ABSTRACT

Title of Thesis: RACIAL AND ETHNIC DISPARITIES IN ADL LIMITATIONS AMONG MEDICARE BENEFICIARIES AND THE EXPERIENCE OF TRANSPORTATION BARRIERS IN THE ADL POPULATION

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The study's aims were to first determine if racial/ethnic disparities in ADL limitations for low-income Medicare beneficiaries. The logistic regression results suggested there is a variance in ADL limitation among Medicare Beneficiaries across race. Then, it tested if low-income elderly Medicare enrollees aged 65 years and older were at a higher risk of experiencing transportation barriers to care. On account of covariates, persons with ADL limitations (OR: 2.47 $p<0.001$) had higher odds of having transportation barriers compared to those without ADL limitations. Non-Hispanic African Americans had a higher chance of experiencing transportation delays than non-Hispanic Whites (OR 1.76 $p<0.001$). Finally, the effect size for transportation access barriers did not have a dose-relationship with increasing ADL limitation severity. Though the point estimates suggested that barriers were greatest for those with moderate severity (3-4 ADLs), it failed to find evidence of a statistically significant dose-response relationship between ADL severity and transportation.

RACIAL AND ETHNIC DISPARITIES IN ADL LIMITATIONS AMONG MEDICARE BENEFICIARIES AND THE EXPERIENCE OF TRANSPORTATION BARRIERS IN THE ADL POPULATION

by

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Chapter 1: Introduction

Activities of daily living (ADL) limitations include challenges performing routine activities such as dressing, bathing, eating, or attending to hygiene, due to physical, intellectual, or mental impairments (Bickenbach et al. 1999). Either ADL limitations pose challenges for elderly persons in the form of having unmet care needs, having to pay for a caregiver, or experiencing relationship changes as family caregivers take on caregiving roles.

Nearly twenty-six percent of people in the United States experience one or more ADL limitation(s) (Centers for Disease Control and Prevention, 2020). Prior studies have documented that ADL limitations are not evenly distributed in the U.S. (Merrill et al., 1997). In the general US population, ADL limitations are more prevalent among low-income groups who face unique barriers to health care services in their communities. For example, low-income people lack the same resources as higher-income individuals and may not have the same access to enabling services such as transportation (Van Houtven et al., 2020). These resource constraints may result in barriers to accessing health care.

While there is a large body of evidence on the distribution of ADLs and the challenges they present, less is known about variation in ADL prevalence among low-income elderly Medicare beneficiaries. Furthermore, little is known about whether low-income elderly Medicare beneficiaries experience transportation-related barriers to care compared to their non-limited counterparts.

In the United States, African Americans and Hispanics report poor functional ability at a higher rate than non-Hispanic Whites (Kington et al., 1997). These patterns reflect broader disparities in health: racial and ethnic minority groups experience a higher disease burden for hypertension, diabetes, arthritis, and heart conditions across the life course (Lin, 2000). These disparities result from racism and economic inequalities in the United States. Racism forms structural barriers, fosters implicit bias, and generates explicit barriers for low-income persons seeking to access health care. Jones (2000) suggests that institutionalized, personally mediated, and internalized racism contributes to observed racial difference in health outcomes. Of the three levels of racism, institutionalized racism can lead to organizational inaction in the face of need and preserve societal norms predicated on biological determinism (Jones, 2000).

Of course, the three categories of racism are not mutually exclusive in creating ADL limitations. For one thing, these categories of racism play a crucial role in how health interventions are implemented to address health inequities. Similarly, intentional and unintentional actions from external stakeholders such as the government can also impact who is allowed to obtain quality health care in a system that reflects systems of privilege.

Documenting whether race and ethnicity-based differences in ADL limitation prevalence exists among elderly low-income Medicare beneficiaries addresses an important research gap. If racial and ethnic disparities in ADL limitations exist for low-income Medicare beneficiaries, health systems can begin to develop wrap-around programs to address the care needs of this vulnerable population. Indeed, as of 2020,

the Medicare Advantage program can tailor benefit offerings to beneficiaries with chronic illnesses under the CHRONIC Care Act (Willink et al., 2018). Successful implementation of programs like the CHRONIC Care Act will require evidence about the distribution of ADLs across groups and what tangible barriers, like transportation, people with ADLs face.

Chapter 2: Research Questions and Specific AIMS

This project will estimate racial and ethnic differences in the prevalence of ADL limitations among low-income elderly Medicare beneficiaries. It will also estimate the prevalence of transportation barriers faced by low-income elderly Medicare beneficiaries living with ADL limitations. My specific aims are:

Aim 1: Estimate racial and ethnic disparities in ADL limitations for low-income Medicare beneficiaries.

> Hypothesis 1: Non-Hispanic Black and Hispanic low-income Medicare beneficiaries experience greater ADL limitations compared to non-Hispanic White beneficiaries.

Aim 2: Determine if low-income Medicare beneficiaries with ADL limitations report greater transportation barriers in accessing healthcare than low-income Medicare beneficiaries without ADL limitations and examine the dose-response associations of ADL severity.

> Hypothesis 2a: Low-income Medicare beneficiaries with ADL limitations will report greater transportation barriers than low-income Medicare beneficiaries without ADL limitations.

> Hypothesis 2b: The effect size for transportation access barriers will positively correlate with increasing ADL severity.

Chapter 3: Background and Literature Review

My literature review first presents an overview of Medicare, Medicaid, dual-eligibility, and coverage of supportive services. Second, I address racial and ethnic disparities in ADL limitations. Third, I review studies examining other margins of disparities in ADL limitations in the United States. Fourth, I present literature on male-female differences in ADL limitations in the United States. Finally, I discuss the intersectionality of risk and protective factors and describe the gap in knowledge regarding the intersection of being a low-income (but not dually eligible) Medicare beneficiary, race and ethnicity, and transportation barriers to receiving health care among seniors with ADL limitations.

Section 1: Activities of Daily Living Limitations

Activities of Daily Living (ADLs) make up the essential and routine tasks that individuals do to maintain normal health and function, including eating, bathing, dressing, and toileting. ADLs are typically assessed in elderly persons to understand level of function in order to enhance patient care and management (Edemekong et al., 2021). Sidney Katz first used the term 'activity of daily living' in 1950. Since then, ADL has been used as an indicator of an individual's functional status. The Activities of Daily Living Scale developed by Katz remains the commonly used instrument for measuring the basic and instrumental activities of daily living.

Katz (1983) also mentioned that elderly persons who require long-term care are likely to have two or more illnesses, which are commonly referred to now as multiple chronic conditions. The study by Katz (Katz, 1983) suggested that success of

long-term care for elderly persons is often evaluated based on maintenance of function as opposed to finding a cure for chronic conditions. In a general sense, the measure of ADLs contributed to the knowledge expansion regarding finding a balance between intensive and supportive services for elderly persons over time.

While useful for finding the balance between intensive and supportive services for elderly persons, potential issues may arise with the unsolicited collection of individual data on functional limitations (Willink et al., 2018). Impaired ability to perform ADLs has been associated with poorer access to health care after adjusting for sociodemographic, behavioral and system features (McClintock et al., 2017). In this case, innovative models of care could elucidate on racial and ethnic disparities in ADL limitations for low-income Medicare beneficiaries (Aim 1). At the same time, Willink and colleagues' study (2018) proposed for the revision of payment models to understand the factors driving the higher costs incurred by those with functional impairments. These factors are in alignment with my study's aim 2 on finding out if low-income Medicare beneficiaries with ADL limitations report greater transportation barriers in accessing healthcare than those who are not functionally impaired.

Section 2: Racial and Ethnic Disparities in ADL Limitations

Tipirneni et al. (2020) used the 2002-2016 Health and Retirement Study (HRS) national sample survey of community-dwelling adults aged 55-64 years old prior to the Medicare eligibility age. Approximately, 48,340 person-years were identified, of which 17,516 respondents participated in the survey. The objective of the study was to examine trends in functional ability among U.S. adults and evaluate

if changes occurred or if disparities were concentrated among specific demographic groups (Tipirneni et al., 2020).

The results generated showed that the proportion of non-Hispanic Blacks with ADL impairments is nearly double that of non-Hispanic Whites (Tipirneni et al. 2020). There were significant differences in ADL and IADL limitations overtime for adults aged 55-64 years of age. Nonetheless, in this study, the prevalence of functional limitation was non-significant across gender, Hispanic ethnicity and urban/rural groups. The findings suggest that persons with lower education and income levels experienced greater functional impairment (Tipirneni et al., 2020).

Garcia and colleagues focused on the topic of disability among Hispanics of Mexican origin. According to the findings of the study (Garcia et al. 2015) smoking and drinking did not affect disability prevalence among Hispanics. In this study the major finding was that older Hispanics are more likely to be more disabled than older non-Hispanic whites.

In a follow up study, Garcia et al. (2017) conducted a literature review identifying risk factors for disability in older Hispanic populations in the United States. They assessed studies from 1996 to 2017 in their review. The life course perspective and the Hispanic Paradox served as frameworks to summarize recent literature on the risk factors impacting older Hispanics with disabilities. The Hispanic paradox indicates that Hispanics have better health and mortality outcomes than African Americans despite comparable poverty rates. Though Hispanics aged 70 years and older had longer life expectancies than non-Hispanic whites, they were more likely to remain permanently disabled in old age. Their disabilities varied by

country of origin, age, and the number of years they lived in the United States (Garcia et al., 2017). Puerto Ricans had the highest rates of disability regardless of gender, and South Americans reported lower disability rates than non-Hispanic Whites (Garcia et al., 2017). Interestingly, older Hispanic women experienced higher levels of disability compared to non-Hispanic women after controlling for health, socioeconomic status, and behavioral health covariates (Garcia et al., 2017).

The larger body of research suggests that ADL limitations can be impacted by health characteristics (i.e., smoking, drinking, etc.) and acculturation. Immigrants adopt behaviors and traits of their host country when they assimilate into a new environment (Melvin et al., 2014). This could lead to adopting negative health behaviors over time. The literature is clear that overweight and obesity increase among Hispanics dependent on length of residence in the US (Kaplan et al., 2004). There is a well-documented relationship between overweight, obesity, and type 2 diabetes risk (Aguayo et al., 2019). These associations suggest a sequela between length of stay in the US, overweight/obesity, type 2 diabetes, and ADL limitations for Hispanics (Howrey et al., 2016).

One study's objective was to determine if older Medicare recipients enrolled in Medicare risk health maintenance organizations (HMOs) reported differences in disability status than fee-for-service (FFS) beneficiaries (Porell et al., 2001). Porell et al. (2001) conducted telephone interviews from the 1991 to 1996 via the Medicare Current Beneficiary Survey. Five multinomial logit models estimated as single-state transition model to facilitate the secondary analysis of annual functional status transitions of 44,765 Medicare beneficiaries with or without supplementary

insurance. These beneficiaries were either enrolled in FFS or HMO programs. In this study, functional decline was associated with body mass index (Porell et al., 2001). Elderly persons with a higher BMI exhibited accelerated functional deterioration. Those with a BMI below 20 had a greater risk of mortality.

Moreover, a cross-sectional study (Vazquez et al.,2020) examined the prevalence of mobility and physical function limitations by race and ethnicity on 28,854 adults sixty years and older with and without ADL limitations. About 33.3 percent of non-Hispanic Blacks reported limitations in basic and instrumental ADLs, followed by 28.6 percent of non-Hispanic Whites and 26.2 percent Hispanics adjusting for age, gender, and education. The unadjusted model revealed that Hispanics and other races had lower mobility limitations odds than non-Hispanic Whites (Vasquez et al., 2020). Nonetheless, Vasquez et al. (2020) did not have data in all of the components of IADLs/ADLs, which may have undervalued the observed association between race and ethnicity with functional limitations.

Social support can serve as a protective factor to lower the odds of elderly persons having mobility limitations. In this case, Hispanics may self-report increased social support due to living in places where public transportation is available and accessible for persons with mobility impairment (Chen et al., 2004). These social networks may provide resources to their residents by promoting social connectedness and well-being consistent with the Hispanic paradox (Speare et al. 1991; Vazquez et al., 2020).

Section 3: Other Margins of Disparity

Subsection 1: Geographic, Gender and Income Variation in ADL Limitations in the United States

Tipirneni et al. (2020) examined trends on how disparities are concentrated in specific demographic groups using a nationally representative sample of community-dwelling persons. The cross-sectional study found that functional disparities are prevalent for minorities and individuals with a low socioeconomic status (SES). Furthermore, individuals with similar socio-demographic attributes from different states may not receive the same level of quality of care or services (Merlis, 2004).

When looking at the regional level, Porell and colleagues (2002) found regional differences in the prevalence of ADL limitations that were not attributed to population composition, socio-demographic factors, and chronic medical conditions. The majority of ADL limitations among older women living in the Deep South could not be traced back to these risk factors compared to older men. This is consistent with the findings of previous studies (Zopf, 1992) showing that southern states have higher burden of disease. One of the limitations to furthering the study of geographical differences in distribution of ADLs is that geo-referenced data from national surveys are often restricted in public use files, making it more challenging to determine disability prevalence in different states or regions (Lin, 2000).

Similarly, differences were found among men and women in motor and ADL processes and ability (Murtagh et al., 2004). In general, women needed more assistance with gripping and reaching than with the upkeep of hygiene. It should be noted that the causes of ADL limitations may be attributed to differences in body

composition between men and women. One study found differences in muscle group strength to perform tasks such as carrying, squatting, raising arms, and climbing stairs (Wheaton et al., 2016). One possible explanation may be that men have a slight advantage on the ADL motor scale because of their more significant physical activity and physiologically determined greater muscle mass. This is consistent with recent literature on women performing everyday household tasks than men inducing more physical strain on their physical bodies (Merritt et al., 2003). However, there have been no conclusive studies on the sex differences in performance measures for women compared to men (Wheaton et al., 2016).

Subsection 2: Transportation Barriers in Medicare Beneficiaries with ADL Limitations in the United States

Across the literature I surveyed, I found some studies that focused on transportation barriers that would impact Medicare beneficiaries in near poor or low-income households. Though the literature review on health disparities by race and ethnicity is clear, the paucity of analyses focused on low-income Medicare beneficiaries who are not dually eligible remains a gap (Aim 1). Furthermore, the lack of studies on transportation barriers among Medicare beneficiaries provides justification for my study on documenting whether race and ethnicity-based differences in ADL limitation prevents low-income Medicare beneficiaries from obtaining health care services (Aim 2).

Coordinated care plans such as Medicare Advantage are planning to include supplemental nonemergency medical transportation benefits for dually eligible enrollees (Govender et al. 2021). Notwithstanding, in addition to increasing the

availability of transportation for Medicare beneficiaries, additional support is needed in augment the availability of volunteer drivers (University of Minnesota Rural Health Research Center, 2021).

When transportation assistance is not provided, elderly persons may feel a sense of social isolation and a decrease in their quality of life because transportation also impacts their access to grocery shopping, getting to medical appointments, picking up medications, and an increase in their perception of not having control or being able to adapt in their communities (Anderson et al., 2020). Ryvicker et al. (2020) supports this finding by reporting that an estimated 10.8 million community-dwelling elderly persons in the United States rarely or never drive. Out of the 10.8 million nondrivers, 2.3 million of these persons (25%) were deemed transportation disadvantaged (Ryvicker et al., 2020).

Moreover, the Transit Cooperative Research Program (2005) reported that in 2005, about 3.6 million older, poor and people of ethnic and racial minorities did not receive non-emergency medical care due to transportation barriers or transit systems. Non-emergency medical transportation services are mostly available for those with chronic diseases and with poor access to transportation (Powers et al. 2016).

In particular, the transportation barriers impacted forty-one percent of patients who live in rural communities in the United States (University of Minnesota Rural Health Research Center, 2021). On average, these patients have poorer health compared to individuals living in urban areas (University of Minnesota Rural Health Research Center, 2021). These barriers further exacerbate patients' access to care due to the long distances between patients' homes of record and health facilities, the lack

of affordability of existing transportation options, and the lack of public transportation in small towns.

These factors are coupled with the lack of distinct boundaries between state, regional, and municipal transportation systems that make travel difficult for elderly persons (University of Minnesota Rural Health Research Center, 2021). Even with the expansion of telehealth capabilities, older Medicare beneficiaries may not have access to internet services to obtain care in rural or urban areas (McClintock et al., 2017).

A study by McClintock et al. (2017) found statistically significant differences in transportation barriers with 8.8 percent of beneficiaries with no ADL limitations reporting needing transportation to get to the doctor or hospital compared with 39.3 percent with higher ADL limitations reporting transportation barriers. Therefore, my study contributes to the ongoing effort to understand social determinants of health to generate more inclusive policies to improve health, and reduce longstanding disparities in health and health care related outcomes due to ADL limitations.

Subsection 3: Medicare, Medicaid, and Coverage of Supportive Services for People with ADL Limitations

The population for the proposed study is the community dwelling, low-income elderly adults who are eligible for Medicare on account of their age. The

following section describes the major health insurance programs effecting this population: Medicare and Medicaid.

Medicare is the U.S. public health insurance program that covers people with end-stage renal disease, those with long-term disabilities, and adults aged 65 and over. While Medicare is available to all income groups, Medicaid is a means-tested health insurance program intended to insure the lowest income individuals in the US, including very low-income seniors. When people are eligible for both Medicare (based on age) and Medicaid (based on income), these individuals are referred to as "dual eligible" individuals. Dual eligible populations face unique challenges because they often have high intensity needs, multiple chronic conditions, and high use of prescription drugs.

The program requirements for Medicare are uniform nationwide, though Medicare does not cover all medical expenses, the cost of long-term care, or many support services needed by people living with ADL limitations. The program is sectioned in four major parts: Medicare Part A (Hospital Insurance) and Medicare Part B (Medical Insurance), Part C (Managed Care Plans) and Part D (Drugs). Beneficiaries pay premiums for B and D coverage and Part C if they opt in to a managed care plan. Beneficiaries with higher incomes pay higher monthly premiums for Parts B and D.

Each part of Medicare is subject to distinct cost sharing policies. Medicare Part A covers limited time in a skilled nursing facility and inpatient care in a hospital. Medicare Part B pays for outpatient care, medical equipment and some preventive services. Part D covers prescription drugs. Beneficiaries may purchase private

supplementary policies to cover the gaps left by the basic Medicare benefit package. For example, Medigap policies help beneficiaries pay for Medicare out-of-pocket copayments. Beneficiaries may opt to forgo Medicare's traditional fee-for-service system and instead opt for a managed care plan. Medicare Advantage Plans provide a comprehensive health benefits bundle package that includes Parts A, B, and D, and often includes vision, hearing, dental services and other services not covered by traditional Medicare. An early finding was that functionally independent FFS individuals with supplementary insurance had lower odds of becoming disabled in ADLs than HMO beneficiaries. Also, having Medigap supplementary insurance was associated with lower mortality risk among beneficiaries with functional limitations (Porell et al., 2001).

Medicare beneficiaries with low incomes may also be also eligible for Medicaid, dependent on the income standards established in the states where they live. The Medicaid population often includes persons with multiple chronic illnesses, disabilities, and behavioral health conditions (Medicaid and CHIP Payment and Access Commission (MACPAC) 2021). In 2020, MACPAC reported that sixty-one percent of recipients of Medicaid were females, fifty-eight percent were aged 65 and older, fifty-seven percent white and fifty-six percent had at least one ADL. On average, dually eligible beneficiaries accounted for thirty-four percent of spending in Medicare among twenty percent of enrollees (MACPAC, 2021).

Medicaid is a joint federal and state assistance program that varies across states. Low-income Medicare beneficiaries can qualify for Medicaid under different pathways. Dual eligible rely on Medicaid for the coverage of long-term care services

and supports (LTSS) including some behavioral health services and Medicare premiums and cost sharing (Medicare-Medicaid Coordination Office, 2020). Elderly persons can become eligible for dual status based on age, disability, and income.

Dual status recipients qualify for Medicaid through one of the following eligibility criteria: Low Income—SSI-Cash, Low Income—Poverty, Medically Needy, Section 1115 Waiver, or other special income rule or requirements (Feng et al., 2017). The three pathways to dual eligibility status are Medicare-to-Medicaid, Medicaid-to-Medicare, and simultaneous transition (Feng et al., 2017).

In the Medicare-to-Medicaid pathway, persons are Medicare beneficiaries who later become eligible for full Medicaid benefits, most likely because of low income. In the second Medicaid-to-Medicare pathway, a person retains full Medicaid benefits and later qualifies for Medicare. In the final pathway, individuals are not initially eligible for Medicare and Medicaid benefits, but they subsequently gain coverage with full benefits (Feng et al., 2017). Medicaid covers Medicare cost-sharing liability and for full-benefit duals, offers additional benefits (i.e., long-term care) beyond the standard Medicare benefit package.

While dual eligibility offers several important benefits, many who are eligible do not participate. Many people who do participate often have high needs. The dual eligible population has increased from 8.6 million in 2006 to 12.3 million beneficiaries in 2019 (Govender et al., 2021). Approximately 12.2 million individuals qualified for combined Medicare and Medicaid health benefits in 2018 (Medicare-Medicaid Coordination Office, 2020). The combined Medicaid and Medicare spending for dual-eligible beneficiaries was $312.4 billion (Govender et al., 2021).

Increasingly dual-eligible individuals are forced to participate in managed care plans, with thirty-seven percent of dual eligible individuals enrolled in Medicare managed care in 2018, an eighteen percent increase from 2009 (CMS, 2020).

This thesis project will develop new evidence about the distribution of ADLs among the population of people that the dual-eligible program is designed to assist. Furthermore, I will present evidence about the importance of transportation barriers in this population – a key enabling resource.

Porell et al. (2001) conducted a secondary analysis of annual functional status transitions using the Medicare Beneficiary Survey (1991-1996). The survey results showed the odds of beneficiaries enrolled in Medicare or fee-for-service private insurance minimized functional decline. In a year, the odds of becoming disabled with ADLs decreased to about thirty to forty percent for individuals with supplementary health insurance or HMO insurance coverage compared to persons with no private supplemental health insurance. Overall, no association was found between adverse functional status outcomes and enrollment in managed care plans (Porell et al., 2001).

Managed care plans not only influence health outcomes, but also have unique cost sharing compared to FFS. The extent to which consumers share costs for FFS Medicare has been studied extensively. Cubanski et al. (2018) have shown how health-related expenses are a share of total household spending for Medicare and non-Medicare households, using the 2016 Consumer Expenditure Survey (CE). The survey excludes non-institutional populations and out-of-pocket costs on nursing homes and long-term care facilities. Overall, the average total household spending on

health-related expenses for Medicare households was fourteen percent compared to six percent for non-Medicare households. This may indicate that health expenses increase for older Medicare households due to the increase of healthcare needs and a decline on spending on other items compared to younger Medicare households. Moreover, near poor and middle-income Medicare households has a larger spending share of the total household spending on health-related expenses than very low and high-income Medicare households (Cubanksi et al., 2018).

In contrast, in an older study, it was observed that under traditional fee-for-service programs from 1993 to 1997, Medicare enrollees spent an average of twenty-three percent of their income for out-of-pocket health expenses (Gross et al., 1999). These expenses included Medicare deductibles, copays, premiums for private insurance, and billing expenses from medical providers. Overall, the gaps in Medicare coverage since the 1990s to the present can affect health outcomes of low-income beneficiaries living below the federal poverty level or who do not receive Medicaid assistance.

Notably, Medicare does not cover many of the support services needed by people living with functional limitations. In a study by Komisar and colleagues, fifty-eight percent of elderly persons needing support with activities of daily living report unmet care needs (Komisar et al., 2005). Notwithstanding, Komisar et al. (2005) found that this population reported not having difficulties accessing medical services, since this group qualified for both the Medicaid and Medicare programs which provides them access to medical and long-term care services.

To further elaborate on the study by Komisar and colleagues (2005), their approach was to survey dual-eligible across six states. At the outset, a large proportion of dual-eligibles reported experiencing falls or difficulty bathing or clothing themselves. The findings suggest that long-term care expenses related to meeting ADL limitations made up the majority of dual-eligible program costs. The findings also demonstrated that when states funded access to supportive care, the incidence of unmet ADL support needs was reduced. Notwithstanding, the high cost of providing ADL support services remains a contentious debate, as states face critical challenges in managing state Medicaid expenses.

Chapter 4: Conceptual Model

Andersen's Behavioral Model of Health Service Use provides a useful framework for organizing the empirical evidence reviewed above and motivates my conceptual model described in Figure 1. While Andersen's model is focused on service use rather than health as the end point of analysis, the framework nonetheless helps to organize ideas.

The Andersen model emphasizes a social structure that explains how predisposing (age, sex) enabling factors (e.g., social networks, demographic factors, economic resources), and need factors (e.g., chronic conditions) can impact individuals' utilization of health services and measures of health care access (Andersen, 1995). Importantly, Andersen's model highlights why describing the level of need and enabling factors in the population is critical for delivering accessible health care to populations.

In my application of Andersen's model, I conceptualize race and income as enabling factors. Locating income as an enabling factor agrees with Andersen's original formulation (Andersen & Newman, 1973). Enabling factors refer to resources that allow for the consumption of services when there is demand for service use. Andersen states: "Even though individuals may be predisposed to use health services, some means must be available for them to do so. A condition which permits a family to act on a value or satisfy a need regarding health service use is defined as enabling."

However, locating race as an enabling factor is not aligned with Andersen's formulation. Instead, Andersen locates race as a predisposing factor. While he separates predisposing factors into demographic, *social structure* (of which race is a

member), and beliefs, he conceptualizes all categories of predisposing factors, including social structure variables, as capturing individual preferences. He states of predisposing social structure variables, "These characteristics suggest what the lifestyle of the individual may be, and they point to the physical as well as social environment of the individual and associated behavior patterns which may be related to the use of health services."

Positioning race as factor that predicts a person's service use via "behavior" and "lifestyle" ignores and obscures that racial differences in service use fundamentally arise from racist systems that constrain people of color from using services they desire. Race is better located as an enabling factor because racism transforms meaningless phenotypic variation into real resources and real power that enable people "to act on a value or satisfy a need." This is not to say that racism might not also influence individual behaviors and underlying desires. However, on balance, the insights of scholars such as Jones (2000), suggest that race *enables* service use.

Figure 1 on the conceptual framework suggests that racial and ethnic disparities are associated with ADL limitations and limitation severity for low-income Medicare beneficiaries (Aim 1). Race/ethnicity moderates the strength of the association between ADL limitations and transportation barriers, and health care outcomes (Aim 2). In addition to race/ethnicity, the other observed confounders and ADL limitations can have an effect on transportation barriers among elderly persons.

Aim 2 will explore the association of transportation barriers with ADL limitations. The independent variables for this study include age, gender, income

level, educational attainment, region, and marital status. These variables will be used to assess its potential effect on the prevalence of ADL limitations for Medicare beneficiaries. Previous studies suggest these variables may be risk factors that can lead some groups to self-report higher functional status than others (Van Houtven et al. 2020).

The unobserved covariates are the effects of occupation history and health behavior history. These could be potential confounders on higher reporting of ADL limitations amongst elderly persons. According to Figure 1, not only can race/ethnicity influence the independent variables and ADL limitations, but also the observed confounders may have an impact on ADL limitations, limitation severity, and transportation barriers. Whereas ADL limitations can pose a challenge to elderly persons with transportation barriers, occupation and health behavior histories can shed light on the antecedent factors to ADL limitations and transportation barriers.

Marital status does not necessarily inform self-reporting on the severity level of ADL limitations. Marriage may or may not reduce financial burdens, nor is it a good predictor of whether assistance from a spouse would be assistive in performing daily tasks such as bathing, clothing, or walking up a flight of stairs.

Chapter 5: Relevance of Study

This study will provide new evidence on low-income elderly Medicare Beneficiaries with ADL limitations. Our understanding of racial and ethnic disparities and transportation barriers to accessing health care among this population will be expanded. The findings will also provide a roadmap for those working with this population to increase health care access for persons with ADL limitations. This roadmap will also help policymakers identify the gaps between personal capacities, environmental demands by activity accommodations, and external supports for elderly persons with ADL limitations.

Chapter 6: Data and Methods

Section 1: Human Subjects Research

The study was exempt from the University of Maryland's Institutional Review Board (IRB) Human Subjects Research because the data used is de-identified.

Subsection 1: Data

The study uses data from the 2013-2018 National Health Interview Survey, which the University of Minnesota has harmonized through IPUMS (Integrated Public Use Microdata Series). The NHIS survey uses a stratified clustered sampling design (Drew et al. 2021). The Primary Sampling Units (PSUs) are comprised of a group of counties, which contain a cluster of households. The resulting sample is nationally representative of the non-institutionalized civilian population of all ages. NHIS data is cross-sectional. All household members answer a set of basic questions during an in-person interview and one adult and child per family is selected to complete additional questions—these respondents are called the sample adult and the sample child. The NHIS annual response rate is approximately 70% of eligible households in the sample (NCHS, 2021).

Subsection 2: Target Population (Inclusion/Exclusion Criteria)

The population of interest is community-dwelling persons aged 65 and older with Medicare coverage who have incomes below 150% of the federal poverty level, which is roughly equal to annual income of $18,000 for a single person household. Of important note, elderly persons in long-term care institutions (i.e., nursing homes,

hospitals and prisons) are excluded from the NHIS sample and hence are not included in my analysis.

Subsection 3: Outcomes

This study will consider two primary outcomes. The first (Aim 1) uses as the outcome a 0/1 indicator of ADL limitations. The indicator is based on the question: *"Because of a physical, mental, or emotional problem, does anyone in the family need the help of other persons with personal care needs, such as eating, bathing, dressing, or getting around inside the house?"* In addition to serving as the outcome in Aim 1, the ADL indicator will serve as the primary independent variable of interest in Aim 2. The second primary outcome (Aim 2) is a 0/1 indicator of experiencing a transportation barrier. The variable of interest will be coded into two categories: (1) yes, persons delayed care because of lack of transportation, and those who did not experience a barrier will be coded as no (0).

Section 2: Race/Ethnicity

The primary independent variable in Aim 1 is race/ethnicity. This variable comes from two questions (the 1997 OMB format) about race and Hispanic origin. Responses will be combined to have the following levels during analysis: (1) Non-Hispanic White, (2) Non-Hispanic Black/African American, (3) Hispanic, all races, (4) Non-Hispanic Other Races. The catch-all other race category is used due to small sample sizes of Asian, Native American, and Pacific Islanders.

Subsection 1: ADL Severity

ADL severity will be measured as a count variable indicating how many ADL limitations elderly persons report. The scale can take a range of 0 to 6 ADL limitations.

Subsection 2: Control Variables

The primary control variables are region (Northeast/North Central/Midwest /South/ West), gender (male/female), age (elderly persons between 65-74 years old / 75-84 years old/ over 85 years old), marital status (Married/Divorced/Never Married), level of income (0-100% Federal Poverty Level (FPL); 101-150% FPL), educational attainment (Less than a high school diploma/ High School diploma or GED/ some college / Bachelor's degree or higher) and citizenship status (native born US citizens versus other nativity status).

Subsection 3: Item Missing Values

I will use list-wise deletion to account for item-missing values. The only exception are variables used by NCHS to produce survey weights (age, gender, and race) and poverty status, all of which are fully imputed by NCHS.

Section 3: Data Analysis

For each aim, I generate descriptive statistics for the full analysis sample and by levels of the independent variable of interest. In Aim 1, this will be race/ethnicity.

In Aim 2, it will be ADL status. Descriptive statistics will be survey weighted and standard errors will account for the complex sample design.

Subsection 1: AIM 1

Multiple logistic regression models will be used to assess the association between race/ethnicity and ADL status, independent of the covariates described above. I will produce unadjusted (no controls) and adjusted results (including controls). Associations will be measured using odds ratios.

Subsection 2: AIM 2

Aim 2 will proceed in two steps. To test hypothesis 2a, I will run multiple logistic regression models as described above, except binary ADL status will be the independent variable of interest and transportation barriers will be the outcome. All other variables will remain the same.

The second part of Aim 2 (hypothesis 2b) suggests that there is a dose-response association between ADL severity and transportation barriers. I do not have strong predictions about the shape of the dose-response curve. For example, it could increase monotonically with ADL severity. Or, there could be a non-linear relationship such that those with the most severity experience the least barriers because they are more likely to receive supported services and those with moderate severity experience the worst burdens because they face extra difficulties without additional supports. Nonetheless, the analysis will proceed by replicating the regression for 2a but replacing the 0/1 ADL indicator with the categorical variable LADL.

Chapter 7: Results

Section 1: AIM 1

Table 1 shows the descriptive statistics of low-income elderly Medicare beneficiaries by race/ethnicity. The total number of observations of Medicare beneficiaries in the study is 868,476 aged 65 years and older. The sample size is 16,105 low-income Medicare beneficiaries aged 65 years and older. Non-Hispanic whites tended to be younger ($P<0.001$) than their counterparts. Non-Hispanic Asians and Hispanics were more likely to be married. The majority of African Americans resided in the South, at a much higher rate than other racial groups. Non-Hispanic whites were less likely to have family incomes below 100% of poverty.

Table 2 indicates Unadjusted ADL Rates by Race of Low-Income Elderly Medicare Beneficiaries. Non-Hispanic White individuals had an estimated 10.33% (95% CI: 9.4-11.3) prevalence of ADL limitations. Non-Hispanic Blacks had ADL limitation prevalence of 13.82% (95% CI: 12.43-15.33). Hispanics had estimated ADL limitations prevalence of 14.43% (95% CI: 12.39-16.73). Non-Hispanic Asians had a 14.44 % (95 % CI: 11.73-17.64) prevalence of ADL limitations. Non-Hispanic other races had a 14.09% (95 % CI: 9.831-19.78) prevalence of ADL limitations.

Table 3 presents the main results of the multiple logistic regression models. Compared to non-Hispanic Whites, non-Hispanic Blacks have higher odds of having ADL limitations (OR 1.38, $p<0.05$). I did not find evidence that other racial or ethnic groups have different odds of having ADL limitations compared to non-Hispanic Whites, after accounting for covariates. However, non-Hispanic/other races had

meaningfully large odds ratio (1.67) and was marginally significant at the 10% level. Age showed a significant gradient in the odds of ADL limitations. Seniors aged 75 to 84 years old had 1.40 ($p<0.00$) times the odds of having ADL limitations compared to persons aged 65-74 years old. Similarly, persons aged 85 years and older had 3.16 ($p<0.000$) the odds of having an ADL limitation compared to individuals aged between 65 and 74 years old.

Females had 1.53 the odds of having an ADL limitation compared to males. The association of ADL prevalence and gender was found to be statistically significant. Seniors living at 101-150% of Federal Poverty Level (FPL) had 0.76 times ($p<0.004$) the odds having a functional limitation compared to individuals living below 100% of Federal Poverty Level (FPL). The association between functional status and poverty level was statistically significant. Regional differences were not noted. The findings indicated that region of residence, marital status, U.S. citizenship status, usual place for medical care and educational attainment had no statistically significant relationship with the outcome of interest.

Section 2: AIM 2

Table 4 reports descriptive statistics of low-income elderly Medicare beneficiaries. The analysis showcases whether low-income Medicare beneficiaries with ADL limitations report greater transportation barriers in accessing healthcare than low-income Medicare beneficiaries without ADL limitations across covariates. Among elderly persons, aged 75 to 84 years old had more ADL limitations and were married. Females experienced more ADL limitations than men. Persons with functional status challenges lived in the Northeast and the West regions. Many of

them lived below 100% of Federal Poverty Level (FPL), wherein some experienced delayed care due to lack of transportation.

Table 5 shows the unadjusted transportation delay rates by ADLs of low-income elderly Medicare Beneficiaries. The sample size of persons with ADL limitations had an estimated 9.252% (95% CI: 7.724 – 11.05) prevalence of transportation delays.

Table 6 shows the logistic regression results of the association of transportation delays and ADLs. Persons with ADL limitations (OR 2.47, $p<0.001$) have higher odds of having ADL limitations compared to those without ADL limitations. Moreover, non-Hispanic African Americans had a higher chance of experiencing transportation delays as opposed to non-Hispanic Whites (OR 1.76 $p<0.001$). Similarly, Hispanic/all races ($p<0.00$) had 2.45 times the odds of having delays to care compared to non-Hispanic Whites. Elderly persons (OR 0.44, $p<0.00$) who are married had decreased odds of experiencing delays to care due to transportation in contrast to those who are not married.

In addition, those (OR 2.44, $p<0.002$) who completed some college or more had an increased risk of experiencing transportation delays compared to persons with less than a high school diploma. The association between transportation delays and ADLs was statistically significant. The findings indicated that age, gender, region of residence, foreign born, poverty level, and usual place for medical care had no statistically significant association with the outcome of interest.

Finally, Table 7 describes the logistic regression of the association of transportation delays and ADL counts. I failed to find evidence of a statistically

significant dose-response relationship between ADL severity and transportation. The point estimates suggest that barriers are greatest for those with moderate severity (3-4 ADLS), but none of the point estimates were significant. The covariate pattern in Table 7 generally agrees with the pattern in Table 6. However, the model described in Table 7 resulted in perfect prediction for non-Hispanic / other races. The coefficient for that group has been suppressed. This likely arose in Table 7 and not Table 6 because Table 7 is based on a different survey question that had a different pattern of missing values.

Chapter 8: Discussion

Section 1: AIM 1

My study examined the differences in ADL limitations for low-income Medicare beneficiaries by race and ethnicity after accounting for covariates, I found the non-Hispanic African Americans had statistically significant 38% higher odds of having an ADL compared to non-Hispanic whites. I also found suggestive evidence than non-Hispanic/other races had elevated ADL rates compared to their non-Hispanic white counterparts, but the point estimate was only marginally significant (P=0.09). This finding is consistent with previous evidence that non-Hispanic Blacks are at greater risk of ADL compared to non-Hispanic Whites (Tipirneni et al., 2020). Non-Hispanic Blacks have higher odds of ADLs due to racism faced in accessing care. Similarly, Blacks may be less likely to use medical services compared to their White counterparts.

The non-Hispanic Black population could benefit from programs under the Chronic Care Act, where services can be tailored to enrollees with chronic illnesses. In addition, additional support could be provided by health plans such as Medicare Advantage that favor reducing transportation costs or states could increase additional mass transit zone routes as part of their community benefit responsibility for low-income populations. This would enhance the social functionality and quality of life of these patient groups and enable Medicare providers identify the unique needs of Medicare beneficiaries. While not the focus of this thesis, the covariates included in Aim 1 suggested important patterns of functional burden among the low-income

elderly. In the regression model, the strongest predictor of ADL limitations was advancing age.

Different protective factors were associated with ADL prevalence across races and ethnicities: living at 101-150 % of the Federal Poverty Level (FPL) and having received a high school diploma /GED or a college degree. Surprisingly, those with some college fared worse than those without a high-school degree. This pattern might be reflective of birth cohort experience, i.e., it might capture those who participated in the Korean or Vietnam conflict. However, my study's results are in general alignment with Tipirneni and colleagues' study (2020) which found that functional limitations are more common among individuals with a low socioeconomic status (SES).

Section 2: AIM 2

Second, the study examined whether low-income Medicare beneficiaries with ADL limitations report greater transportation barriers in accessing healthcare than low-income Medicare beneficiaries without ADL limitations. The results suggest that Medicare enrollees with ADL limitations report far greater delayed care due to lack of transportation compared to beneficiaries with no ADL limitations (OR=2.47; P<0.01). However, I failed to find evidence of a dose-response gradient.

Given that those with ADL's have observed needs for services, this is a troubling finding. From a policy standpoint, the federal government, state, and local municipalities should mandate that programs, services, benefits enforce inclusive policies accessible to Medicare beneficiaries with disabilities. Programs, as those envisioned under the Chronic Care Act, would reduce service users' difficulties in accessing transportation services that enable health service use. Two types of policy

interventions are likely needed. First, reasonable accommodations within existing infrastructure (public transportation, ride sharing services, etc.) could ease transportation burdens. Second, new services should likely be added. Ryvicker and colleagues (2020) estimated 10.8 million community- dwelling elderly persons in the United States rarely or never drive. In addition to using payers like Medicare to finance paid transportation services (via dedicated programs or via ride sharing), another potential model for delivery these new services are mutual aid societies that organize volunteer drivers in urban and rural areas.

Transportation delays did not only vary for those with and without an ADL, but also across other factors. Non-Hispanic Black /African American and Hispanics, faced higher odds of experiencing delays in care due to transportation difficulties.

Overall, my study contradicts Vasquez and colleagues' unadjusted model (2020) suggesting that that Hispanics and other races have lower transportation limitation odds than non-Hispanic Whites. Somewhat surprisingly, increasing education attainment was associated with higher odds of transportation-based delays. The reasons remain unclear, but that result from the fact that NHIS does not include measures of urban/rural status and so rural status is an unobserved confounder. The protective factors that appeared to contribute to lowering transportation barriers were being married, not living in the South, and being at 101-150% of the Federal Poverty Level (FPL). These results are consistent with other work (Porrell et al. 2002).

Chapter 9: Limitations and Challenges

The limitations of this study include that several important variables were not observed, and my study is subject to unobserved confounding. For example, I lacked contextual information about the respondent, including their urban/rural location or neighborhood exposures. This limitation is more of a concern in Aim 2 than Aim 1. In Aim 1, there is no theoretically sound reason why race/ethnicity should cause ADL limitations. As such, most potential confounders could also be considered as mediators that explain racial differences rather than confound it.

In AIM 2, unobserved confounding is more of a serious threat. For example, the outcome was based on a question that asked respondents if they delayed care due to transportation. An affirmative answer implies that the respondent not only delayed care but also wanted/needed it in the first place. However, I did not control for variation in care desires. Future work should investigate if the results I describe here are explained by such variation. Moreover, the study is focused on a fixed eight-year period. It is possible that results will vary over time because additional variables will become available to test these variances. Finally, this study is based on self-reports. It is possible the respondents faced social-desirability bias in reporting ADLs and under-reporting was correlated with the independent variables of interest.

Chapter 10: Conclusion

This study provides novel evidence on important racial disparities in ADL prevalence among the low-income elderly. I also found that ADL limitations are associated with delays in care, and there is variance in ADL limitations across race. Reducing transportation barriers and improving conditions for low-income populations and Medicare Beneficiaries with ADL limitations should remain key. I hope the study provides information that will help states, federal governments and local municipalities create inclusive policies for health care systems to leverage resources to benefit underserved communities with functional limitations. Such policies could potentially increase the well-being of underserved populations and likely generate cost-savings to effectively manage care.

Appendix I

List of Variables Recodes

Variables used in the analysis abstracted from the harmonized NHIS available through IPUMS, 2010-2018			
Variable Type	**Concept**	**Variable Name And Brief Definition**	**Recodes**
Independent Variable	Race	Name: RACENEW This variable describes the self-reported racial background of all persons in the survey.	The race will be recoded into 5 levels: (1) Non-Hispanic White, (2) Non-Hispanic Black/African American, (3) Hispanic / all races, (4) Asian and (5) Non-Hispanic Other. The remaining race labels will be set to missing. This variable will be combined with Ethnicity to make one variable that covers race and ethnicity.
Independent Variable	Ethnicity	Name: HISPYN This variable describes the self-reported Hispanic ethnicity of all persons in the survey.	Ethnicity will be recoded and merged with the RACENEW to make a category of Hispanic all races.
Independent Variable	Gender	Name: SEX This variable identifies whether persons in the survey are females or males.	Gender remains into 2 levels: (1) Female (2) Male.
Independent Variable	Region	Name: REGION This variable reports the geographical location of the survey participants.	The region will be recoded into 4 levels: (1) Northeast, (2) North Central/Midwest, (3) South, and (4) West. The remaining variables are set to missing.
Independent Variable	Age	Name: AGE This variable denotes persons of different ages through 2018.	Age will be recoded into 4 levels: (1) elderly persons between 65-74 years old, (2) elderly persons between 75-84 years old, and (3) elderly persons over 85 years old, and (0) all other key respondent

			responses for persons below 65 years old.
Independent Variable	US Nativity	Name: USBORN This variable indicates persons who are born in the U.S. versus those who are not U.S. born.	The variable USBORN will be recoded to two levels: (1) those born in the US, and (0) those not born in the US.
Independent Variable	Educational Attainment	Name: EDUC This variable indicates the highest level of schooling individuals completed. It includes persons who have a high school degree and those who do not along with respondents who have attained a higher education.	Educational Attainment will be recoded to four levels: (1) Less than a high school diploma (2) High School diploma or GED, (3) Some college, (4) Bachelor's degree or higher. All remaining labels for the variable will be set to missing.
Internal & External inclusion	Health Insurance Coverage	Name: HIMCAREE (Medicare Only) This variable indicates persons covered by Medicare.	Health insurance coverage will be recoded to three levels: (1) Yes, Medicare only, (2) Unknown and (0) No Medicare.
Dependent Variable	Transportation Barriers: Delayed Care because lacked transportation	Name: DELAYTRANS This variable indicates sample children and adults who have delayed medical care during the past 12 months because they did not have transportation.	Transportation will be recoded to two levels: (1) Yes, delayed care because of lack of transportation and (0) No, delayed care is not based on lacked transportation.
Independent Variable	Poverty	Name: POVIMPPOINT1 This variable indicates the ratio of imputed family income to poverty threshold based on income and the family's size and the number of children to the U.S. Census Bureau's poverty thresholds.	Poverty will be recoded to three levels: (1) 0-100% percent poverty level; (2) 101-150 percent poverty level and (0) 150+. The remaining values will be set to missing. My reference group would be individuals living under

			100% of the federal poverty level.
Independent Variable	Usual Source of Care	Name: USUALPL This variable refers to persons who has a usual place for medical care.	Usual Source of Care will be recoded to two levels: (0) No, there is no usual place for care and (1) yes, there is a usual place of care
Dependent Variable	ADL Limitations	Name: LADL This variable measures the sample of persons who need help with activities of daily living.	Activities of Daily Living will be recoded to two levels: (1) Yes, needs help with activities of daily living, and (0) No, does not need help with activities of daily living.
Independent Variable	Marital Status	Name: MARST This variable measures the current marital status of respondents.	Marital Status will be recoded to two levels: (1) Married, (0) Not Married.
Independent Variable	Need Help with bath/shower	Name: LABATH	Will be recoded to two levels: (1) Yes and (0) No. The remaining labels will be set to missing.
Independent Variable	Need help eating	Name: LAEAT	Will be recoded to two levels: (1) Yes and (0) No. The remaining labels will be set to missing.
Independent Variable	Need help dressing	Name: LADRESS	Will be recoded to two levels: (1) Yes and (0) No. The remaining labels will be set to missing.
Independent Variable	Need help in/out of bed or chairs	Name: LABED	Will be recoded to two levels: (1) Yes and (0) No. The remaining labels will be set to missing.
Independent Variable	Need help using the toilet	Name: LATOILT	Will be recoded to two levels: (1) Yes and (0) No. The remaining labels will be set to missing.
Independent Variable	Need help getting around in home	Name: LAHOME	Will be recoded to two levels: (1) Yes and (0) No.

			The remaining labels will be set to missing.
Independent Variable*	Total Number of Limitations	Name: totalADL This new variable counts the total number of limitations by adding the individual variables LAHOME, LATOILT, LABED, LADRESS, LAEAT and LABATH	Total number of Limitations will be recoded to six levels: (0) None, (1) One, (2) Two, (3) Three, (4) Four, (5) Five, and (6) Six
Independent Variable *	ADL Counts	Name: totalADL_count This new variable was created by using totalADL as an original variable by grouping the number count of ADL limitations in the sample size.	ADL Counts will be recoded in 4 levels: (1) 1-2 ADLs, (2) 3-4 ADLs, (3) 5-6 ADLs, and (4) None

AIM 1: Table 1

Descriptive Statistics of Low-Income Elderly Medicare Beneficiaries, NHIS Sample Adults 2010-2018.											
	Non-Hispanic White		Non- Hispanic Black/ African American		Non-Hispanic Asian		Non-Hispanic Other		Hispanic / All Races		P - Value
	Estimates		Estimates		Estimates		Estimates		Estimates		
	Percent	SE	Percent	SE	Percent	SE	Percent	SE	Percent	SE	
Age											**0.00**
65-74	45.70	0.72	55.51	1.16	47.98	2.18	60.80	3.58	56.26	1.17	
75-84	35.95	0.67	32.60	1.03	37.61	2.24	31.19	3.40	32.66	1.05	
85+	18.35	0.56	11.89	0.76	14.41	1.76	8.01	1.54	11.08	0.82	
Sex											**0.0002**
Male	33.00	0.67	32.12	1.21	38.13	2.15	34.60	2.82	38.59	1.40	
Female	67.00	0.67	67.88	1.21	61.87	2.15	65.40	2.82	61.41	1.40	
Marital Status											**0.00**
Married	28.31	0.73	23.92	1.24	53.45	2.46	23.95	3.30	41.05	1.47	
Not Married	71.69	0.73	76.08	1.24	46.55	2.46	76.05	3.30	58.95	1.47	
Region											**0.00**
Northeast	19.36	0.80	14.67	1.09	22.79	3.28	12.29	2.96	18.89	1.62	
North Central / Midwest	26.24	0.89	15.94	1.27	5.89	1.36	13.73	2.62	4.40	0.64	
South	38.25	1.01	62.84	1.68	17.40	1.95	35.40	4.77	43.28	2.51	
West	16.15	0.74	6.55	0.67	53.92	3.34	38.59	5.91	33.43	2.08	
US Born											**0.00**
No, not U.S. Born	6.88	0.43	8.69	0.96	89.91	1.43	3.11	1.13	74.16	1.48	

Yes, U.S. Born	93.13	0.43	91.31	0.96	10.09	1.43	96.89	1.13	25.84	1.48	
Poverty											**0.00**
Below 100% of Federal Poverty Level	37.44	0.69	51.83	1.15	57.58	2.62	54.39	4.31	55.09	1.26	
At 101-150% of Federal Poverty Level	62.56	0.69	48.17	1.15	42.42	2.62	45.61	4.31	44.91	1.26	
Usual Place for Medical Care											**0.0004**
Yes, has usual place of care	95.19	0.25	96.85	0.37	97.95	0.50	92.21	2.35	96.09	0.52	
No, does not have usual place of care	4.82	0.25	3.15	0.37	2.05	0.50	7.79	2.35	3.91	0.52	
Educational Attainment											**0.00**
Less than a High School Diploma	2.66	0.28	6.34	0.84	14.13	2.10	6.45	2.70	31.24	1.93	
High School Diploma or GED	56.59	0.90	56.49	1.66	39.92	2.64	49.08	5.01	41.51	1.87	
Some College	24.65	0.75	26.33	1.47	11.66	1.57	28.81	4.64	15.50	1.42	
Bachelor's Degree or Higher	16.10	0.66	10.83	1.27	34.29	2.97	15.66	4.38	11.76	1.33	
Functional Status											**0.00**
Yes, has ADL Limitations	10.33	0.48	13.82	0.74	14.44	1.50	14.09	2.52	14.43	1.10	
No, does not have ADL Limitations	89.67	0.48	86.18	0.74	85.56	1.50	85.91	2.52	85.57	1.10	
Delayed Care due to lack of Transportation											**0.0007**
Yes	4.27	0.26	6.50	0.55	3.95	0.88	7.26	1.86	5.53	0.53	
No	95.73	0.26	93.50	0.55	96.05	0.88	92.75	1.86	94.47	0.53	

Source: National Health Interview Survey (NHIS), 2010-2018 person files. Note: Standard errors (SE) are calculated using Taylor Linearized Series with Stata version 16.1. Percentage means represent proportions for the subpopulation low-income Medicare Beneficiaries.

AIM 1: Table 2

Unadjusted ADL Rates by Race of Low-Income Elderly Medicare Beneficiaries, NHIS Sample Adults 2010-2018.		
	Estimates	
	Percent	**Confidence Interval**
Race		
Non-Hispanic White	10.33	9.431 - 11.31
Non-Hispanic Black / African American	13.82	12.43 -15.33
Hispanic / All races	14.43	12.39-16.73
Non-Hispanic Asian	14.44	11.73-17.64
Non-Hispanic Other	14.09	9.831 -19.78
Source: National Health Interview Survey (NHIS), 2010-2018 person files. Note: Confidence Intervals are calculated using Taylor Linearized Series with Stata version 16.1. Percentage means represent proportions for the subpopulation low-income Medicare Beneficiaries.		

AIM 1: Table 3

Association of Race and ADL Prevalence, Logistic Regression Results, NHIS Sample Adults 2010-2018.

	OR	SE	P-Value
Race			
Non-Hispanic White	(REF)		
Non-Hispanic Black / African American	1.38	0.17	0.01
Non-Hispanic Asian	1.03	0.24	0.88
Non-Hispanic Other	1.67	0.50	0.09
Hispanic / All Races	1.16	0.25	0.48
Age			
65-74	(REF)		
75-84	1.40	0.15	0.002
85+	3.16	0.36	0.00
Sex			
Male	(REF)		
Female	1.53	0.17	0.00
Marital Status			
Not Married	(REF)		
Married	0.81	0.11	0.14
Region			
Northeast	(REF)		
North Central / Midwest	0.76	0.11	0.07
South	0.82	0.11	0.14
West	0.90	0.13	0.46
US Born			
No, not U.S. Born	(REF)		
Yes, U.S. Born	0.76	0.14	0.14
Poverty			
Below 100% of Federal Poverty Level	(REF)		
At 101-150% of Federal Poverty Level	0.76	0.07	0.004

Usual Place for Medical Care			
No, does not have usual place of care	(REF)		
Yes, has usual place of care	1.41	0.37	0.19
Educational Attainment			
Less than a High School Diploma	(REF)		
High School Diploma or GED	0.67	0.11	0.018
Some College	0.65	0.12	0.023
Bachelor's Degree or Higher	0.81	0.16	0.27

Source: National Health Interview Survey (NHIS), 2010-2018 person files. Note: Standard errors (SE) are calculated using Taylor Linearized Series with Stata version 16.1.

AIM 2: Table 4

Descriptive Statistics of Low-Income Elderly Medicare Beneficiaries with ADL Limitations, NHIS Sample Adults 2010-2018.					
	ADL Limitation		**No ADL Limitation**		**P - Value**
	Estimates		**Estimates**		
	Percent	**SE**	**Percent**	**SE**	
Age					**0.00**
65-74	34.1	1.43	51.4	0.55	
75-84	36.5	1.43	34.7	0.54	
85+	29.4	1.41	13.9	0.40	
Sex					**0.00**
Male	26.5	1.31	35.0	0.55	
Female	73.5	1.31	65.0	0.55	
Marital Status					**0.00**
Married	23.5	1.57	31.8	0.62	
Not Married	76.5	1.57	68.0	0.62	
Region					**0.0002**
Northeast	21.5	1.62	18.2	0.62	
North Central / Midwest	15.7	1.21	20.4	0.67	
South	39.9	1.99	42.1	0.86	
West	22.9	1.65	19.3	0.72	
US Born					**0.00**
No, not U.S. Born	29.6	1.74	21.0	0.67	
Yes, U.S. Born	70.4	1.74	79.0	0.67	
Poverty					**0.00**
Below 100% of Federal Poverty Level	52.3	1.56	42.8	0.62	
At 101-150% of Federal Poverty Level	47.7	1.56	57.2	0.62	
Usual Place for Medical Care					**0.0002**
Yes, has usual place of care	97.7	0.41	95.4	0.22	
No, does not have usual place of care	2.35	0.41	4.59	0.22	
Educational Attainment					**0.0001**

Less than a High School Diploma	11.7	1.31	6.84	0.40	
High School Diploma or GED	51.2	2.01	53.9	0.79	
Some College	19.9	1.63	23.4	0.64	
Bachelor's Degree or Higher	17.2	1.57	15.9	0.60	
Delayed Care due to lack of Transportation					**0.00**
Yes	9.25	0.84	4.29	0.21	
No	90.8	0.84	95.7	0.21	

Source: National Health Interview Survey (NHIS), 2010-2018 person files. Note: Standard errors (SE) are calculated using Taylor Linearized Series with Stata version 16.1. Percentage means represent proportions for the subpopulation low-income Medicare Beneficiaries.

AIM 2: Table 5

Unadjusted Transportation delays by ADLs of Low-Income Elderly Medicare Beneficiaries, NHIS Sample Adults 2010-2018.		
	Estimates	
	Percent	**Confidence Interval**
ADL Limitations		
Yes, with ADL Limitations	9.252	7.724 - 11.05
No ADL limitations	4.291	3.904 - 4.715
Source: National Health Interview Survey (NHIS), 2010-2018 person files. Note: Confidence Intervals are calculated using Taylor Linearized Series with Stata version 16.1. Percentage means represent proportions for the subpopulation low-income Medicare Beneficiaries.		

AIM 2: Table 6

Association of Transportation Delays and ADLs, Logistic Regression Results, NHIS Sample Adults 2010-2018.			
	OR	**SE**	**P-Value**
Functional Status			
No ADL Limitations	(REF)		
Yes, has ADL Limitations	2.47	0.43	0.00
Race			
Non-Hispanic White	(REF)		
Non-Hispanic Black / African American	1.76	0.30	0.001
Non-Hispanic Asian	1.48	0.53	0.28
Non-Hispanic Other	1.22	0.49	0.62
Hispanic / All Races	2.45	0.58	0.00
Age			
65-74	(REF)		
75-84	0.85	0.12	0.25
85+	0.74	0.13	0.10
Sex			
Male	(REF)		
Female	1.13	0.17	0.41
Marital Status			
Not Married	(REF)		
Married	0.44	0.09	0.00
Region			
Northeast	(REF)		
North Central / Midwest	0.87	0.18	0.51
South	0.65	0.12	0.02
West	0.78	0.15	0.20
US Born			
No, not U.S. Born	(REF)		
Yes, U.S. Born	1.18	0.28	0.49

Poverty			
Below 100% of Federal Poverty Level	(REF)		
At 101-150% of Federal Poverty Level	0.77	0.10	0.043
Usual Place for Medical Care			
No, does not have usual place of care	(REF)		
Yes, has usual place of care	0.71	0.22	0.26
Educational Attainment			
Less than a High School Diploma	(REF)		
High School Diploma or GED	1.85	0.54	0.037
Some College	2.44	0.70	0.002
Bachelor's Degree or Higher	2.08	0.67	0.025

Source: National Health Interview Survey (NHIS), 2010-2018 person files. Note: Standard errors (SE) are calculated using Taylor Linearized Series with Stata version 16.1. Percentage means represent proportions for the subpopulation low-income Medicare Beneficiaries.

AIM 2: Table 7

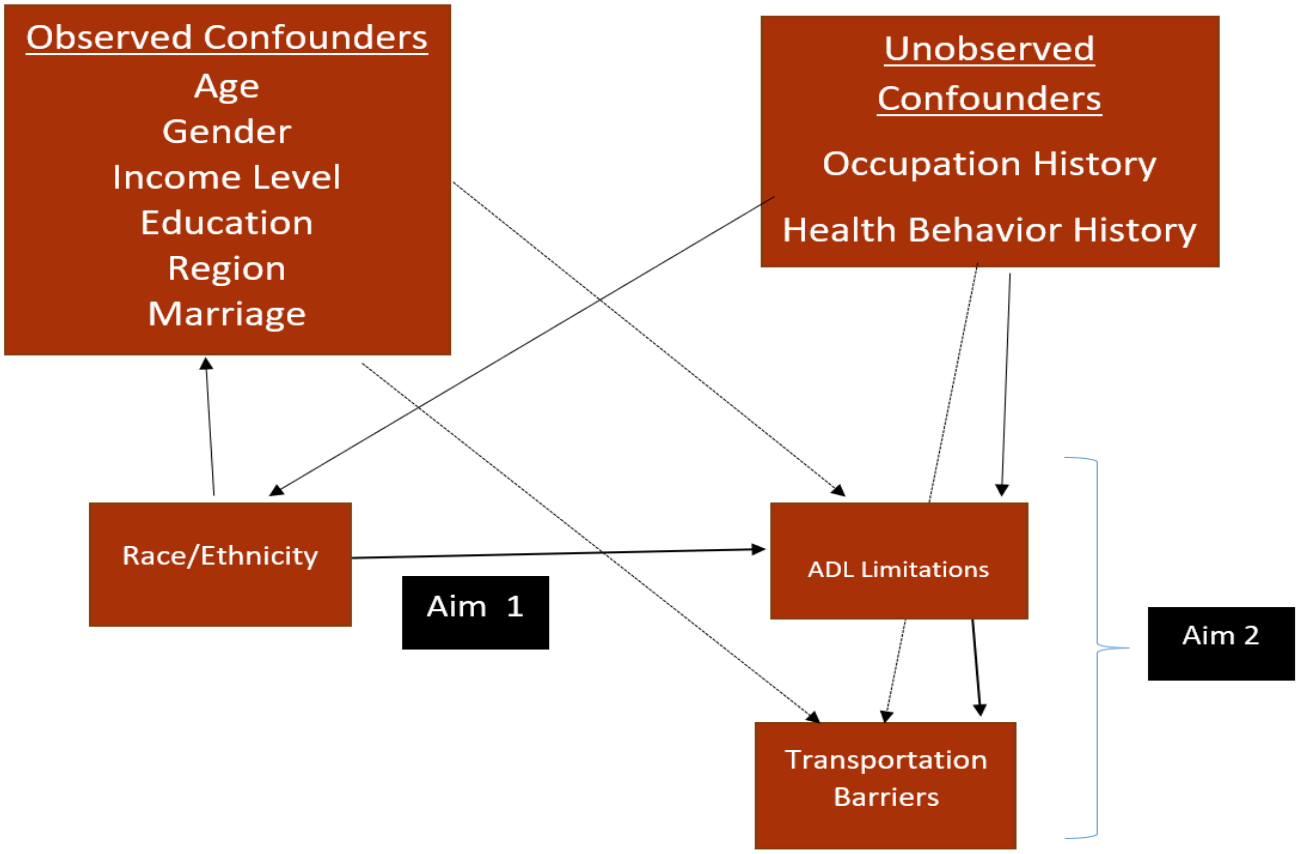
Association of Transportation Delays and ADL Counts, Logistic Regression Results, NHIS Sample Adults 2010-2018.

	OR	SE	P-Value
ADL Counts			
None	(REF)		
1-2 ADLs	1.19	0.50	0.68
3-4 ADLs	1.30	0.58	0.55
5-6 ADLs	1.09	0.52	0.85
Race			
Non-Hispanic White	(REF)		
Non-Hispanic Black / African American	1.46	0.53	0.30
Non-Hispanic Asian	0.56	0.39	0.41
Non-Hispanic Other [1]			
Hispanic / All Races	1.78	0.77	0.18
Age			
65-74	(REF)		
75-84	0.99	0.35	0.98
85+	0.55	0.21	0.11
Sex			
Male	(REF)		
Female	1.65	0.59	0.16
Marital Status			
Not Married	(REF)		
Married	0.92	0.37	0.83
Region			
Northeast	(REF)		
North Central / Midwest	2.44	1.13	0.06
South	1.07	0.43	0.88
West	1.15	0.49	0.74
US Born			

No, not U.S. Born	(REF)		
Yes, U.S. Born	0.60	0.24	0.20
Poverty			
Below 100% of Federal Poverty Level	(REF)		
At 101-150% of Federal Poverty Level	0.90	0.27	0.73
Usual Place for Medical Care			
No, does not have usual place of care	(REF)		
Yes, has usual place of care	1.04	0.87	0.97
Educational Attainment			
Less than a High School Diploma	(REF)		
High School Diploma or GED	1.64	0.93	0.38
Some College	3.65	2.18	0.030
Bachelor's Degree or Higher	2.76	1.70	0.098

Source: National Health Interview Survey (NHIS), 2010-2018 person files. Note: Standard errors (SE) are calculated using Taylor Linearized Series with Stata version 16.1. Due to a small sample size, there was a perfect predictor. Coefficients have been suppressed.

Figure 1: Conceptual Model



Bibliography

1. Agree, E. M. (1999). The influence of personal care and assistive devices on the measurement of disability. Soc Sci Med, 48(4), 427-443. https://doi.org/10.1016/s0277-9536.

2. Aguayo-Mazzucato, C., Diaque, P., Hernandez, S., Rosas, S., Kostic, A., & Caballero, A. E. (2019). Understanding the growing epidemic of type 2 diabetes in the Hispanic population living in the United States. Diabetes Metab Res Rev, 35(2), e3097. doi:10.1002/dmrr.3097

3. Albrecht, G. L., & Devlieger, P. J. (1999). The disability paradox: high quality of life against all odds. Soc Sci Med, 48(8), 977-988. https://doi.org/10.1016/s0277-9536.

4. Alexandre, T. a. S., Corona, L. P., Nunes, D. P., Santos, J. L., Duarte, Y. A., & Lebrão, M. L. (2012). Gender differences in incidence and determinants of disability in activities of daily living among elderly individuals: SABE study. Arch Gerontol Geriatr, 55(2), 431-437. https://doi.org/10.1016/j.archger.2012.04.001.

5. Alexandre, T. a. S., Corona, L. P., Nunes, D. P., Santos, J. L., Duarte, Y. A., & Lebrão, M. L. (2014). Disability in instrumental activities of daily living among older adults: gender differences. Rev Saude Publica, 48(3), 379-389. https://doi.org/10.1590/s0034-8910.2014048004754.

6. Andersen, R. M. (1995). Revisiting the behavioral model and access to medical care: does it matter? *Journal of health and social behavior*, 1-10.

7. Anderson, Jessa K. Engelberg, et al. "Indicators of potential health-related social needs and the association with perceived health and well-being outcomes among community-dwelling medicare beneficiaries." *Quality of Life Research* 29.6 (2020): 1685-1696. Indicators of potential health-related social needs and the association with perceived health and well-being outcomes among community-dwelling medicare beneficiaries (umd.edu).

8. Auais, M., Ahmed, T., Alvarado, B., Phillips, S. P., Rosendaal, N., Curcio, C. L., Zunzunegui, M. V. (2019). Gender differences in four-year incidence of self-reported and performance-based functional disability: The International Mobility in Aging Study. Arch Gerontol Geriatr, 82, 266-272. https://doi.org/10.1016/j.archger.2019.03.002.

9. Bickenbach, J. E., Chatterji, S., Badley, E. M., & Ustün, T. B. (1999). Models of disablement, universalism and the international classification of impairments, disabilities and handicaps. Soc Sci Med, 48(9), 1173-1187. https://doi.org/10.1016/s0277-9536.

10. Blewett, L.Drew, J.A.R., King, M.L, and Williams, C.W.K. (2019). IPUMS health surveys: National health interview survey, Version 6.4 [dataset]. Minneapolis, MN: IPUMS. https://doi.org/10.18128/D070.V6.4.

11. Breen, R., Karlson, K. B., & Holm, A. (2013). Total, direct, and indirect effects in logit and probit models. *Sociological Methods & Research*, *42*(2), 164-191.

12. Carmel, S. (2019). Health and Well-Being in Late Life: Gender Differences Worldwide. Front Med (Lausanne), 6, 218. https://doi.org/10.3389/fmed.2019.00218.

13. Medicare-Medicaid Coordination Office: Centers for Medicare & Medicaid Services. (2020, March). *People dually eligible for medicare and medicaid*. People Dually Eligible for Medicare and Medicaid Fact Sheet (032020) (cms.gov).

14. Centers for Medicare & Medicaid. (2020, March).*Medicare-Medicaid Dual Enrollment from 2006 through 2018.* Data Analysis Brief: Medicare-Medicaid Dual Enrollment Trends 2006-2018 (cms.gov).

15. Clark, D. O., & Maddox, G. L. (1992). Racial and social correlates of age-related changes in functioning. J Gerontol, 47(5), S222-232. https://doi.org/10.1093/geronj/47.5.s222.

16. Chen, P. C., & Wilmoth, J. M. (2004). The effects of residential mobility on ADL and IADL limitations among the very old living in the community. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *59*(3), S164-S172.

17. Cubanski, J., Orgera, K., Damico, A., & Neuman, T. (2018). The financial burden of health care spending: larger for Medicare households than for non-Medicare households. *Kaiser Commission on Medicare*.

18. Edemekong, P. F., Drew, J. A. R. (2021, February). An Introduction to IPUMS Health Surveys: Harmonized versions of the National Health Interview and Medical Expenditure Panel Surveys. Indiana University

Workshop in Methods.Bomgaars, D. L., & Levy, S. B. (2017). Activities of daily living (ADLs). Activities of Daily Living - Abstract - Europe PMC.

19. Fagan, A. A., Bumbarger, B. K., Barth, R. P., Bradshaw, C. P., Cooper, B. R., Supplee, L. H., & Walker, D. K. (2019). Scaling up Evidence-Based Interventions in U.S. Public Systems to Prevent Behavioral Health Problems: Challenges and Opportunities. Prev Sci, 20(8), 1147-1168. https://doi.org/10.1007/s11121-019-01048-8.

20. Feng, Z., Vadnais, A., Vreeland, E., Haber, S., Wiener, J., & Baker, B. (2017). Analysis of pathways to dual eligible status. Analysis of Pathways to Dual Eligible Status: Final Report (hhs.gov).

21. Flores Morales, J. (2021). Aging and undocumented: The sociology of aging meets immigration status. Sociol Compass, 15(4), e12859. https://doi.org/10.1111/soc4.12859.

22. Garcia, M. A., Angel, J. L., Angel, R. J., Chiu, C. T., & Melvin, J. (2015). Acculturation, gender, and active life expectancy in the Mexican-origin population. Journal of aging and health, 27(7), 1247-1265.

23. Garcia, M. A., Downer, B., Crowe, M., & Markides, K. S. (2017). Aging and Disability Among Hispanics in the United States: Current Knowledge and Future Directions. Innov Aging, 1(2), igx020. https://doi.org/10.1093/geroni/igx020.

24. Govender, A., Mohanty, S. A., Bynum, J., & Iyengar, V. (2021). Protecting the Medically Vulnerable Amid COVID-19: Insights from the Dually Eligible Population in the United States. *NAM perspectives*, *2021*.

25. Gross, D. J., Alecxih, L., Gibson, M. J., Corea, J., Caplan, C., & Brangan, N. (1999). Out-of-pocket health spending by poor and near-poor elderly Medicare beneficiaries. Health Serv Res, 34(1 Pt 2), 241-254.

26. House, J. S., Lepkowski, J. M., Kinney, A. M., Mero, R. P., Kessler, R. C., & Herzog, A. R. (1994). The social stratification of aging and health. J Health Soc Behav, 35(3), 213-234.

27. Howrey, B. T., Al Snih, S., Jana, K. K., Peek, M. K., & Ottenbacher, K. J. (2016). Stability and Change in Activities of Daily Living Among Older Mexican Americans. J Gerontol A Biol Sci Med Sci, 71(6), 780-786. doi:10.1093/gerona/glv172.

28. Issel, L. M., & Wells, R. (2018). Health program planning and evaluation: a practical, systematic approach for community health (Fourth edition. ed.). Jones & Bartlett Learning.

29. Jones, C. P. (2000). Levels of racism: a theoretic framework and a gardener's tale. *American journal of public health*, *90*(8), 1212.

30. Kaiser Family Foundation. (2021). Lowering the age of medicare eligibility would likely reduce health spending for employers, but raise costs for the federal government by covering more people in medicare. Lowering the Age of Medicare Eligibility Would Likely Reduce Health Spending for Employers, But Raise Costs for the Federal Government by Covering More People in Medicare | KFF

31. Kaiser Family Foundation. (2021). Medicaid: what to watch in 2021. https://www.kff.org/medicaid/issue-brief/medicaid-what-to-watch-in-2021/

32. Kaplan, M. S., Huguet, N., Newsom, J. T., & McFarland, B. H. (2004). The association between length of residence and obesity among Hispanic immigrants. Am J Prev Med, 27(4), 323-326. doi:10.1016/j.amepre.2004.07.005.

33. Kasper, J. D. (1998). Asking about access: challenges for surveys in a changing healthcare environment. *Health Services Research*, *33*(3 Pt 2), 715.

34. Katz, S. J., Kabeto, M., & Langa, K. M. (2000). Gender disparities in the receipt of home care for elderly people with disability in the United States. JAMA, 284(23), 3022-3027. https://doi.org/10.1001/jama.284.23.3022.

35. Kawachi, I., & Kennedy, B. P. (1999). Income inequality and health: pathways and mechanisms. Health Serv Res, 34(1 Pt 2), 215-227.

36. Kemper, P., Weaver, F., Short, P. F., Shea, D., & Kang, H. (2008). Meeting the need for personal care among the elderly: does Medicaid home care spending matter? Health Serv Res, 43(1 Pt 2), 344-362. https://doi.org/10.1111/j.1475-6773.2007.00762.x.

37. Kington, R., Carlisle, D., McCaffrey, D., Myers, H., & Allen, W. (1998). Racial differences in functional status among elderly U.S. migrants from the South. Soc Sci Med, 47(6), 831-840. https://doi.org/10.1016/s0277-9536(98)00145-2.

38. Kington, R. S., & Smith, J. P. (1997). Socioeconomic status and racial and ethnic differences in functional status associated with chronic diseases. Am J Public Health, 87(5), 805-810. https://doi.org/10.2105/ajph.87.5.805.

39. Komisar, H. L., Feder, J., & Kasper, J. D. (2005). Unmet long-term care needs: an analysis of Medicare-Medicaid dual eligibles. Inquiry, 42(2), 171-182. https://doi.org/10.5034/inquiryjrnl_42.2.171.

40. Lahr, M., Henning-Smith, C., Rahman, A., & Hernandez, A. M. (2021). Barriers to Health Care Access for Rural Medicare Beneficiaries: Recommendations from Rural Health Clinics. UMN-RHC-Access-to-Care-PB_1.20.pdf.

41. Liang, J., Bennett, J. M., Shaw, B. A., Quiñones, A. R., Ye, W., Xu, X., & Ofstedal, M. B. (2008). Gender differences in functional status in middle and older age: are there any age variations? J Gerontol B Psychol Sci Soc Sci, 63(5), S282-292. https://doi.org/10.1093/geronb/63.5.s282.

42. Lin, G. (2000). Regional assessment of elderly disability in the U.S. Soc Sci Med, 50(7-8), 1015-1024. https://doi.org/10.1016/s0277-9536.

43. Mayer, A., Thoemmes,McClintock, H. F., Kurichi, J. E., Kwong, P. L., Xie, D., Streim, J. E., Pezzin, L. E., ... & Bogner, H. R. (2017). Disability stages and trouble getting needed health care among Medicare beneficiaries. *American journal of physical medicine & rehabilitation*, *96*(6), 408. Disability Stages and Trouble Getting Needed Health Care Among Medicare Beneficiaries (nih.gov)

44. Rose, N., Steyer, R., & West, S. (2014). Theory and Analysis of Total, Direct, and Indirect Causal Effects. *Multivariate Behavioral Research*, *49*(5), 425-442. https://doi.org/10.1080/00273171.2014.931797.

45. McWilliams, J. M., Hatfield, L. A., Landon, B. E., Hamed, P., & Chernew, M. E. (2018). Medicare spending after 3 years of the Medicare Shared Savings Program. *New England Journal of Medicine*, *379*(12), 1139-1149.

46. Medicaid and CHIP Payment and Access Commission. (2021). *Medicaid and chip payment and access commission*. Dually Eligible Beneficiaries : MACPAC

47. Melvin, J., Hummer, R., Elo, I., & Mehta, N. (2014). Age patterns of racial/ethnic/nativity differences in disability and physical functioning in the United States. Demogr Res, 31, 497-510. https://doi.org/10.4054/DemRes.2014.31.17.

48. Merrill, S. S., Seeman, T. E., Kasl, S. V., & Berkman, L. F. (1997). Gender differences in the comparison of self-reported disability and performance measures. J Gerontol A Biol Sci Med Sci, 52(1), M19-26. https://doi.org/10.1093/gerona/52a.1.m19.

49. Merritt, B. K., & Fisher, A. G. (2003). Gender differences in the performance of activities of daily living. Arch Phys Med Rehabil, 84(12), 1872-1877. https://doi.org/10.1016/s0003-9993(03)00483-0.

50. Miller, M., & Socker, E. (2021). Addressing medicare solvency will require both revenue and spending changes. *To the Point* (blog), Commonwealth Fund. https://doi.org/10.26099/d17w-g866

51. Murtagh, K. N., & Hubert, H. B. (2004). Gender differences in physical disability among an elderly cohort. Am J Public Health, 94(8), 1406-1411. https://doi.org/10.2105/ajph.94.8.1406.

52. National Academies of Sciences, Engineering, and Medicine. (2005). Cost-Benefit Analysis of Providing Non-Emergency Medical Transportation.

53. National Health Interview Survey. (2016). National health interview survey (NHIS) public use data release. Retrieved from 2016 National Health Interview Survey Description (cdc.gov).

54. Porell, F. W., & Miltiades, H. B. (2001). Disability outcomes of older Medicare HMO enrollees and Fee-for-service Medicare beneficiaries. *Journal of the American Geriatrics Society*, *49*(5), 615-631.

55. Porell, F. W., & Miltiades, H. B. (2002). Regional differences in functional status among the aged. Soc Sci Med, 54(8), 1181-1198. https://doi.org/10.1016/s0277-9536(01)00088-0.

56. Powers, B. W., Rinefort, S., & Jain, S. H. (2016). Nonemergency medical transportation: delivering care in the era of Lyft and Uber. *Jama*, *316*(9), 921-922. Nonemergency Medical Transportation delivering care in the Era of Lyft and Uber.pdf.

57. Ryvicker, M., Bollens-Lund, E., & Ornstein, K. A. (2020). Driving status and transportation disadvantage among Medicare beneficiaries. *Journal of applied gerontology*, *39*(9), 935-943. Driving Status and Transportation Disadvantage Among Medicare Beneficiaries (umd.edu).

58. Schön, P., Parker, M. G., Kåreholt, I., & Thorslund, M. (2011a). Gender differences in associations between ADL and other health indicators in 1992 and 2002. Aging Clin Exp Res, 23(2), 91-98. https://doi.org/10.1007/BF03351074.

59. Sheehan, C., Domingue, B. W., & Crimmins, E. (2019). Cohort Trends in the Gender Distribution of Household Tasks in the United States and the Implications for Understanding Disability. J Aging Health, 31(10), 1748-1769. https://doi.org/10.1177/0898264318793469.

60. Social Security Administration. (2021, October 16). *Medicare Benefits*. Medicare Benefits | SSA.

61. Sonn, U., Grimby, G., & Svanborg, A. (1996). Activities of daily living studied longitudinally between 70 and 76 years of age. Disabil Rehabil, 18(2), 91-100. https://doi.org/10.3109/09638289609166023.

62. Steeves, J. A., Shiroma, E. J., Conger, S. A., Van Domelen, D., & Harris, T. B. (2019). Physical activity patterns and multimorbidity burden of older adults with different levels of functional status: NHANES 2003-2006. Disabil Health J, 12(3), 495-502. https://doi.org/10.1016/j.dhjo.2019.02.005.

63. Steyer R., Mayer A., Fiege C. (2014) Causal Inference on Total, Direct, and Indirect Effects. In: Michalos A.C. (eds) Encyclopedia of Quality of Life and Well-Being Research. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-0753-5_295.

64. Stierman, B., Afful, J., Carroll, M. D., Chen, T. C., Davy, O., Fink, S.,& Akinbami, L. J. (2021). National health and nutrition examination survey 2017-March 2020 Prepandemic data file—Development of files and prevalence estimates for selected health outcomes. National Health Statistics Reports, Number 158, June 14, 2021 (cdc.gov).

65. Stuck, A. E., Walthert, J. M., Nikolaus, T., Büla, C. J., Hohmann, C., & Beck, J. C. (1999). Risk factors for functional status decline in community-living elderly people: a systematic literature review. Soc Sci Med, 48(4), 445-469. https://doi.org/10.1016/s0277-9536(98)00370-0.

66. Szanton SL, Thorpe RJ, Boyd C, et al. Community aging in place, advancing better living for elders: a bio-behavioral-environmental intervention to improve function and health-related quality of life in disabled older adults. J Am Geriatr Soc. 2011;59(12):2314-2320.

67. Tipirneni, R., Karmakar, M., & Maust, D. T. (2020). Trends and Disparities in Functional Impairment among U.S. Adults Age 55–64, 2002 to 2016. *Journal of General Internal Medicine*, 1-4.

68. Thorpe, R. J., Koster, A., Kritchevsky, S. B., Newman, A. B., Harris, T., Ayonayon, H. N., Health, A. i., and Body Composition Study. (2011). Race, socioeconomic resources, and late-life mobility and decline: findings from the Health, Aging, and Body Composition study. J Gerontol A Biol Sci Med Sci, 66(10), 1114-1123. https://doi.org/10.1093/gerona/glr102.

69. U.S. Department of Health & Human Services. (2023, August 31). *What is the difference between medicare and medicaid?* What is the difference between Medicare and Medicaid? | HHS.gov.

70. Van der Vorst, A., Zijlstra, G. A., Witte, N., Duppen, D., Stuck, A. E., Kempen, G. I., Consortium, D.-S. (2016). Limitations in Activities of Daily Living in Community-Dwelling People Aged 75 and Over: A Systematic Literature Review of Risk and Protective Factors. PLoS One, 11(10), e0165127. https://doi.org/10.1371/journal.pone.0165127.

71. Van Houtven, C. H., Konetzka, R. T., Taggert, E., & Coe, N. B. (2020). Informal And Formal Home Care For Older Adults With Disabilities Increased, 2004–16: Study examines changes in the rates of informal home care use among older adults with disabilities 2004 to 2016. *Health Affairs*, *39*(8), 1297-1301.

72. Vásquez, E., Germain, C. M., Tang, F., Lohman, M. C., Fortuna, K. L., & Batsis, J. A. (2020). The role of ethnic and racial disparities in mobility and physical function in older adults. *Journal of Applied Gerontology*, *39*(5), 502-508.

73. Vega, W. A., Angel, J. L., Gutiérrez Robledo, L. M. F., Markides, K. S., & SpringerLink. (2019). Contextualizing Health and Aging in the Americas: Effects of Space, Time and Place (1st 2019. ed.). Springer International Publishing: Imprint: Springer.

74. Verbrugge, L. M., & Jette, A. M. (1994). The disablement process. *Social science & medicine*, *38*(1), 1-14.

75. Waite, L. J., & Hughes, M. E. (1999). At-risk on the cusp of old age: living arrangements and functional status among black, white and Hispanic adults. J Gerontol B Psychol Sci Soc Sci, 54(3), S136-144. https://doi.org/10.1093/geronb/54b.3.s136.

76. Wang, S., Phillips, D., & Lee, J. (2021). Disability prevalence in midlife (aged 55-65 years): Cross-Country comparisons of gender differences and time trends. Women's Midlife Health, 7(1), 1. https://doi.org/10.1186/s40695-020-00061-0.

77. Wheaton, F. V., & Crimmins, E. M. (2016). Female disability disadvantage: a global perspective on sex differences in physical function and disability. Ageing Soc, 36(6), 1136-1156. https://doi.org/10.1017/S0144686X15000227.

78. Willink, A., & DuGoff, E. H. (2018). Integrating medical and nonmedical services-the promise and pitfalls of the CHRONIC Care Act. *N Engl J Med*, *378*(23), 2153-2155.