2752	0.5642
Other	1.501	0.3465	0.0689
Marital Status			
Never married / Single		Ref.	
Married	1.163	0.115	0.2916
Separated / Divorced	1.036	0.1256	0.9654
Widowed	0.936	0.1112	0.385
Health Insurance Type			
No Insurance		Ref.	
Medicare only	5.785	0.2706	0.0002*
Medicaid only	1.286	0.6749	0.4619
Dual enrollment	2.682	0.2851	0.4037

Notes: * Indicates significance at the $p<0.05$ level

The second version of the model explored if having assistive features among the subpopulation of older adults with ADL limitations, influenced the likelihood of having a good or better health status (Table 3). This second version of the model was created to explore if there were any differences in the likelihood of reporting a good or better health status among the subpopulation of older adults with an ADL limitation compared to the broader older adult population. This version of the model found that older adults with ADL limitations (OR=1.107) were more likely to have a good or better health status if they did not have assistive features in-home. Among this subpopulation, it was also found that having Medicare (OR=4.455) and dual enrollment in Medicare and Medicaid (OR=3.528) made older adults more likely to report a good or better health status compared to older adults who did not have insurance.

Among older adults with ADL limitations, those who rent (OR=1.014), live rent free (1.103), or use another housing arrangement (OR=1.089) were more likely to report having a good or better health status compared to those who own their homes. This version of the model also showed that older adults aged 65-74 (OR=0.677) and 75-84 (OR=0.609) were less likely to report a good or better health status compared to the reference group of the older adults aged 85 and above. Overall, these results from both versions of the model support the literature that assistive features, age, and ADL limitations impact older adult health status (Pynoos et al., 2012).

Table 3. Logistic Regression of Good or Better Health Status among Older Adults with ADL Limitations, 2018 HRS

	Odds Ratio	Std. Err.	*P*
Assistive Features			
Yes		Ref.	
No	1.107	0.1263	0.6872
Sex			
Male		Ref.	
Female	0.68	0.1093	0.0784
Age			
65-74 years	0.677	0.1541	0.5382
75-84 years	0.609	0.1325	0.13
85+ years		Ref.	
Housing Arrangement			
Own		Ref	
Rent	1.014	56.5002	0.9731
Live Rent Free	1.103	56.5006	0.9719
Other	1.089	56.5018	0.9721
Marital Status			
Never married / Single		Ref.	
Married	0.917	0.19	0.376
Separated / Divorced	0.638	0.2055	0.3426
Widowed	0.617	0.1774	0.1994
Health Insurance Type			
No Insurance		Ref.	
Medicare only	4.455	71.8105	0.9712
Medicaid only		.--	
Dual enrollment	3.528	71.8105	0.9686

Notes:
There was on only one Medicaid only observation,
thus, it was omitted. * Indicates significance at the $p<0.05$ level

Chapter 6: Conclusion

Discussion

The primary purpose of this study was to analyze the relationship between assistive features in the home and health status using the person-environment concept and environmental press theory to guide my study. The addition of assistive features in homes would help reduce the environmental press older adults with ADL limitations experience and thus increase their health status. From this study, I was able to find that among all older adults, not having assistive features within home environments increased the odds of having a good or better health status and that older adults who reported at least one ADL limitation report higher rates of a poor or fair health status.

One reason behind the lack of assistive features increasing the odds of having a good or better health status may be that older adults who have assistive features may perceive their health as fair or poor because of their need for these features or the limitations they face that make assistive features helpful. The presence of these features may be seen to challenge their independence and thus could have a negative impact on their self-perceived health. Overall, both the descriptive statistics and regression analysis confirm that older adults with ADL limitations report higher levels of poor or fair health status compared to older adults without ADL limitations. Additionally, older adults with health insurance were more likely to report good or better health status compared to those who did not have insurance.

Limitations

This study has several limitations. One of the main limitations revolves around the data. Since the 2018 HRS datasets are relatively new and not yet finalized, the data cannot be used as an estimate for the U.S. population as survey weights are not available. Without using survey weights, any existing response bias is likely to alter the results. HRS data also has the limitation of being a very content-rich source of data that provides information on a vast number of different topics, but many insightful questions in modules are left blank, due to a huge number of partial interviews.

For this study, I was unable to include race/ethnicity as a part of my data analysis as less than 2% of respondents completed the race and ethnicity questions within the demographics module. This massive lack of information made it best to not include race/ethnicity data since too many observations were blank for those specific questions' responses. Another weakness of the HRS is that all the information is self-reported. My outcome variable, indicating a good or better health status, was based on the respondents' self-reported health on a five-point scale, which can be subject to misreporting, bias, and measurement errors. Additionally, another limitation is not knowing what older adults may need to deem themselves in good or better health status, as self-reported health status questions are highly subjective and dependent on the respondent.

Public Health Significance

As the population continues to age, housing and aging in place disparities will increase due to the current housing stock of affordable, accessible living spaces being significantly limited. Less than 4% of U.S. residential units currently on the market are suitable for people with moderate mobility disabilities, and only 1% of these units are wheelchair accessible (U.S. Department of Housing and Urban Development, 2017). In order to address the housing, health, and service needs of older adults, we must develop additional coordinated care efforts.

Examples of these efforts include supporting aging in place and home modifications through the expansion of the self-directed services model to cover additional Medicaid and Medicare recipients. Currently, much of aging in place and home modifications programs for older adults are executed through Medicaid waivers, Community Block Grants, or Older Americans Act Title III funds, which have strict eligibility requirements. The U.S. should consider the efforts other countries such as Japan have made to support aging in place. Japan's National Long Term Care Insurance Program pays for the installation of grab bars, "comfort"-height toilets, and floor level modifications such as ramps for older adults (Pynoos, 2018). If the U.S. adopts this modification portion of Japan's program and makes it available to a variety of older adults, it could make a significant impact on older adult health and help older adults age in place.

Successful aging requires involvement from older adults, members of their social networks, the government, and health professionals. Further research is needed to investigate how older adults' housing including types of housing, communities,

and modifications affects their health. As shown through the data presented and the literature, the need for built environments, specifically housing, that are accessible and affordable for some older adults is greatly needed. By proposing solutions to the age-related housing problems stated in this study and understanding what specific needs are supportive to older adults successfully aging within their homes and communities, researchers and legislators can help restructure housing policies to improve older adults access to homes tailored for their needs.

Bibliography

Administration for Community Living, & Administration on Aging. (2018). *2017 Profile of Older Americans*. U.S. Department of Health and Human Services.

Barnett, E., & Casper, M. (2001). A definition of "social environment". *American Journal of Public Health, 91*(3), 465.

Byrnes, M., Lichtenberg, P. A., & Lysack, C. (2006). Environmental Press, Aging in Place, and Residential Satisfaction of Urban Older Adults. *Sociological Practice, 8*(2), 50–76. JSTOR.

Cacioppo, J. T., & Cacioppo, S. (2018). The growing problem of loneliness. *Lancet (London, England), 391*(10119), 426. https://doi.org/10.1016/S0140-6736(18)30142-9

Carnemolla, P., & Bridge, C. (2016). *ACCESSIBLE HOUSING AND HEALTH-RELATED QUALITY OF LIFE: MEASUREMENTS OF WELLBEING OUTCOMES FOLLOWING HOME MODIFICATIONS*. https://doi.org/10.26687/archnet-ijar.v10i2.977

Fixr. (2017). *Cost to Remodel for Aging in Place—Estimates and Prices at Fixr*. Fixr.Com. https://www.fixr.com/costs/aging-in-place-remodeling

Fredriksen-Goldsen, K. I., Kim, H.-J., Emlet, C. A., Muraco, A., Erosheva, E. A., Hoy-Ellis, C. P., Goldsen, J., & Petry, H. (2011). *The Aging and Health Report: Disparities and Resilience Among Lesbian, Gay, Bisexual, and Transgender Older Adults: (561402013-001)* [Data set]. American Psychological Association. https://doi.org/10.1037/e561402013-001

Harvard Joint Center for Housing Studies. (2014). *Housing America's Older Adults—Meeting the Needs of an Aging Population*. https://www.jchs.harvard.edu/sites/default/files/jchs-housing_americas_older_adults_2014.pdf

Health and Retirement Study 2018 Core Data Description and Usage. (2019). University of Michigan. http://hrsonline.isr.umich.edu/modules/meta/2018/core/desc/h18dd.pdf

Hwang, E., Cummings, L., Sixsmith, A., & Sixsmith, J. (2011). Impacts of Home Modifications on Aging-in-Place. *Journal of Housing For the Elderly*, *25*(3), 246–257. https://doi.org/10.1080/02763893.2011.595611

Johnson, J. H., & Appold, S. J. (2017). *U.S. OLDER ADULTS: DEMOGRAPHICS, LIVING ARRANGEMENTS, AND BARRIERS TO AGING IN PLACE* (p. 32). Kenan Institute.

Keenan, T. A. (2010). Home and Community Preferences of the 45+ Population. *AARP*, 25.

Kemperman, A., van den Berg, P., Weijs-Perrée, M., & Uijtdewillegen, K. (2019). Loneliness of Older Adults: Social Network and the Living Environment. *International Journal of Environmental Research and Public Health*, *16*(3). https://doi.org/10.3390/ijerph16030406

Kenan Institute. (2017a). *Older Adults and The Challenges of Aging in Place*.

Lee, S. B., Oh, J. H., Park, J. H., Choi, S. P., & Wee, J. H. (2018). Differences in youngest-old, middle-old, and oldest-old patients who visit the emergency

department. *Clinical and Experimental Emergency Medicine*, *5*(4), 249–255. https://doi.org/10.15441/ceem.17.261

Lyu, W., & Wolinsky, F. D. (2017). The Onset of ADL Difficulties and Changes in Health-Related Quality of Life. *Health and Quality of Life Outcomes*, *15*. https://doi.org/10.1186/s12955-017-0792-8

Newman, S. (2003). The Living Conditions of Elderly Americans. *The Gerontologist*, *43*(1), 99–109. https://doi.org/10.1093/geront/43.1.99

Pearson, C. F., Quinn, C. C., Loganathan, S., Datta, A. R., Mace, B. B., & Grabowski, D. C. (2019a). The Forgotten Middle: Many Middle-Income Seniors Will Have Insufficient Resources For Housing And Health Care. *Health Affairs*, *38*(5), 10.1377/hlthaff.2018.05233. https://doi.org/10.1377/hlthaff.2018.05233

Pearson, C. F., Quinn, C. C., Loganathan, S., Datta, A. R., Mace, B. B., & Grabowski, D. C. (2019b). The Forgotten Middle: Many Middle-Income Seniors Will Have Insufficient Resources For Housing And Health Care. *Health Affairs*, *38*(5), 10.1377/hlthaff.2018.05233. https://doi.org/10.1377/hlthaff.2018.05233

Pynoos, J. (2017). Housing for Older Adults: A Personal Journey in Environmental Gerontology. *Annual Review of Gerontology & Geriatrics*, *38*(1), 147–164. https://doi.org/10.1891/0198-8794.38.147

Pynoos, J. (2018). The Future of Housing for the Elderly: Four Strategies that Can Make a Difference. *Public Policy & Aging Report*, *28*(1), 35–38. https://doi.org/10.1093/ppar/pry006

Pynoos, J., & Nishita, C. M. (2003). The Cost and Financing of Home Modifications in the United States. *Journal of Disability Policy Studies*, *14*(2), 68–73. https://doi.org/10.1177/10442073030140020201

Pynoos, J., Steinman, B., Nguyen, A. Q. D., & Bressette, M. (2012). Assessing and Adapting the Home Environment to Reduce Falls and Meet the Changing Capacity of Older Adults. *Journal of Housing for the Elderly*, *26*(1–3), 137–155. https://doi.org/10.1080/02763893.2012.673382

Robert Wood Johnson Foundation. (2009). *Developing and Implementing Self-Direction Programs and Policies: A Handbook*. https://www.rwjf.org/en/library/research/2009/02/developing-and-implementing-self-direction-programs-and-policies.html

Shaw, J. G., Farid, M., Noel-Miller, C., Joseph, N., Houser, A., Asch, S. M., Bhattacharya, J., & Flowers, L. (2017). Social Isolation and Medicare Spending: Among Older Adults, Objective Isolation Increases Expenditures While Loneliness Does Not. *Journal of Aging and Health*, *29*(7), 1119–1143. https://doi.org/10.1177/0898264317703559

Tanner, B., Tilse, C., & Jonge, D. de. (2008). Restoring and Sustaining Home: The Impact of Home Modifications on the Meaning of Home for Older People. *Journal of Housing For the Elderly*, *22*(3), 195–215. https://doi.org/10.1080/02763890802232048

Taylor, L. (2018). *Housing And Health: An Overview Of The Literature*. Health Affairs. https://www.healthaffairs.org/do/10.1377/hpb20180313.396577/full/

Thomson, H., Thomas, S., Sellstrom, E., & Petticrew, M. (2013). Housing improvements for health and associated socio-economic outcomes. *The Cochrane Database of Systematic Reviews*, *2*, CD008657. https://doi.org/10.1002/14651858.CD008657.pub2

Urban Institute. (2014, December 16). *The US Population Is Aging*. Urban Institute. https://www.urban.org/policy-centers/cross-center-initiatives/program-retirement-policy/projects/data-warehouse/what-future-holds/us-population-aging

U.S. Department of Housing and Urban Development. (2017). *Housing for Seniors: Challenges and Solutions*. https://www.huduser.gov/portal/periodicals/em/summer17/highlight1.html