Service Use and Health Outcomes of Low Income Older Adults with Unmet Needs

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Dissertation submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Doctor of Philosophy
in
Human Development

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February 24, 2017
Blacksburg, VA

Keywords: low-income older adults, service use, unmet needs, self-management, adverse health outcomes

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ABSTRACT

The goal of this investigation was to assess service use, self-management strategies, and health status of older adults (60+ years) with perceived need who sought assistance from the Virginia Medicaid Elderly and Disabled Consumer-Direction (EDCD) waiver services. A sequential explanatory mixed method design was used to address the overall research question: *How do older adults manage unmet needs*? Using health services data from two independent State agencies, regression techniques were used to examine predictors of service use, hospitalization, and mortality among 1,008 individuals. A purposive subsample of eight rural-dwelling waiver-ineligible individuals was identified for follow-up semi-structured telephone interviews to explore self-management strategies for confronting functional care needs. Waiver-ineligible individuals were at risk for hospitalization and mortality; rural-dwelling individuals were more likely to be waiver-ineligible and had increased risk of mortality. Analysis of interviews revealed individuals had ongoing unmet needs and relied on family and community services and used internal and external strategies to manage them; plans were not in place should their health continued to decline. For this group of near-risk older adults who are waiver-ineligible and do not have financial means to pay for more help, accessible preventive services are necessary to reduce risk of adverse health outcomes. Policymakers are encouraged to advocate for preventive services that assist individuals before care needs become unmanageable. Agencies responsible for service delivery need to target efforts toward this group, particularly those residing in rural areas. Researchers must continue forging partnerships that permit use of health services data to identify when and how older adults use services, and explore how self-management strategies influence health and functioning over time.

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GENERAL AUDIENCE ABSTRACT

The purpose of this research was to advance understanding of help-seeking behaviors of low-income older adults who were deemed ineligible to receive state-funded assistance. I used health services data from two independent state agencies to assess factors associated with service use and health status; follow-up interviews were conducted to explore self-management strategies of rural older adults with unmet needs. Older adults who did not receive help were at increased risk for hospitalization and mortality compared to individuals who received helped. Rural older adults were significantly more likely to not receive help and were at increased risk for mortality, placing them in a vulnerable position. Interviews with rural-dwelling older adults that were not receiving help highlighted the challenges associated with living with unmet needs but demonstrated resilience through their use of physical and psychological coping mechanisms to navigate daily challenges and maintain health and well-being. They had to deal with numerous difficulties performing instrumental activities of daily living (IADL); mobility was an underlying problem that led to subsequent IADL limitations, such as difficulty with household chores and meal preparation. Policymakers need to advocate for services that allow older adults to address preemptively their care needs before they become unmanageable. Ensuring the availability of services for near-risk older adults who are proactive in addressing their functional care needs would benefit individuals and caregivers on whom they rely. Such services not only support older adults' health, functioning, and well-being but may be cost-effective for public programs. Policies should reduce unmet needs among older adults by increasing service access in rural communities because even if services exist, they may not be available to this near-risk population of older adults.

ACKNOWLEDGEMENTS

It takes a village, and my village included my advisor Dr. Karen Roberto, who believed in me and helped me develop into a researcher. ‘Thank you’ cannot begin to describe my gratitude and appreciation for your mentorship and support. You are one of a kind!

My other committee members, Drs. Blieszner, Savla, and Teaster, who mentored me and provided unique perspectives that contributed to my professional development.

My parents, who provided endless optimism and encouragement to dream big and laugh more!

My sisters, who tolerated my time constraints and validated my experience.

Bethanians, Bereans, and Blacksburg friends and mentors, who constantly supported, encouraged, and believed in me.

And the coffee shops around Blacksburg.

Thank you!

But most importantly, Bob—the memory of our friendship—and Joanne Sykes who are constant reminders of *why I do what I do.*

Table of Contents

List of Tables

List of Figures

CHAPTER I

Background

By 2030, more than one in five people in the United States will be aged 65 and older (Ortman, Velkoff, & Hogan, 2014). While disability (e.g., limitations with personal care and other daily activities) is not inevitable in late life, the risk of disability associated with chronic conditions increases with age (Freedman, Stafford, Schwarz, Conrad, & Cornman, 2012). The World Health Organization (WHO) defines disability as a negative consequence occurring when an individual cannot independently and safely complete a task in his or her environment (WHO, 2002). Unmet need occurs when a person cannot perform activities of daily living (ADL) and instrumental activities of daily living (IADL), and does not receive adequate assistance to overcome the challenges (Desai, Lentzner, & Weeks, 2001). Even after adaptive strategies are employed (e.g., using assistive technology such as a cane; asking for assistance from family members), older persons still may not be able to adequately manage their care needs.

When older individuals fail to receive any or sufficient assistance for daily self-care and functional activities, a situation of unmet need is created (Quail, Wolfson, & Lippman, 2011). Based on the National Long-Term Care Survey of 2,422 older adults who reported at least one I/ADL limitation, 31.6% of older adults received no assistance with I/ADLs, while the remaining older adults received either informal assistance or a combination of informal and formal assistance (Davey, Takagi, Sundström, & Malmberg, 2013). Overall, more than half of the older adults reported unmet need with their I/ADLs, indicating inadequacy of the assistance received. In a representative sample of 530 women aged 70+, at least one in five women reported having inadequate assistance meeting their ADLs (Quail et al., 2011). Nearly half of community-dwelling older adults receive help or have difficulty with daily activities; close to one-third of

these individuals are expected to experience adverse consequences because of experiencing unmet needs (Freedman & Spillman, 2014). Thus, having insufficient help in late life represents a serious public health concern (Freedman, Kasper, Spillman, Agree, Mor, Wallace, & Wolf, 2014).

One of the challenges facing the system of long-term services and supports (LTSS) is the declining informal caregiver support ratio, due in part because of changing family size (Redfoot, Feinburg, & Houser, 2013). According to the AARP Public Policy Institute, there were seven potential caregivers for every one individual 80+ years in 2010; by 2030 there only will be four potential caregivers for every one older person (Redfoot et al., 2013). In a society where informal caregiving has been considered the de facto approach for providing care of vulnerable individuals (Alkema, 2013), the changing demographics of the United States indicate a need for alternative forms of caregiving.

Older adults first turn to family to provide assistance with their daily care, with spouses and adult children their preferred caregivers (Davey & Szinovacz, 2008). Based on the National Health and Aging Trends study, nearly all older adults received some type of informal, unpaid help (Freedman & Spillman, 2014). Survey data from the 1999 and 2004 National Long Term Care Survey show that nearly two-thirds of older adults with disabilities received their care exclusively from family caregivers (Doty, 2010). While older adults may have multiple informal caregivers (Davey & Szinovacz, 2008; Freedman & Spillman, 2014), availability of informal caregivers does not necessarily mean that older adults' needs are being met (Davey et al., 2013; Li et al., 2012). As disability increases, the amount of informal and formal care increases (Kemper, 1992). Nearly one-third of older adults receive a combination of formal and informal care (Freedman & Spillman, 2014). Although most older adults will need some type of formal

assistance at some point in their life (Swartz, Miake, & Farag, 2012), when the need arises, older adults often turn to home and community-based services (HCBS). HCBS provide help and support individuals need to continue living in their own homes and communities, but many cannot afford formal services (Casado, van Vulpen, & Davis, 2011). HCBS options are designed to enhance the feasibility of older adults remaining in their homes and communities (Medicaid.gov, n.d.). Use of HCBS is associated with improved quality of life, prevention of institutionalization, and government cost-savings for LTSS (Ng, Harrington, & Kitchener, 2010; Shapiro, Loh, & Mitchell, 2011).

Medicaid is the nation's health insurance program for low-income individuals, including older adults. When financially eligible for Medicaid, individuals may receive a range of Medicaid-funded services, including long-term care services. States offer additional programs and supports targeted for specific populations, such as the Medicaid Section 1915(c) Home and Community-based Waiver Program (hereafter referred to as the *waiver program*). Established in 1981 as an alternative to nursing home placement for individuals with economic and physical vulnerabilities (Ng & Harrington, 2012), the waiver program offers services and supports for eligible individuals with functional care needs. Administered under the State division of long-term services and supports, it is a self-directed program where participants have decision-making authority over certain services. Services, such as personal care, emergency response system, respite, and adult day services, help older adults and their caregivers meet older adults' care needs. In 2011, nearly 1.5 million individuals benefited from the waiver program (Ng, Harrington, Musumeci, & Reaves, 2015).

To be eligible for waiver programs, individuals must have financial need (i.e., determined by income) and be assessed to have care needs at an institutional level; HCBS services should

not cost more than they would in an institutional care setting; and provider standards must be adequate and reasonable (Medicaid.gov, n.d.). Beyond these federal eligibility criteria, there are state-specific eligibility criteria (Kaye, 2015; Komisar, Feder, & Kasper, 2005). In 2014, all states imposed mechanisms to control waiver program costs (Black, Dobbs, & Young, 2015; Lockhart, Giles-Sims, & Klopfenstein, 2009; Ng et al., 2015). States decide on the criteria for how many functional ADL limitations individuals must have for eligibility. In most states, individuals must have two functional limitations to be nursing home eligible. Ten states require three or more limitations (Ng et al., 2015).This dual level eligibility process based on financial need and functionality results in unequal access to benefits, depending on state of residence. Despite individuals having the same level of need, the system tends to be generous to some, meager for others, and devoid for the rest (Kaye, 2015).

Virginia is one of the states with stricter functional eligibility criteria for Medicaid-funded nursing facility placement and thus waiver eligibility, requiring an individual to demonstrate four ADL limitations. Many older adults benefit from the Virginia Elderly and Disabled Consumer-Directed (EDCD) waiver program. According to the Department of Medical Assistance Services (2009) which administers the program, the Uniform Assessment Instrument (UAI) is the state-designated preadmission screening instrument used to assess five dimensions of individuals' functioning (social resources, economic resources, mental health, physical health, and activities of daily living). Eligibility is determined with standardized decision criteria developed based on the UAI. By using more stringent need requirements, a large number of Virginians are not eligible to receive services designed to enhance the feasibility of remaining in their homes. This can be interpreted as an effort to target individuals with greatest disability (personal correspondence with Director of DMAS), but also may reflect budgetary concerns.

Thus, a group of older adults are ineligible for waiver services and emerge as a vulnerable population at risk for unmet need and adverse health consequences. An unintended consequence of stricter waiver criteria is higher cost to the state due to costlier institutionalization associated with unmet care needs.

In addition, Virginia is one of 11 states that has more restrictive financial eligibility criteria for waiver programs (AARP, 2010). Even with more stringent functional and financial eligibility criteria, there is a growing demand for waiver programs as evident by the increasing number of older individuals waiting to receive services in Virginia and elsewhere (Ng & Harrington, 2012).

Based on available data, prevalence of unmet need ranges from 20% to 58% of older adults with disabilities in the United States (Davey et al., 2013; Keeling, 2014). Challenges to identifying unmet need are a direct result of the multiple definitions used to determine what constitutes unmet need (e.g., Li, Kyrouac, McManus, Cranston, & Hughes, 2012; Sands et al., 2006) and various algorithms used to determine need (e.g., Davey et al., 2013; Freedman & Spillman, 2014; Li et al., 2012; Quail, Addona, Wolfson, Podoba, Lévesque, & Dupuis, 2007). Risk factors associated with having unmet needs include older age, living alone, being female, high level of disability, multiple I/ADL difficulties, cognitive impairment, and low socioeconomic status (Davey et al., 2013; Desai, Lentzner, & Weeks, 2001; Dubuc, Dubois, Raiche, Gueye, & Hebert, 2011; Freedman & Spillman, 2014; Li et al., 2012).

Adverse consequences experienced by older adults with unmet needs include hospitalization, nursing home placement, and death (Desai et al., 2001; Komisar et al., 2005; Li, Chadiha, & Morrow-Howell, 2005; Ronksley et al., 2013). Characteristics of individuals with the highest risk for adverse consequences included minority status, low socioeconomic status

(Freedman & Spillman, 2014), and living alone (Desai et al., 2001; LaPlante et al., 2004). Among a sample of 2,123 older Medicare and Medicaid recipients with unmet functional needs, more than one-half reported adverse consequences relating to ADLs going unmet, such as falling out of bed or not being able to shower (Komisar et al., 2005). Based on the Canadian Community Health Survey, adults aged 18 years and older with limited financial resources had a slightly higher risk of hospitalization compared to adults with greater financial resources (Ronksley et al., 2013). Similarly, Li and colleagues (2005) found that 1-year mortality rates increased for adults aged 70 years and older when financial resources were more limited.

Although unmet need has been studied extensively, the experiences of individuals who have requested services and been deferred because they are not yet eligible have been ignored. Additional research is needed to develop a more complete picture of what resources older adults and their caregivers draw on when they do not have access to appropriate services (Lucke et al., 2008). Experiencing unmet or undermet needs (i.e., receiving an insufficient amount of care) increases the risk for adverse consequences, yet the long-term consequences of managing care needs when ineligible for formal assistance is virtually unknown. It is unclear how low-income older adults, who clearly perceive the need for assistance but are not yet eligible for Medicaid-funded services, manage without access to affordable services.

Purpose of Study

Using Virginia as the study site, the overall goal of this investigation was to assess service use, self-management strategies, and health status of older adults with perceived need who sought assistance but were deemed ineligible to receive Virginia Elderly and Disabled Consumer-Direction (EDCD) waiver services. Using health services data from two independent State agencies, the purpose of Phase 1 of the study was to assess predictors of service use and

adverse health outcomes of older adults. Research questions focused on the association of predictors with service use, occurrence of hospitalization, and mortality up to two years after individuals initially sought assistance.

In Phase 2 of the study, I conducted semi-structured interviews with a purposive sub-sample of eight rural older Virginians to further the understanding of how older adults who perceive a need for assistance manage their unmet care needs. This population is particularly vulnerable not only because of the known association between increasing age and higher levels of disability (Freedman et al., 2012), but because older persons in rural areas are less likely to have adequate access to services to assist them with daily care needs (McAuley, Spector, & Van Nostrand, 2009). The primary research question guiding this phase of the study was: *How do older individuals living in rural counties manage their ongoing unmet care needs?* This phase of the study, in combination with findings from Phase 1, provided new insights about low-income older adults' challenges, successes, and strategies associated with self-management of daily care needs, especially in rural areas.

CHAPTER II

Review of the Literature

Prevalence of disability increases with advancing age. One-quarter of individuals between the ages of 65 and 74 reported having a disability while more than half of the individuals aged 75+ years reported they had a disability (Erickson, Lee, & von Schrader, 2015). Among individuals 65 to 74 years old, 8% reported a disability that interferes with living independently, and 9% reported a disability with self-care. Among individuals aged 75+, 26% and 14% reported having independent living and self-care disabilities, respectively.

When faced with disabilities in late life, older adults strive to maintain their independence by using various help-seeking behaviors to address their functional and emotional care needs. Individuals with unmet care needs are at risk for adverse health consequences (Drum, Krahn, Peteron, Horner-Johson, & Newton, 2009), and individuals with disabilities experience increased risk for poor health outcomes (Dixon-Ibarra & Horner-Johnson, 2014). In this chapter, I review the literature on help-seeking behavior using Andersen's (1995) behavioral model of health service use to identify factors that influence help-seeking behaviors as they relate to late life disability, unmet needs, and subsequent adverse health consequences experienced by older adults. The chapter concludes by highlighting gaps in the literature.

Help-Seeking Behavior

Help-seeking behavior is an intentional action taken to solve problems associated with a decline in personal abilities (Cornally & McCarthy, 2011). As older adults acknowledge a need for assistance, they usually turn to family and other informal caregivers first to provide assistance when their personal care needs become too difficult to manage alone. When additional help is needed beyond what family or other informal helpers can provide, older individuals may

seek assistance from federal and state programs. However, there are several barriers to formal service use, including inability to pay for services (Kemper, 1992), lacking awareness of and access to available services (Casado et al., 2011; Harrington, Ng, LaPlante, & Kaye, 2012; Hong et al., 2011; Wiener et al., 2013) and stringent eligibility criteria for Medicaid-funded services (Kaye, 2015; Komisar et al., 2005).

Various theories have been developed to explain how help-seeking behavior influences health and service use (Wacker & Roberto, 2016). For example, psychological theories explain the individuals' processes when considering using services. Individuals may evaluate whether receiving assistance from others would maintain equity in their relationships, be a threat to their self-esteem, or be a threat to their personal freedom (Wacker & Roberto, 2014). Because psychological theories focus on individuals who are still contemplating whether to use services, psychosocial theories offer a more specific explanation of factors associated with actual service use. They offer explanations about why people may be reluctant to use services and how perceptions of self-reliance and competency contribute to reluctance.

Andersen's (1995) behavioral model of health service use is considered a psychosocial theory that offers explanations about who is likely to use services. Certain individuals are more inclined to use services when a need arises, but their likely of using services is associated with availability and affordability of services. Thus, individuals' financial situation must be taken into consideration when examining factors associated with help-seeking behaviors. An additional vulnerability occurs when individuals have limited financial ability to pay for services (Leach et al., 2008). The link between low income level and greater risk of unmet need is well established (e.g., Desai et al., 2001; Quail et al., 2007; Sachs-Ericsson et al., 2006). Although Medicaid is health insurance for low-income individuals (described previously), states have authority to

establish stricter criteria for financial and/or functional need. Depending on the state, individuals may be financially eligible to receive Medicaid but not meet functional-need criteria for specific programs. Despite perceived need for assistance and help-seeking behaviors, individuals may not receive assistance due to inability to pay for assistance, which in turn is associated with increased risk for adverse health outcomes (Li et al., 2005).

The Behavioral Model of Health Service Use

First presented in 1968, Andersen's Behavioral Model of Health Services Use provided a framework for examining factors that contribute to service use (Andersen, 1995). This model is a psychosocial theory of help-seeking behavior. Individual determinants influence health service use (Fisher, Harrison, Reeder, Sari, & Chad, 2015). Within an individual's external environment and system of health care, predisposing characteristics (e.g., demographic characteristics, social structures, health beliefs), enabling resources (e.g., personal/family, community), and need-based factors (both perceived and evaluated) influence health behavior and use of health services, which ultimately influence health outcomes (Andersen, 1995).

Research using this model as a predictive mechanism has identified several factors associated with service use including old age, being female, poor health, family assistance, higher education, lack of access to transportation, and knowledge of and need for services (Ferris, Glicksman, & Kleban, 2016). Andersen's model has been used to identify differences among groups of older adults. For example, McAuley and colleagues (2009) found that rural older adults received significantly fewer days of homecare services than urban older adults, which the study authors suggested might have resulted from lack of availability of services in more remote areas. Iecovich and Carmel (2011) used the framework to identify predisposing, enabling, and need-based factors significantly associated with the use of adult day services

(ADS) in Israel, where ADS in Israel is considered a social meeting place rather than a place to meet instrumental needs of participants. Severity of need was strongly associated with use of ADS, but unlike ADS users in the United States, Israeli users were less frail but more socially vulnerable than non-users (e.g., unmarried, living alone, less education). Thus, individuals with greater severity of mental or physical disability were less likely to use ADS. However, the enabling factor of whether individuals had a homecare worker to provide assistance at home most strongly explained the difference between users and non-users.

Health beliefs are considered a predisposing characteristic that influence service use (Andersen, 1995). Before taking action, individuals evaluate their beliefs about the benefits of health behaviors and the costs and barriers to such behaviors (Shaw, Brittain, Tansey, & Williams, 2008). Threat perception, the perceived susceptibility to illness, and the anticipated consequences of the illness influence individuals' response to care needs (Shaw et al., 2008). Self-efficacy represents individuals' belief about their ability to exert control or behave in a certain way (Bandura, 1986). The personal factors associated with self-efficacy influence an individual's ability to cope with co-morbidities (Horrocks, Somerset, Stoddart, & Peters, 2004). One form of coping behavior is self-management (Horrocks et al., 2004), which directly affects quality of life (Shaw et al., 2008).

Andersen's model provides a useful framework to conceptualize factors associated with the likelihood of using services. As a broad framework to understand factors associated with service use, there is great variability in how researchers incorporate variables in the model (Babitsch, Gohl, & von Lengeke, 2012). For example, availability of informal caregiving and length of caregiving have been conceptualized as enabling resources (Chen & Thompson, 2010; McAuley et al., 2009; Weaver & Roberto, 2015), whereas family status and living arrangement

have been considered predisposing characteristics (Auslander, Soffer, & Auslander, 2003; Willis, Glaser, & Price, 2010). Similarly, psychological characteristics, such as mastery or perception of control, have been considered as predisposing factors (Andersen, 1995) and as intrinsic enabling factors (Gilmore, 2013). Income is another variable that researchers have conceptualized differently. Hong (2010) maintained Andersen's designation of income as an enabling resource, but later considered income as a predisposing variable (Hong, Hasche, & Lee, 2011). Given the flexibility of this model, researchers define variables as predisposing, enabling, or need-based factors based on the available data and their specific research questions.

Need and Late Life Disability

As individuals are living longer, it is likely they will experience functional difficulties and disability in late life (Chatterji, Byles, Cutler, Seeman, & Verdes, 2015). Defined broadly as "the presence of any physical (mobility-related), cognitive, or sensory impairment or activity limitation" (Freedman et al., 2012, p.589), disability is a strong indicator of a person's ability to remain independent in the community (Schulz, Heckhausen, & O'Brien, 2014). Currently, nearly one-half of the older population is not fully able to complete daily activities but do not receive assistance from another person (Freedman et al., 2014). That is, more than 7 million older adults have difficulty carrying out activities independently. An additional 2.1 million individuals have reduced their activity level but still had trouble (Freedman et al., 2014). Thus, maintaining independence in late life is one of the ultimate challenges faced by older adults (Schulz et al., 2014).

In order to access formal services, a professional assessment is often conducted to determine need and document level of severity (e.g., Allin, Grignon, & Le Grand, 2010; Dubuc et al., 2011; Stirling et al., 2010). Subjective need, or the perception of needing more health

care, is often overlooked when allocating scarce resources for assistance (Allin et al., 2010). Older adults who do not receive services they perceive they need are at risk for experiencing unnecessary adverse health outcomes (Desai et al., 2001; Li et al., 2005). For example, over a 10-year period, community-dwelling older adults who perceived their basic physical functioning needs were not being met at baseline were more likely to have increased physical functioning problems (Sachs-Ericsson, Schatschneider, & Blazer, 2006). These findings held even when controlling for socioeconomic status and health problems and behaviors at baseline, revealing that perceptions of insufficient help were an accurate reflection of needs and unmet needs lead to worse health over time.

Predisposing Characteristics

When faced with functional and emotional care needs, personal characteristics are associated with the likelihood of service use (Andersen, 1995). According to Andersen (1995), predisposing characteristics include demographics (e.g., age, gender), social structures (e.g., level of education, ethnicity), and health beliefs (e.g., attitudes, values, knowledge about service use). Psychological characteristics, such as perception of control and resilience also are considered predisposing variables that influence the propensity for help-seeking behavior. Individuals often rely on internal protective factors to adjust to disruptions in daily life (Wells, 2010), especially when impairment progresses to functional limitations and disability (Schulz et al., 2014).

Service use has been associated with being older and female (e.g., Laditka, Laditka, & Drake, 2006; Sands et al., 2012; Borrayo et al., 2004). However, researchers have reported conflicting findings on the association of sex with unmet need. While some researchers found that females had lower odds of experiencing unmet needs (Casado et al., 2011), others reported

males were at increased risk (LaPlante et al., 2004). Yet other studies did not find a significant relationship between unmet need and sex or age (Ferris et al., 2014; Ronksley et al., 2013; Schure, Conte, & Goins, 2015).

Service use varies across race and ethnic groups, but study findings are inconsistent. Analysis of data collected in 1994 for the national Longitudinal Study of Aging showed that Black individuals were more likely to use a greater number of services and use services at a higher intensity than White and Hispanic individuals (Laditka et al., 2006). Data collected in 2004 for the National Long-term Care Survey showed that non-White individuals were more likely to receive formal care support than their White counterpart (Davey et al., 2013). More recently, findings from the National Home and Hospice Care Survey (2000 and 2007) of home health care recipients revealed White individuals were more likely to be service users, compared to Black or other race and ethnic groups (Caffrey, Sengupta, Moss, Harris-Kojetin, & Valverde, 2011). Similarly, a statewide assessment of Medicaid HCBS users in Indiana found that White individuals were more likely to use a higher volume of services (Sands et al., 2012) compared to non-White individuals.

Regarding functional and emotional unmet care needs of participants, researchers reported inconsistent findings associated with race and ethnicity. Findings from the National Health Interview Survey on Disability showed that non-White individuals were more likely to have unmet needs than White individuals (LaPlante, Kaye, Kang, & Harrington, 2004). Casado and colleagues (2011) found being self-identified as Black was a consistent predictor of unmet need, which the authors speculated was associated with Black caregivers being less aware of services than White caregivers. However, Davey and colleagues found that race was not a predictor of unmet needs. Other researchers did not report on the effects of race on unmet needs

(e.g., Quail et al., 2011; Ronksley et al., 2013) or had a predominately White sample (e.g., Li, Kyrouac, et al., 2012).

Since the groundbreaking study by Langer and Rodin (1976) that examined the role of enhanced personal responsibility and choice on older adults' general sense of well-being, control has "been an underlying theme in theoretical discussions of health" across the life course (Umberson, Crosnoe, & Reczek, 2010, p. 145). A two-year longitudinal study of 951 older adults within Los Angeles County found that higher levels of personal control at baseline was associated with having more positive health behaviors at the one-year follow up (Seeman & Seeman, 1983). Based on a review of the literature on knowledge, sense of personal control, and health, Mirowsky and Ross (2005) found evidence that perceived personal control is cumulative over individuals' lifetime. Low sense of personal control negatively influenced later life health outcomes while a high sense of personal control positively influenced health outcomes. Other research showed that while sense of control declines with age, there is consistent evidence that higher educational attainment is associated with higher control beliefs across the lifespan (Lachman, Neupert, & Agrigoroaei, 2011). To maintain a sense of control over declining health circumstances, older adults may engage in primary and secondary control strategies (Heckhausen & Schulz, 1995). Primary control strategies involve various behaviors that acknowledge a threat or limitation, but are aimed at maintaining functioning (Schulz et al., 2014). Secondary control strategies often occur by restructuring or adjusting goals to maintain a sense of self-efficacy (Leach & Schoenberg, 2008; Schulz et al., 2014).

The reduced ability to exert primary control to maintain functional independence is associated with anxiety and depressive affect (Schulz et al., 2014). Wrosch, Schulz, and Heckhausen (2002) measured how older adults employed cognitive and behavioral resources to

attain their health goals (a higher score indicated greater ability to employ resources. Cross-sectional and longitudinal analyses showed that older adults who had higher levels of health engagement reported lower levels of depressive symptoms initially and over time. Thus, when individuals are confronted with late life disabilities, health goals may be effectively addressed by learning control strategies to improve physical and psychological well-being.

Clinical depression is a non-normative experience in later life (Weil, Hutchinson, & Traxler, 2014). Having a lower level of functional status, as measured by need for ADL and IADL assistance, predicted depression status among a sample of rural, homebound older adults (Tanner, Martinez, & Harris, 2014). Studies that examine the association between concurrent depression and unmet need are few, and have yielded inconsistent results. Based on the Montreal Unmet Needs Study of older women, being unable to perform an IADL was associated with increased psychological distress (Quail et al., 2011). Unmet needs in ADL, IADL, and transportation needs were significantly associated with depressive symptoms among older and younger individuals with disabilities in Massachusetts (Allen & Mor, 1997). Older adults reporting unmet needs were more likely to have symptoms of depression, compared to older adults without unmet needs. Otero and colleagues assessed unmet needs among a representative sample of community-dwelling older Spaniards (Otero, de Yebenes, Rodriguez-Laso, & Zunzunegui, 2003). They found that depressed individuals were twice as likely to have unmet ADLs. Among a sample of older Native Americans, Schure and colleagues (2015) found a significant association between having one or more unmet assistance needs and depressive symptoms. Conversely, Sands and colleagues' (2006) analysis of acute care admissions among older individuals participating in the Program for All-inclusive Care for the Elderly (PACE) at 13 nationwide sites did not find an association between unmet need and concurrent depression.

One possible explanation for the lack of association between unmet functional need and depressive symptoms is that the study sample was receiving various other services, including medical and psychosocial services, provided by the PACE program. Thus, while additional unmet needs may have been present, other needs were being addressed.

Researchers have identified a strong link between individuals' self-management abilities and prevention of depression and maintenance of well-being (Cramm et al., 2012; Cramm et al., 2013; Gerber et al., 2011). For example, being more self-efficacious and taking greater initiative were significantly associated with greater well-being and lower levels of depression symptoms, respectively in a sample of older adults aged 65+ who had been recently discharged from the hospital (Cramm et al., 2012). Similarly, older adults with greater self-management knowledge, skill, and confidence reported fewer depression symptoms compared to individuals with less knowledge, skill, and confidence (Gerber et al., 2011).

Being resilient may contribute to an individual's reduced risk of adverse environmental conditions (Dannefer, 2015) and adjustment to challenges associated with aging, including late life disability (Wells, 2010). Resilience is defined as a persons' ability to physically and psychologically cope effectively when faced with challenging circumstances (Wagnild & Collins, 2009). Using data from the Health and Retirement Study (2006-2010), Manning, Carr, and Kail (2014) found that over time, older adults with high levels of resilience accrued fewer additional I/ADL limitations. Although Wells (2010) found no differences in level of resilience within a sample of rural, urban, or suburban older adults, greater levels of resilience were significantly associated with having a stronger family network, lower household income, and good mental and physical health (Wells, 2010). Here, resilience served as a buffer to deleterious health events and everyday challenges of living with late life disability.

Enabling Factors

Andersen (1995) considered enabling factors to include personal and community resources, such as financial resources (e.g., income, health insurance), having an available source of care, and geographic region. Other researchers have conceptualized enabling factors as intrinsic or extrinsic to the individual, with intrinsic enabling factors encompassing internal perspectives and perceptions of oneself, such as resiliency, mastery, and self-efficacy (Gilmore, 2013). Enabling resources can also include environmental modifications, such as adaptive devices, adequate housing structures, and accessible transportation (Sachs-Ericsson et al., 2006). Older adults use devices and make environmental modifications to meet ADL needs (Freedman et al., 2014). Keeping with Andersen's (1995) conceptualization, the following studies focused on extrinsic enabling factors.

The role of socioeconomic status has been examined in relation to service use, barriers to service use, and unmet needs. Lower socioeconomic status is a predictor of increased likelihood of using services (Laditka et al., 2006), increased barriers to service use (Lai & Chau, 2007), and having unmet needs (Lai & Chau, 2007; Peng, Wu, & Ling, 2015; Sachs-Ericsson et al., 2006). Rural older adults may be particularly vulnerable to having unmet needs because of limited availability of community and health care services in remote geographic areas (Glasgow & Brown, 2012; Krout, 1998). Lucke and colleagues (2008) found that rural female caregivers for older adults, compared to their urban counterparts, were more aware of services, and rated services as having higher quality. While some studies reported that rural residents were more likely to use services than their urban counterparts (Laditka et al., 2006), other studies reported that rural older adults were less likely to utilize formal assistance than urban older adults

(McAuley et al., 2009), which was attributed to increased distance to service providers and health facilities (Nemet & Bailey, 2000).

Early life experiences and behaviors shape later life health outcomes (Umberson et al., 2010). Several researchers have used longitudinal data to explain how socioeconomic situation in earlier life and level of education shape later life outcomes. For example, retrospective measures of poor childhood health and disadvantaged social origins were associated with greater decline in functional ability at older ages (Haas, 2008). In another study of individuals ranging in age from 21 to 79 years old, the relationship between satisfaction with dimensions of physical, social, and self-efficacy needs and health-promoting self-care behavior was examined (Acton et al., 2000). Older individuals, as well as individuals with higher social class, income, and level of education were more likely to engage in health-promotion self-care behaviors (Acton et al., 2000). A secondary analysis of several international longitudinal aging surveys among individuals 60+ years revealed that individuals with less education and less wealth had worse health, compared to their more fortunate counterparts (Chatterji et al., 2015). The health status disparity evident between rich and poor individuals revealed how poorer individuals' health worsened more rapidly than rich individuals. Individuals' social position is associated with health throughout their lifetime (Corna, 2013). Socioeconomic inequalities tend to diverge even more in late life (Kim & Durden, 2007), making the enabling resource of socioeconomic status (or the various other measures, such as income or wealth) an important variable that provides information about health behaviors.

Individuals do not exist in isolation; rather, family and community influence how individuals manage their care needs (Settersten, 2015). When faced with late life disability, family members are often the preferred source to provide assistance and care (Silverstein &

Wang, 2015). Although families are increasingly diverse and have various constellations of care arrangements in late life, most studies draw on predominantly White populations (Roberto & Weaver, anticipated 2018). Typically, informal care is provided until physical, emotional, and financial resources are exhausted and formal care is accessed. In the United States, public policies reflect (and reinforce) underlying values of filial responsibility. Thus, implementation of federal and state service sector policies limit access to affordable LTSS and place most of the responsibility of care on families.

The availability of social support influences individuals' likelihood of engaging in behavioral changes (Gilmore, 2013) and lower levels of social support is associated with having unmet needs (Schure et al., 2015). Despite having unmet care needs, older adults who were married and living with their spouse had a lower likelihood of using formal homecare compared to unmarried and living alone older adults (McAuley et al., 2009). This finding suggests that older married couples are more likely to rely on informal care. However, in a representative sample of married older couples living in the United States, about one-half of older adults with ADL limitations did not receive any assistance from their spouse because their spouses' own functional limitations prohibited them from assuming a helping role (Shen, Feld, Dunkle, Schroepfer, & Lehning, 2015).

Positive social support has been associated with reduced psychological distress and improved the ability to cope with unmet needs (Quail et al., 2011). Based on a national survey of older men and women, those who received support from more than just immediate family members reported better health outcomes than individuals who only received support from immediate family (White, Philogene, Fine, & Sinha, 2009). That is, adequate emotional support was associated with better health status. In a 10-year longitudinal study based on a nationally

representative sample of 6,535 older adults, receiving informal social support from non-spouse family and friends was associated with reducing depressive symptoms over time (Muramatsu, Yin, & Hedeker, 2010). For Australian community-dwelling men and women, satisfaction with social support (i.e., perceived as relevant and adequate) was more effective in limiting subsequent disability than the amount of social support provided (McLaughlin et al., 2012).

Data from the Women's Health and Aging Study revealed that perceived adequacy of instrumental support was not associated with depressive symptoms (Weil et al., 2014; Wolff & Agree, 2004). However, whether support was provided in a reciprocal and respectful context were significantly associated with depressive symptoms (Wolff & Agree, 2004). That is, perceived quality of care arrangements was associated with mental health outcomes; when older women with late life disabilities perceived reciprocity and respect by their informal caregiver, they were less likely to report symptoms of depression. For both men and women in Australian, lack of satisfaction with social support was associated with greater ADL and IDL limitations (McLaughlin et al., 2012). Similarly, there were no gender differences when examining the effects of social isolation and loneliness on morality over seven years among a nationally representative British sample (Steptoe, Shankar, Demakakaos, & Wardle, 2013).

Health Behavior and Health Outcomes

In Andersen's original behavioral model, health service use was the primary outcome variable measured (Andersen, 1995). Health service was operationalized broadly as hospitalization, ambulatory care, and inpatient services. Currently, health service use is considered a component of health behavior, which influences health outcomes. Health behavior consists of personal health practices, such as self-management behavior, and use of health services. Frequent measures of health outcomes include perceived health status, evaluated health

status, and consumer satisfaction. Adverse consequences like hospitalization, institutionalization, and/or death are frequently used to assess the health outcomes associated with unmet need (e.g., Allen & Mor, 1997; Gaugler, Kane, Kane, & Newcomer, 2005; Li et al., 2012; Sands et al., 2006). As his model evolved, Andersen (1995) acknowledged a feedback loop from health outcomes back to predisposing factors, enabling resources, perceived need, and subsequent health behaviors. Thus, perceived health status in terms of perceived need for assistance and the extent of unmet need can be considered a health outcome. In this section, research on self-management behaviors, the use of formal health services, and health outcomes as a result of insufficient assistance and unmet need are discussed.

Health Behavior and Self-Management

With late life disabilities, older adults experience lifestyle changes that increase self-management demands (Tanner et al., 2014). Self-management is a process in which individuals learn and use skills to improve physical and emotional well-being (Lorig, 1993). Self-management skills are intended to help individuals achieve optimal health within their current circumstances (Dickerson et al., 2011), to minimize decline in physical health functioning, and to cope with psychosocial consequences (Gallant, Spitze, & Prohaska, 2007). More broadly, community-dwelling older adults use self-management programs to minimize decline in ADLs (Phelan, Williams, Penninx, LoGerfo, & Leveille, 2004). The ability to self-manage contributes to the ability to maintain overall well-being and limits functional decline (Cramm et al., 2012).

Research on self-management and quality of life in later life has focused primarily on a single condition, such as arthritis (e.g., Nuñez, Keller, & Der Ananian, 2009), heart disease (e.g., Moore, Frost, & Britten, 2015), schizophrenic disorder (e.g., Stein-Parbury, Gallagher, Chenoweth, & Luscombe, 2012), diabetes (e.g. Erdem & Korda, 2014), and osteoporosis

(Francis, Matthews, Van Mechelen, Bennell, & Osborne, 2009). A few studies have focused on self-management of multiple morbidities (Leach & Schoenberg, 2008), considered how self-management is beneficial within the family context (Gallant et al., 2007), or focused on socioeconomically vulnerable older adults (Clark et al., 2008).

Leach and Schoenberg (2008) interviewed 41 adults aged 50 and older with multiple morbidities to understand specific strategies that individuals use to feel more in control of and self-manage their health. The sample was more racially and socioeconomically diverse than used in most prior studies, representing the disproportionate burdens of multiple morbidities experienced by Black individuals and individuals with lower socioeconomic status. The study authors identified an overarching theme of "striving for control" despite lacking material wealth. The strong desire of participants to retain control of their health was achieved by using three primary strategies: (1) cognitive structuring techniques including health vigilance, normalizing the situation as part of the aging process, making social comparison, and relinquishing control; (2) self-care activities that involved taking medication, modifying dietary intake, exercising, modifying existing activities, and making regular doctor visits; and (3) faith-oriented strategies that encompassed prayer and church as a central part of life. Except for faith-oriented strategies, in which Black participants expressed stronger religiosity than White participants, there were no other race or ethnicity differences.

To examine how the social context of family and friends facilitated or hindered self-management of chronic illnesses in older adults, Gallant et al. (2007) conducted focus groups with 84 Black and White men and women who were aged 65 and older. The participants' social network influence on decision-making about care was mostly positive, including direct help with meal preparation, medication reminders, dietary advice, transportation, information, and

companionship. The source of negative influence was more likely from family members than friends. Negative influences occurred when assistance fell short of the individuals' needs, such as not following dietary guidelines or engaging in depressing talk. Often, the social network intended to be supportive but their actions were interpreted as negative or a hindrance to the older adults. Family provided more tangible support for continuous activities (e.g., meal preparation, communication with physicians) while friends provided emotional and informational support. Coping with psychosocial aspects of functional disability is a component of self-management; social network members provided positive emotional support by talking, understanding, and motivating older adults.

Clark and colleagues (2008) examined the role of social context in self-management strategies via in-depth, home-based interview with 23 vulnerable and 12 non-vulnerable community-dwelling older adults. Based on the work of others (Clark, Stump, Miller, & Long, 2007; Morrow et al., 2006, as cited in Clark et al., 2008), the study authors defined *vulnerable* as "having low income, low education, and/or low health literacy" (p.312). Non-insured older adults with low educational attainment and low health literacy considered keeping doctor visits and taking prescription medications as their primary self-management behaviors. The privately insured older adults' definition of self-management consisted of additional behaviors that lead to healthy aging. That is, non-vulnerable older adults were much more likely to discuss health maintenance behaviors, highlighting their belief of control over their health and aging. The non-vulnerable group was more physically and mentally healthy compared to the vulnerable group. Similarly, a study by Cramm and colleagues (2013) demonstrated that older adults with higher levels of social, cognitive, and physical functioning were more successful at self-management compared to those with lower levels of functioning (Cramm et al., 2013).

Although individuals at risk of social and functional decline in late life benefit from self-management (Cramm et al., 2013), interventions designed to improve self-management often yield weak results. This may be in part because individuals' unmet needs are sensitive to change over time (Wiersma et al., 2009). Clark and colleagues (2008) suggested researchers need to better understand the lived experiences of older adults with unmet needs before self-management interventions can improve. An array of factors influence self-management abilities, including self-efficacy, available resources, expectations, life priorities, awareness, and social network demands and can inform research efforts to identify individuals with low self-management capacity (Clark et al., 2008). A broad repertoire of skills may prevent further losses in late life for vulnerable older adults, especially for individuals with lower levels of education (Cramm, Twisk, & Nieboer, 2014). For example, there were distinctly different levels of expectation for health between vulnerable and non-vulnerable older adults (Clark et al., 2008). Vulnerable older adults did not expect to live much longer and reported comfort, rest, and elimination of pain as health priorities. Conversely, non-vulnerable older adults expressed health goals that reflected expectations to reach milestones of family, working, and socializing. Thus, to support individuals with health self-management, the discrepant expectations need to be addressed.

Additional research focusing on the contextual, cultural, and psychological factors that influence coping strategies to maintain control of health and well-being in late life is needed (Leach & Schoenberg, 2008). While Leach and Schoenberg (2008) purposefully oversampled a racially and socioeconomically diverse sample, there are gaps in understanding about how older adults living in rural areas may employ unique strategies to address late life disabilities. Using self-management strategies may contribute to individuals' ability to deal with adversity in late life.

Formal Health Service Use

Seeking formal support services often indicates individuals perceive a need for more help (Chen & Thompson, 2010; Cornally & McCarthy, 2011). Accepting help through formal services is one form of self-management. Using formal services has the potential to reduce adverse health outcomes (Kadowaki, Wister, & Chappel, 2015) and mitigate informal caregiver burden (Sussman & Regehr, 2009). In a sample of older adults 65 years and older, receiving formal homecare services to meet their needs for a health condition or limitation that affected their daily life was associated with having higher levels of life satisfaction, lower levels of loneliness, and lower levels of perceived life stress compared to older adults with ongoing unmet needs (Kadowaki, Wister, & Chappel, 2015). HCBS users have reported improved quality of life (Ng, Harrington, & Kitchener, 2010) and fewer unmet needs (Schore, Foster, & Phillips, 2007). Many HCBS options, such as personal care and home health, are intended to help older adults with their functional care needs and supplement the ongoing informal caregiving for older adults' care needs (Davey et al., 2005; Freedman & Spillman, 2014). Individuals who received more hours of personal care and homemaking services had a lower risk of nursing home placement over a 2-year period, compared to individuals with fewer hours (Sands, Xu, et al., 2012). That is, individuals with insufficient help are at increased risk of hospitalization (Hass, DePalma, Craig, Xu, & Sands, 2015; Sands, Wang, McCabe, Jennings, Eng, & Covinsky, 2006; Xu, Covinsky, Stallard, Thomas, & Sands, 2012) and mortality (Blazer, Sachs-Ericsson, & Hybels, 2005; Carey, Covinsky, Lui, Eng, Sands, & Walter, 2008; Ronksley et al., 2013).

However, barriers to service use are frequently cited in the literature. Older adults may not use home-based formal services because they are unaware of the services, the services are unavailable in their area, or they cannot afford the services (Casado et al, 2011; Hong, 2006). For

participants in the National Long-Term Care survey (NLTCS), access barriers to specific HCBS, such as receiving homemaker services were associated with race, educational level, and Medicaid enrollment (Hong, 2006). Other studies using the NLTCS focused on caregiver barriers to service utilization and reported that while awareness, availability, and affordability were common barriers, additional barriers that emerged included staff quality and privacy violation concerns (Hong et al., 2011).

Waitlists provide a good indicator of unmet need, but the definition of and criteria for waitlists vary from state to state (Ng & Harrington, 2012). In 2013, more than half a million people were on a waitlist for a waiver program (Ng et al., 2015). One waitlist-specific study in Iowa assessed the effects of the waiting period to receive services on nursing home placement and hospitalization (Peterson, Brown, Barrett, Wu, & Valenzano, 2014). Less time on the waitlist was associated with lower likelihood of long-stay nursing home placement; rate of hospitalization was high among individuals with either a short or long wait. Thomas, Smego, Akobundu, and Dosa (2015) characterized older adults on the waitlist for the Meals on Wheels program, finding that they were more likely than the general population of community-dwelling adults to be older, widowed, Black or Hispanic, have less formal education, and more likely to receive Medicaid. In addition, older adults on the waitlist were significantly more likely to report symptoms of depression, exhibit symptoms of anxiety, have experienced a fall, and be fearful of falling. By highlighting the vulnerability of individuals who are waitlisted to receive services, the relationship between what should be happening and what is actually happening with access to formal services becomes clearer.

In addition to the health benefits of using formal services, there are also long-term financial advantages for society. HCBS options have been considered a cost-effective alternative

to institutional care (e.g., Kaye, Harrington, & LaPlante, 2010; Lehning & Austin, 2010; Robison, Shugrue, Porter, Fortinisky, & Curry 2012), which supports older adults' preference to remain in their homes and avoid institutionalization (Alkema, 2013; Casado et al., 2011). Sands and colleagues (2008) suggested HCBS waivers might be a partial solution to the increasing costs of LTSS for individuals. Though the use of inpatient services increased for HCBS recipients, their overall expenditures per month were less than those of individuals in nursing homes (Sands et al., 2008).

Insufficient Assistance

There is no standard way to measure unmet needs among older adults. Researchers frequently rely on self-reported health status, which is a strong predictor of health outcomes (Cramm et al., 2014; Sachs-Ericsson et al., 2006) and reflects a person-centered approach that goes beyond a typical clinical health assessment (Xu, Covinsky, Stallard, Thomas, & Sands, 2012). Having unmet needs in one domain of life is likely to affect functioning in other domains (Blazer, Sachs-Ericsson, & Hybels, 2005). Perceptions of health, social support, and financial resources have been studied frequently to predict health outcomes of older adults but rarely has the focus extended to specific perceptions of unmet basic need (Blazer et al. 2005). For example, Turcotte and colleagues (2015) interviewed 11 triads (older adult, caregiver, healthcare provider) to assess older adults' comprehensive needs and found that needs related to daily activities were generally met, but needs related to social activities often were unmet.

Insufficient assistance for ADL dependencies is commonly reported by older adults (Davey et al., 2013; Kaye et al., 2010; Li et al., 2012; Robison et al., 2012) and occurs even when family members provided assistance (Wilkinson-Meyers, Brown, McLean, & Kerse, 2014). The prevalence of self-perceived insufficient assistance remained higher than 50% for

both rural and urban older adults living in China (Peng et al., 2015). Living alone and having more ADL disabilities, poor self-rated health, financial dependence, and unwilling caregivers increased the risk of undermet needs. Similarly, Walters, Iliffe, and Orrell (2001) assessed unmet need within a sample of older adults aged 75 years and older. Nearly two-thirds of the participants revealed unmet need. Less than one-quarter of the participants did seek help, and reported that services were inadequate or inappropriate.

Risk of Hospitalization

Situations of insufficient help and unmet need are associated with the increased risk of hospital admissions and other adverse consequences. Xu and colleagues (2012) analyzed survey data from 5,884 respondents of the National Long-Term Care Survey, finding that 22% reported insufficient help for at least one ADL disability. Individuals with insufficient help were 14% more likely to be hospitalized than individuals who did not report insufficient help (Xu et al., 2012). When individuals have insufficient help, their risk of hospitalization increases, which is dangerous for the individual and costly for the LTSS system. Self-reported unmet need among community-dwelling individuals was associated with increased rates of emergency department admissions (Hass et al., 2015). By addressing unmet ADL needs of older adults, potential health consequences such as acute hospitalizations can be reduced (Sands et al., 2006).

When community-dwelling older adults did not have assistance to address ADL needs, they had an increased risk for hospitalization compared to individuals who had their ADL needs met (Sands et al., 2006). In another study, rates of hospitalization did not differ based on length of waiting period to receive assistance; rather, it was high among the entire study population (Peterson et al., 2014). Risk of hospital readmission was associated with individuals having multiple unmet I/ADL needs and being of minority racial status (DePalma et al., 2013). Li and

colleagues (2005) used a financial disability questionnaire to identify unmet basic needs associated with adverse health outcomes after hospital discharge. Individuals with greater financial disability were significantly more likely to have greater difficulty in performing ADLs 90 days after hospital discharge and to have died 1 year after discharge (Li et al., 2005). If older adults are discharged from the hospital but have financial limitations, they may experience a negative impact on their health and functional status. They become even more vulnerable as they face uncertainty regarding how they will pay for post-hospital needs (Li et al., 2005). Li and colleagues (2005) emphasized the importance of connecting discharged patients with social service resources and suggest following-up with patients to detect early signs of health decline.

Risk of Institutionalization

Peterson et al. (2014) assessed the effects of long (greater than six months) and short (less than six months) waiting periods for waiver services on adults with mainly physical disabilities. They found that individuals who experienced less time between when the individuals requested and received services have substantially less risk of institutionalization than individuals who waited longer for services. The risk for individuals 55 years and older was even more concerning; when the waiting period was relatively short, these adults had a 48% lower risk of nursing home placement compared to when the waiting period was long.

Older adults receiving home-based services had a decreased risk of nursing home placement when they received an additional 5 hours per month of services (Sands et al., 2012). This finding demonstrates the importance of monitoring recipients with low-levels of service use. That is, having restricted hours of service assistance increases risk for nursing home placement, which supports the argument that individuals who have unmet needs, but are not yet eligible for services experience an increased risk for nursing home placement.

Risk of Death

Among a sample of older adults with dementia, having greater unmet need was predictive of increased risk of death (Gaugler et al., 2005). Blazer et al. (2005) examined older adults' perceptions of having their basic needs met and mortality risk; participants were asked whether 11 basic needs were met in domains such as safety, financial resources, and adequate housing, creating a sum score with higher scores indicating greater perception of unmet needs. They found that predisposing (age, gender, race), enabling (level of education, marital status), and need-based (cognitive and function impairment, existing unmet needs) variables were significant predictors of 10-year mortality (Blazer et al., 2005).

Other researchers have examined the influence of factors that effect the association between physical functioning and death. For example, as financial disability increased (i.e., the extent to which older adults could not pay for assistance with basic care needs), 1-year mortality rates significantly increased (Li et al., 2005). Financial disability was associated with increased disability and subsequent death. Carey and colleagues (2008) examined whether demographic characteristics, comorbid conditions, and functional status were risk factors predictive of time to death. Being male, being 75 years or older, having toileting and dressing dependencies, and having several comorbid conditions increased the risk of mortality among older adults.

Gaps in the Literature

Previous research has revealed high prevalence of unmet need and identified a list of known risk factors associated with unmet need. However, the findings are inconsistent pertaining to which predisposing characteristics are significant predictors of both service use and unmet needs. Andersen's model of health service use is frequently used to assess unmet needs. The flexibility of this model makes it compatible with secondary data analysis when variables can be

incorporated into the framework to answer specific research questions. It provides guidance for selection of variables that may influence service use and be associated with likelihood of experiencing adverse health outcomes. Various enabling resources have been identified in previous studies that provide some context of individuals' situation in earlier life, especially with respect to socioeconomic status and its influence on health behaviors and outcomes. Also, family support and community resources are associated with likelihood of having unmet care needs. For example, level of satisfaction with informal support predicts likelihood of unmet needs (McLaughlin et al., 2012; Weil et al., 2014; Wolff & Agree, 2004).

Researchers and policymakers alike agree on the importance of addressing the consequences of older adults experiencing unmet needs. Most studies assume an initial level of support and assistance is being provided formally through state programs or informally through family and friend support. The current literature reports high prevalence of older adults with unmet needs, which highlights the shortcoming of program initiatives and inadequacy of reliance on informal caregiving in assisting older adults. Use of waiting lists, or having individuals deemed ineligible for services because of strict criteria, demonstrate the demand for programs that provide services to individuals with functional care needs (Ng & Harrington, 2012).

Current data were insufficient to understand the issues facing individuals with unmet need (e.g., Kaye & Harrington, 2015; Li et al., 2012). Cross-sectional studies about the unmet needs of older adults dominate the literature, making it difficult to assess causality and risk for adverse health outcomes over time. Previous large-scale studies have identified key factors associated with the probability of needing services, including ADL functioning and cognition, but acknowledge that unknown contextual factors or conditions were overlooked (Stirling et al., 2010).

Researchers have suggested the importance of assessing *felt* or perceived need, but have yet to conduct studies that assess this aspect of need. Many researchers expressed the need for additional studies that follow up with individuals experiencing unmet need (e.g., Keeling, 2014; Li et al., 2012; Stirling et al., 2010; Vlachantoni et al., 2011). That is, asking direct questions about *felt* needs may be better predictors of nursing home admission or death than other types of assessment (Gaugler et al., 2005) and could complement the conventional methods used to assess unmet need (Allin et al., 2010).

Diverse approaches taken by researchers tend to overlook a vulnerable population—older adults who perceive a need but are functionally ineligible to receive assistance. Older adults who requested but were deemed ineligible to receive formal services are an invisible population, falling through the gaps for service delivery. It is assumed that individuals seeking services perceive that their needs are not being met and experience additional need when deferred for assistance they requested through formal services and programs. Thus, current clinical assessment alone does not capture the complexity of older adults' need, specifically perceived need.

The current body of literature stops short of inquiring about this particular group of older adults. Thus, it is unclear what types of services older adults use after their proactive help-seeking behavior is not rewarded. Are these older adults required to seek alternative services, self-manage their care needs, or both? While there is a robust literature available on self-management strategies for specific health conditions like osteoporosis and arthritis, the literature on self-management of unmet care needs is sparse. Having ongoing unmet functional care needs is a critical health concern for community-dwelling older adults.

Research Questions

This study uses a sequential explanatory mixed method design. The focus of Phase 1 was to identify predisposing, enabling, and need-based factors associated with service use and health outcomes among a vulnerable population of older adults who are not receiving services. I address the following research questions.

RQ1: How do Waiver-ineligible individuals compare to Waiver-eligible individuals on predisposing, enabling, and need-based factors?

H1: Waiver-ineligible individuals are more likely to be female, younger, living in rural communities, and assessed by community-based teams, compared to Waiver-eligible individuals. [Independent samples t-test; chi-square test of independence]

RQ2: What predisposing, enabling, and need-based factors differentiate Waiver-eligible individuals from Waiver-ineligible individuals?

H2: Predisposing characteristics (age, race), enabling resources (geographic region), and need-based factors (source of assessment) predict Waiver-eligibility. [Multiple logistic regression]

RQ3: What predisposing, enabling, and need-based factors differentiate individuals who access DARS from individuals that do not access DARS?

H3: Predisposing characteristics (age, race, gender), enabling resources (geographic region), and need-based factors (source of assessment, recommendation of services) predict individuals that accessing DARS. [Multiple logistic regression]

RQ4: What predisposing, enabling, and need-based factors are predictive of use of specific services (i.e., personal care, homemaker, and home-delivered meal services)?

H4: Predisposing characteristics (age, education), enabling resources (living arrangement, available caregiver, relationship to older adult, geographic region), and need-based factors (I/ADL limitations) predict personal care services. [Multiple logistic regression]

H5: Predisposing characteristics (age, level of education), enabling resources (living arrangement, available caregiver, geographic region), and need-based factors (I/ADL limitations) predict homemaker services. [Multiple logistic regression]

H6: Predisposing characteristics (age, sex, level of education), enabling resources (living arrangement, available caregiver, geographic region), and need-based factors (I/ADL limitations) predict home-delivered meals. [Multiple logistic regression]

RQ5: What predisposing, enabling, and need-based factors predict adverse health outcomes?

H7: Predisposing characteristics, enabling resources, and need-based factors predict hospitalization occurrences. [zero-inflated Poisson regression]

H8: There are interaction effects between predisposing characteristics, enabling resources, and need-based factors that predict hospitalization occurrence. [Multiple logistic regression]

H9: Predisposing characteristics, enabling resources, and need-based factors predict death. [Multiple logistic regression]

H10: There are interaction effects between predisposing characteristics, enabling resources, and need-based factors that predict death. [Multiple logistic regression]

RQ6: What specific services are predictive of adverse health outcomes?

H11: Service use predicts reduced risk of hospitalization occurrences. [zero-inflated Poisson regression]

H12: Service use predicts reduced likelihood of death. [Multiple logistic regression]

H13: Type of services used will interact with predisposing, enabling, and need-based factors that predict of hospitalization occurrences. [zero-inflated Poisson regression]

H14: Type of services used will interact with predisposing, enabling, and need-based factors that predict death. [Multiple logistic regression]

For Phase 2 of this study, I followed up with a subsample of rural-dwelling older adults from Phase 1 to inquire about *how older individuals living in rural counties manage ongoing unmet care needs.* Specifically, participants were asked about (1) the type of instrumental and basic activities of daily living assistance for which they receive, (2) who provides them with help and assistance, and (3) how they manage if no or limited help is available. The interview data were used to enhance interpretation of statistical findings about the risks faced by low-income rural older adults with unmet needs.

CHAPTER III

Method

In this chapter I describe the approaches I used to examine enrollment characteristics, service use, health outcomes, and self-management strategies of vulnerable older adults with unmet needs, using a sequential mixed methods design (Creswell & Plano Clark, 2011). Phase 1 of the study relied on existing quantitative data and informed sample selection and questions asked of participants in Phase 2 of the study. The purpose, description of data sources and sample, research questions, hypotheses, and analyses are provided separately for Phase 1 and Phase 2. The university's institutional review board approved this study.

Mixed Method Design

An explanatory mixed methods design was used to explore the question: *how do older adults manage unmet needs*? In this approach, methods are implemented sequentially, starting with statistical analyses of quantitative data in Phase 1, followed by interview data collection and analysis in Phase 2 (Creswell & Plano Clark, 2011; Morgan, 1998). The value of using a mixed methods design is to have the "end product [be] more than the sum of the individual quantitative and qualitative parts" (Bryman, 2007, p.8). Specifically, the quantitative agency data shed light on the relationships between the main variables of interest (Stewart et al., 2008), while interview data provide insight into the lived experience of study participants. A mix of qualitative and quantitative methods has potential to help identify older individuals with the greatest risk for adverse health outcomes and inform policies about how vulnerable groups met their needs when not eligible for government-funded state programs.

Phase 1

Purpose

The purpose of Phase 1 of the study was to assess service use and the risk for adverse health outcomes of older adults (age 60+) in the Commonwealth of Virginia who have applied for the Elderly and Disabled Consumer-Directed (EDCD) waiver services. The behavioral health service use model provided a framework to examine older adults' predisposing, enabling, and need-based variables associated with service use and health outcomes.

Data Sources

Data were from two independent State agencies: the Department of Medical Assistance Services (DMAS) and the Department for Aging and Rehabilitative Services (DARS) in the Commonwealth of Virginia. Below, I provide a description of the role and responsibilities of each department in providing assistance to vulnerable older adults and the specific data provided for this study.

Department of Medical Assistance Services (DMAS). Medicaid provides health insurance coverage for low-income older adults and members of other vulnerable populations (Medicaid.gov). DMAS is the agency that administers Medicaid in Virginia. For individuals who qualify, the agency subsidizes a system of high quality and cost effective health care services (DMAS, n.d.). Within DMAS, the Division of Long Term Care administers the EDCD waiver program, which authorizes designated services to individuals who qualify financially for Medicaid (income limit 300% of the SSI payment limit for one person) and are assessed to be at risk of nursing facility placement (DMAS, 2015). In Virginia, the nursing facility level of care criterion is defined as having 4 or more ADL limitations. Waiver services include adult day health care, medication monitoring, personal care services, personal emergency response system, and respite services. These services are provided if the team of healthcare professionals (e.g.,

hospital or community-based team) determines that the services are critical to the individual remaining at home rather than being placed in a nursing facility.

Individuals are assessed for eligibility for the EDCD waiver using the Uniform Assessment Instrument (UAI, 2005), a standardized questionnaire completed by a hospital- or community-based screening team. The information gathered is used to determine if an individual meets level of care criteria for LTSS funded through Medicaid. Individuals are deemed (1) eligible, (2) ineligible because of financial reasons only (i.e., income is higher than the limit), (3) ineligible because of functional reasons only (i.e., functional ability is greater than the requirement), or (4) ineligible because of both financial and functional reasons. The data for this study are from individuals who applied for services in federal government fiscal year (FY) 2014 and 2015 (between October 1, 2013 and September 30, 2015 and were financially eligible to receive services. That is, the entire study group is financially vulnerable, but ineligible participants were assessed as not having the minimum of four functional limitations required to receive waiver services.

Department of Aging and Rehabilitative Services (DARS). DARS works in collaboration with community partners to provide resources and services designed to improve the quality of life and independence of older Virginians (DARS, n.d.). Working in collaborating with 25 local Area Agencies on Aging (AAA) across the Commonwealth, the Division of Aging is the central point of contact for older, vulnerable adults seeking information and services. The agency's mission is to solve health care problems for older adults living in nursing homes, assisted living facilities, or the community.

DARS authorizes services and supports funded by the Older American's Act (OAA); services are designed to promote older adults' health and independence in their communities.

OAA services are available to individuals who are 60 years and older; individuals are not subject to means-testing and thus cannot be denied services because of inability or unwillingness to contribute to the cost of services (Wacker & Roberto, 2014). Individuals who are ineligible for waiver services often are recommended to DARS for services to help them with their care needs. Leadership at DMAS believe that older adults who are ineligible for the waiver receive services from other agencies designed to provide services, including DARS. This study will explore this assumption. The DARS data acquired for this study are for individuals aged 60 and older who utilized services during FY2014 and FY2015. Information available included specific services used, demographic characteristics, caregiver availability, and ADL and IADL limitations.

Measures and Data Preparation

When individuals are evaluated for the waiver, DMAS electronically receives limited data from the UAI assessments for Waiver-eligible and Waiver-ineligible older adults from the eligibility screening teams. The entity that provides the assessment (i.e., hospital- or community-based team) keeps the completed UAI paper form and gives applicants a copy. When individuals seek assistance from DARS, a partial UAI assessment is completed, which provides additional demographic information and data on functional limitations.

DMAS provided enrollment data from older adults who apply for the EDCD waiver program between October 1, 2013 and September 30, 2015 (Fiscal years 2014 and 2015) and were financially eligible. Health data (i.e., hospitalization occurrence and date of death, when applicable) were obtained for individuals through March 2016.

Because the departments do not share data, I combined the datasets using personal identifying information (date of birth and name). Information on whether these individuals accessed services (between Oct 2013-Sept 2015) was provided from the DARS agency. After

merging the data, all cases were de-identified. Before analysis, the dataset was cleaned, screened, and re-coded for use in STATA and SPSS Software. All variables that were available for my analyses are presented in Table 1.

Study Sample

In FY2014 and FY2015, 1,039 older adults (60+ years) applied for assistance through the EDCD waiver program. Participants were excluded from the study sample if age, sex, or race/ethnicity were missing in the DMAS dataset. Thus, the analytical sample included 1,008 with complete demographic information.

Outcome Variables

Hospitalization and mortality were primary outcomes of interest. I created the count variable of *hospitalization* occurrence to reflect the number of hospitalizations participants experienced. To determined *mortality*, participants were coded to indicate whether death had not occurred (0) or occurred (1).

Outcomes related to service use were a secondary interest. *Waiver eligibility* was operationalized and coded as waiver-ineligible (0) or waiver-eligible (1). *DARS access* indicated whether individuals had sought assistance through the agency and was coded as no (0) or yes (1). Use of specific services, including personal care, homemaker, and home-delivered meals, was also coded as no (0) or yes (1).

Predictor Variables

Predisposing characteristics were age, sex, and race. *Age* was a continuous variable calculated based on individuals' date of birth. *Sex* was coded as male (0) and female (1) and *race* was coded as White (0), Black (1), Asian (2), Hispanic (3), and other (4). County of residence was operationalized into the variable *geographic location* and coded as non- rural (0) and rural

(1), based on the designation provided by the Consumer Financial Protection Bureau (2013). Two need-based factors were available. *Assessment source* was coded as whether individuals were evaluated for the waiver from a hospital-based (0) or community-based (1) screening team of healthcare professionals. Individuals received a *service recommendation,* operationalized and coded as waiver-ineligible with no services (0), waiver-ineligible with limited Medicaid-funded services (1) and waiver-eligible with full services (2). When individuals used minimal assistance through Medicaid, such as medical supplies and equipment or to offset pharmacy, radiology, or surgical expenses, they were categorized as waiver-ineligible with limited Medicaid-funded services.

Data Analysis

Summary statistics were computed for categorical predictors and binary outcomes. Bivariate correlations were examined between all pairs of independent variables; collinearity among multiple variables was addressed by removing one or more variables from analyses. To address the research questions (RQ), regression techniques were used. I controlled for predisposing variables (age, sex, and race) in all models. Multiple logistic regression is used to predict binary outcome variables based on known predictors (Cohen et al., 2003) and models can handle many variables, including variables measured on different scales (Hosmer et al., 2013).

To examine predictors associated with hospitalization, I used the zero-inflated Poisson (ZIP) extension of Poisson regression techniques. Poisson regression assumes that zero counts are a possibility in the data (Hilbe, 2007). I hypothesized there were two groups contributing to excessive zeros: (1) a group of individuals who reflect a meaningful, true zero and did not experience a hospitalization and (2) a group of individuals who did not experience a hospitalization in part because of their service recommendation. ZIP regression is commonly

Table 1.
Variable name, description, coded response categories, and data source

	Variable Name	Description	Coded Response Categories	Data Source	
				DMAS	DARS
Predisposing Characteristics	*Age*	Age calculated from date of birth	60+ (continuous)	X	X
	Sex	Sex of participant	Female (0) Male (1)	X	X
	Race	Race/ethnic category of participant	White (0) Black (1) Asian (2) Hispanic/Latino (3) Other[1] (4)	X	X
	Level of education	Level of education completed by participant	Less than high school (0) Some high school (1) High school graduate (2) At least some college (3)		X
Enabling Resources	*Living arrangement*	Living arrangement of participant	Alone (0) Spouse (1) Spouse and others (2) Others only (3)		X
	Relationship to older adult	Relationship of primary caregiver to participant	Spouse (0) Adult child (1) Extended family/friends (2) Professional caregiver/other (3)		X
	Geographic region	Geographic residence of participant	Rural (0) Non-rural (1)	X	X

Need-based Factors	*Source of waiver assessment*	Service Authorization entity responsible for evaluation of applicant	Hospital-based team (0) Community-based team (1)	X	
	Service recommendation[2]	Recommendation for services given to the individual by the source of assessment	No services (0) Limited services (1) Full services (2)	X	
	ADL limitations	*Each activity assessed:* bathing, dressing, toileting, transferring, continence, and ambulation	No (0) Yes (1)		X
	IADL limitations	*Each activity assessed:* Meal preparation, housekeeping, laundry, money management, transportation, shopping, using phone, and home maintenance	No (0) Yes (1)		X
Secondary Outcomes	*Waiver eligibility*	Determination of eligibility for waiver services	Waiver-ineligible (0) Waiver-eligible (1)	X	X
	Accessed DARS	Individuals who sought assistance through the Department of Aging and Rehabilitative Services	No (0) Yes (1)		X
	Specific DARS services	*Each service assessed:* Personal care, chore/homemaker, and home delivered meals	No (0) Yes (1)		X
Primary Outcomes	*Hospitalization*	The number of hospitalization occurrences, if applicable by April 1, 2016	0-7	X	
	Mortality	Whether individual died by April 1, 2016	No (0) Yes (1)	X	

[1] No individuals identified as being American Indian/Native American, Native Hawaiian or other Pacific Islander, Asian and White, or Asian & Black/African American.

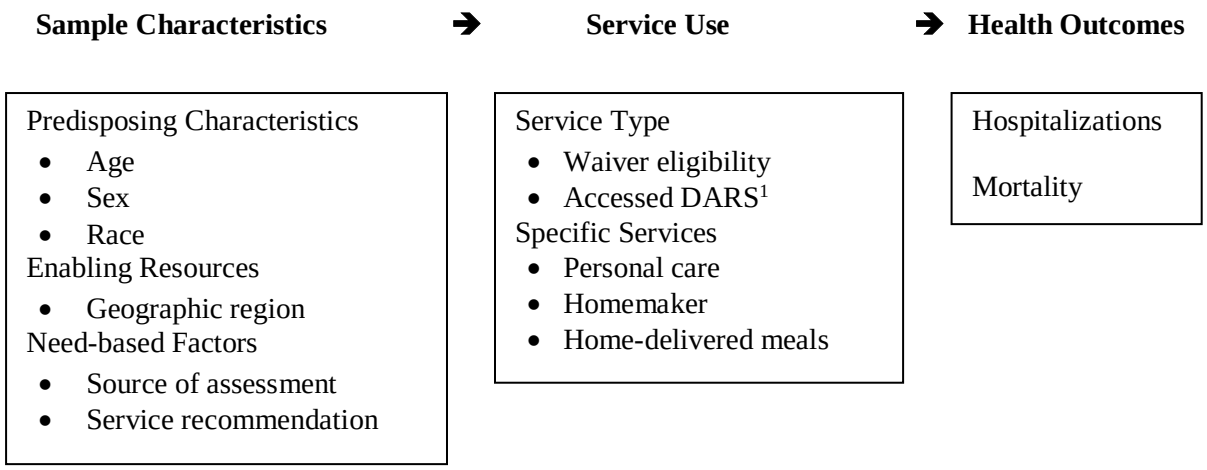
[2] No services = waiver-ineligible and received no services; Limited services = waiver-ineligible but received limited Medicaid services; Full services = waiver-eligible and received services

used to analyze count data such as number of hospitalization, but there are potential limitations when assumptions are violated and the data have overdispersion and excess zeros (Hilbe, 2007; Weaver, Ravani, Oliver, Austin, & Quinn, 2015). Summary statistics showed the data were over-dispersed with an excessive number of zeros. In these data, there were low frequency of hospitalization in the first place; however, the mean was 0.09 and the variance was 0.295. Zero-inflated negative binomial (ZINB) regression is a common extension of Poisson regression that addresses the problem of overdispersion, which occurs when the value of the variance exceeds the value of the mean (Hilbe, 2007). After examining the data and distribution of hospitalization occurrences, both ZIP and ZINB regression were run, but ZIP regression was the best technique for analysis. By selecting the most appropriate regression technique, the likelihood of reporting inaccurate findings due to inappropriate models is reduced.

The IMB SPSS Version 22 software was used for descriptive statistics (frequencies, percentages, means, correlations) and chi-square analyses to characterize the study sample. The STATA 10 statistical package, which uses the maximum likelihood parameter estimation when dealing with data not completely missing at random, was used for regression analyses.

Research Questions and Hypotheses

Development of research questions and hypotheses were guided by Andersen's model and based on availability in the data (see Figure 1). Presented next are the research questions and subsequent hypotheses tested in this study with statistical techniques used included in brackets. Syntax and output from the regression analyses are provided in Appendix A, which includes results not presented in Chapter IV.



[1]DARS = Department of Aging and Rehabilitative Services

Figure 1. Variables available to examine adverse health outcomes of vulnerable older adults. Framework adapted from Andersen (1995).

RQ1: How do Waiver-ineligible individuals compare to Waiver-eligible individuals on predisposing, enabling, and need-based factors?

H1: Waiver-ineligible individuals are more likely to be female, younger, living in rural communities, and assessed by community-based teams, compared to Waiver-eligible individuals. [Independent samples t-test; chi-square test of independence]

RQ2: What predisposing, enabling, and need-based factors differentiate Waiver-eligible individuals from Waiver-ineligible individuals?

H2: Predisposing characteristics (age, race), enabling resources (geographic region), and need-based factors (source of assessment) predict Waiver-eligibility. [Multiple logistic regression]

RQ3: What predisposing, enabling, and need-based factors differentiate individuals who access DARS from individuals that do not access DARS?

H3: Predisposing characteristics (age, race, gender), enabling resources (geographic region), and need-based factors (source of assessment, recommendation of services) predict individuals that accessing DARS. [Multiple logistic regression]

RQ4: What predisposing, enabling, and need-based factors are predictive of use of specific services (i.e., personal care, homemaker, and home-delivered meal services)?

H4: Predisposing characteristics (age, education), enabling resources (living arrangement, available caregiver, relationship to older adult, geographic region), and need-based factors (I/ADL limitations) predict personal care services. [Multiple logistic regression]

H5: Predisposing characteristics (age, level of education), enabling resources (living arrangement, available caregiver, geographic region), and need-based factors (I/ADL limitations) predict homemaker services. [Multiple logistic regression]

H6: Predisposing characteristics (age, sex, level of education), enabling resources (living arrangement, available caregiver, geographic region), and need-based factors (I/ADL limitations) predict home-delivered meals. [Multiple logistic regression]

RQ5: What predisposing, enabling, and need-based factors predict adverse health outcomes?

H7: Predisposing characteristics, enabling resources, and need-based factors predict hospitalization occurrences. [zero-inflated Poisson regression]

H8: There are interaction effects between predisposing characteristics, enabling resources, and need-based factors that predict hospitalization occurrence. [Multiple logistic regression]

H9: Predisposing characteristics, enabling resources, and need-based factors predict death. [Multiple logistic regression]

H10: There are interaction effects between predisposing characteristics, enabling resources, and need-based factors that predict death. [Multiple logistic regression]

RQ6: What specific services are predictive of adverse health outcomes?

H11: Service use predicts reduced risk of hospitalization occurrences. [zero-inflated Poisson regression]

H12: Service use predicts reduced likelihood of death. [Multiple logistic regression]

H13: Type of services used will interact with predisposing, enabling, and need-based factors that predict of hospitalization occurrences. [zero-inflated Poisson regression]

H14: Type of services used will interact with predisposing, enabling, and need-based factors that predict death. [Multiple logistic regression]

Descriptive Statistics

Individuals applying for waiver assistance were predominately female (*n* = 757; 75.10%), Black/African American (*n* = 471; 46.73%) or White (*n* = 400; 39.68%), and ranged in age from 62 to 105 years, with a mean of 80.08 (1.04; see Table 2 for more details). Nearly three in 10 individuals lived in rural counties (*n* = 296; 29.37%). Most were evaluated for eligibility by a community-based team of healthcare professionals (*n* = 552; 54.76%). In total, there were 643 (63.79%) waiver-eligible individuals and 365 (36.21%) waiver-ineligible individuals. Of the

waiver-ineligible individuals, 201 (55.07%) received a service recommendation to receive limited Medicaid services while 164 (44.93%) did not receive a recommendation for any type of Medicaid assistance. Only 44 (4.36%) individuals experienced a hospitalization whereas 271 (26.88%) had died between the time of assessment and the time health data were requested.

Most Waiver-eligible participants were female (*n* = 490). On average, participants were 81.09 years old (SD=10.05; range 62-105 years). Most Waiver-eligible participants self-identified as Black (*n* = 314; 48.83%) or White (*n* = 222; 34.53%), with the remaining Waiver-eligible participants identified as Asian (*n* = 61; 9.49%), Hispanic (*n* = 17; 2.64%), or other (*n* = 29; 4.51%). Nearly one-quarter of the Waiver-eligible participants were living in rural counties (*n* = 157; 43.01%). Of the Waiver-eligible participants, 289 (44.95%) accessed the DARS agency. Nineteen (2.95%) individuals had experienced at least one hospitalization, and 165 (25.66%) individuals had died.

There were 365 older adults who applied for EDCD waiver services and were financially eligible but functionally ineligible to receive services. On average, participants were 77.85 years old (SD=9.72, range 62-101). Most Waiver-ineligible participants were female (*n* = 267; 73.15%); most participants self-identified as White (*n* = 178; 48.77%) or Black (*n* = 157; 43.01%), with the remaining Waiver-ineligible participants identified as Asian (*n* = 23; 6.30%), Hispanic (*n* = 5; 1.37%), or other (*n* = 2; 0.54%). More than one-third of the Waiver-ineligible participants were living in rural counties (*n* = 139; 38.08%). Of the waiver-ineligible participants, 213 (58.36%) accessed the DARS agency. Twenty-five (6.85%) individuals had experienced at least one hospitalization, and 106 (29.04%) individuals had died.

Nearly half of the overall sample accessed the DARS agency to receive services (*n* = 502; 49.80%) and were similar on most demographic characteristics (see Table 3 for descriptive

statistics of DARS users). However, nearly four in 10 individuals (*n* = 193; 38.45%) lived in rural counties. Data indicated that just more than half of DARS users (*n* = 264; 52.6%) received at least one service of interest in this study. Although individuals most frequently used a single service (*n* = 108; 21.5%), the number of services individuals used ranged from 1 to 6 services (see Table 4). Individuals had zero to seven ADL limitations and zero to four IADL limitations. For several variables of interest, data provided by DARS were insufficient, including level of education (predisposing characteristic) and living arrangement and relationship of caregiver (enabling resources). Although these variables were not included in most analyses, frequencies are reported in Table 3. Data on adult day service use were also insufficient and thus was not included as an outcome of interest.

Table 2.
Demographic characteristics of EDCD Waiver applicants

	Waiver-eligible (*n*= 643) *n* (%) *m* (SD)	Waiver-ineligible (*n*= 365) *n* (%) *m* (SD)	Total (*n* = 1008) *n* (%) *n* (SD)
Sex			
Female	490 (76.21)	267 (73.15)	757 (75.10)
Male	153 (23.79)	98 (26.85)	251 (24.90)
Age			
	81.09 (10.05)	77.85 (9.72)	80.08 (1.04)
Race/Ethnicity			
White	222 (34.53)	178 (48.77)	400 (39.68)
Black	314 (48.83)	157 (43.01)	471 (46.73)
Asian	61 (9.49)	23 (6.30)	84 (8.33)
Hispanic/Latino	17 (2.64)	5 (1.37)	22 (2.18)
Other	29 (4.51)	2 (0.54)	31 (3.07)
Geographic region			
Rural	157 (24.42)	139 (38.08)	296 (29.37)
Non-rural	486 (75.58)	226 (61.92)	712 (70.63)
Assessment Source			
Hospital-based	91 (14.15)	99 (27.12)	190 (18.85)
Community-based	552 (85.85)	266 (72.88)	818 (81.15)
Services recommendation[1]			
No services		164 (44.93)	164 (16.27)
Other services		201 (55.07)	198 (19.94)
Full services	643 (100.00)		643 (63.79)
Accessed DARS			
Yes	289 (44.95)	213 (58.36)	502 (49.80)
No	354 (55.05)	152 (41.64)	506 (50.20)
Hospitalization			
Yes	19 (2.95)	25 (6.85)	44 (4.37)
No	624 (97.05)	340 (93.15)	964 (95.63)
Death			
Yes	165 (25.66)	106 (29.04)	271 (26.88)
No	478 (74.34)	259 (70.96)	737 (73.12)

[1] No services = waiver-ineligible and received no services; Other services = waiver-ineligible but received limited Medicaid-funded services; Full services = waiver-eligible and received services

Table 3.

Demographic characteristics of participants who accessed the DARS agency

	Waiver-eligible *n*= 289 *n* (%) *m*(SD)	Waiver-ineligible *n*= 213 *n* (%) *m*(SD)	Total *n*= 502 *n* (%) *m*(SD)
Sex			
Female	232 (80.27)	161 (75.59)	393 (78.29)
Male	57 (19.72)	52 (24.41)	109 (21.71)
Age			
	80.91 (9.73)	77.81 (9.38)	79.59 (9.70)
Race/Ethnicity			
White	105 (36.33)	112 (52.58)	217 (43.23)
Black	142 (49.13)	91 (42.72)	233 (46.41)
Asian	17 (5.88)	9 (4.23)	26 (5.18)
Hispanic/Latino	11 (3.81)	1 (0.47)	12 (2.39)
Other	14 (4.84)		14 (2.79)
Level of education			
< high school			128 (25.49)
some high school			67 (13.35)
high school graduate			65 (12.95)
at least some college			39 (7.77)
Missing			*203 (40.44)*
Relationship of Caregiving			
Spouse			16 (3.19)
Adult child/in-law			54 (10.76)
Extended family/friends			13 (2.59)
Professional caregiver/other			35 (6.97)
Missing			*382 (76.10)*
Living arrangement			
Alone			137 (27.29)
With spouse			48 (9.56)
With spouse and others			33 (6.57)
With others only			120 (23.90)
Missing			*164 (32.67)*
Geographic region			
Rural	103 (35.64)	90 (42.25)	193 (38.45)
Non-rural	186 (64.36)	123 (57.75)	309 (61.55)
Assessment Source			
Hospital-based	37 (12.80)	49 (23.00)	86 (17.13)
Community-based	252 (87.20)	164 (77.00)	416 (82.87)
Hospitalization			
Yes	6 (2.08)	14 (6.57)	20 (3.98)
No	283 (97.92)	199 (93.43)	482 (96.02)
Death			
Yes	62 (21.45)	60 (28.17)	122 (24.30)
No	227 (78.55)	153 (71.83)	380 (75.70)

Table 4.

DARS users who indicated service use, ADL, and IADL assistance*

	n (%)
Service use	
Personal care	89 (17.73)
Chore/Homemaker	55 (10.96)
Home meals	79 (15.74)
Home health	71 (14.15)
Housing	68 (13.55)
Transportation	81 (16.14)
Current use of 1+ service	264 (52.59)
ADL assistance	
Bathing	246 (49.00)
Dressing	161 (32.07)
Toileting	185 (36.85)
Transferring	206 (41.04)
Eating	76 (15.14)
Bowel/Bladder	148 (29.48)
Mobility	287 (57.17)
IADL assistance	
Meal prep, laundry, shopping, phone use	313 (62.35)
Money management	173 (34.46)
Transportation	284 (56.57)
Home maintenance	271 (53.98)
	m (SD)
Sum score of services (0-6)	1.42 (1.20)
Sum score of ADLs (0-7)	2.61 (2.57)
Sum score of IADLs (0-4)	2.07 (1.69)

* These descriptive statistics capture indications of when an individual used a specific services and presence of a limitation. From the data, it is unclear whether a blank entry was missing or absent. Individuals with no indicators for any question were considered missing.

Phase 2

Purpose

The purpose of Phase 2 of the study was to explore how Waiver-ineligible rural older adults managed their ongoing unmet care needs. Having financial vulnerabilities suggests an additional disadvantage for adults striving to manage their needs without assistance. Thus, the overarching research question guiding this phase of the study is: *How do older individuals who live in rural counties manage their unmet care needs?* Specifically, I asked participants about (1) the type of instrumental and basic activities of daily living for which they receive help, (2) who provides them with help and assistance, and (3) how they manage if no or limited help is available.

Study Sample and Procedures for Data Collection

In Phase 2, I used a nested sampling strategy (Yin, 2009) to identify participants where individuals from Phase 1 were identified for follow-up semi-structured telephone interviews. For a visual representation of how available data sources were used to identify the subsample for Phase 2, see Figure 2. I identified participants who were (1) deemed waiver-ineligible and (2) living in rural counties. I requested contact information from DMAS for 105 individuals who met these criteria. DMAS provided some contact information for 64 of these individuals. Even after using multiple methods to confirm addresses and phone numbers, 30 individuals could not be contacted because of invalid contact information. A check of death records through the Virginia Department of Health database (http://collections.ancestry.com/search/VA/DOH), revealed that three persons on the list had died. In addition, eight people were no longer living independently in the community. Based on attempts to contact the remaining 23 participants, 9 individuals could not be reached despite making five telephone calls, and 6 older adults declined

to be interviewed, citing reasons such as challenges associated with talking on the phone or disinterest in the project. The final interview sample comprised eight persons who met the criteria and agreed to participate. Interviews were conducted October through December, 2016.

Participants were sent an initial recruitment letter describing the study and a study consent form; I contacted individuals by telephone within 10 days of mailing the letter and followed standard practice for establishing rapport with participants and describing the purpose of the study (Bogdan & Biklen, 1998; Patton, 2002). Before proceeding with the interview, I

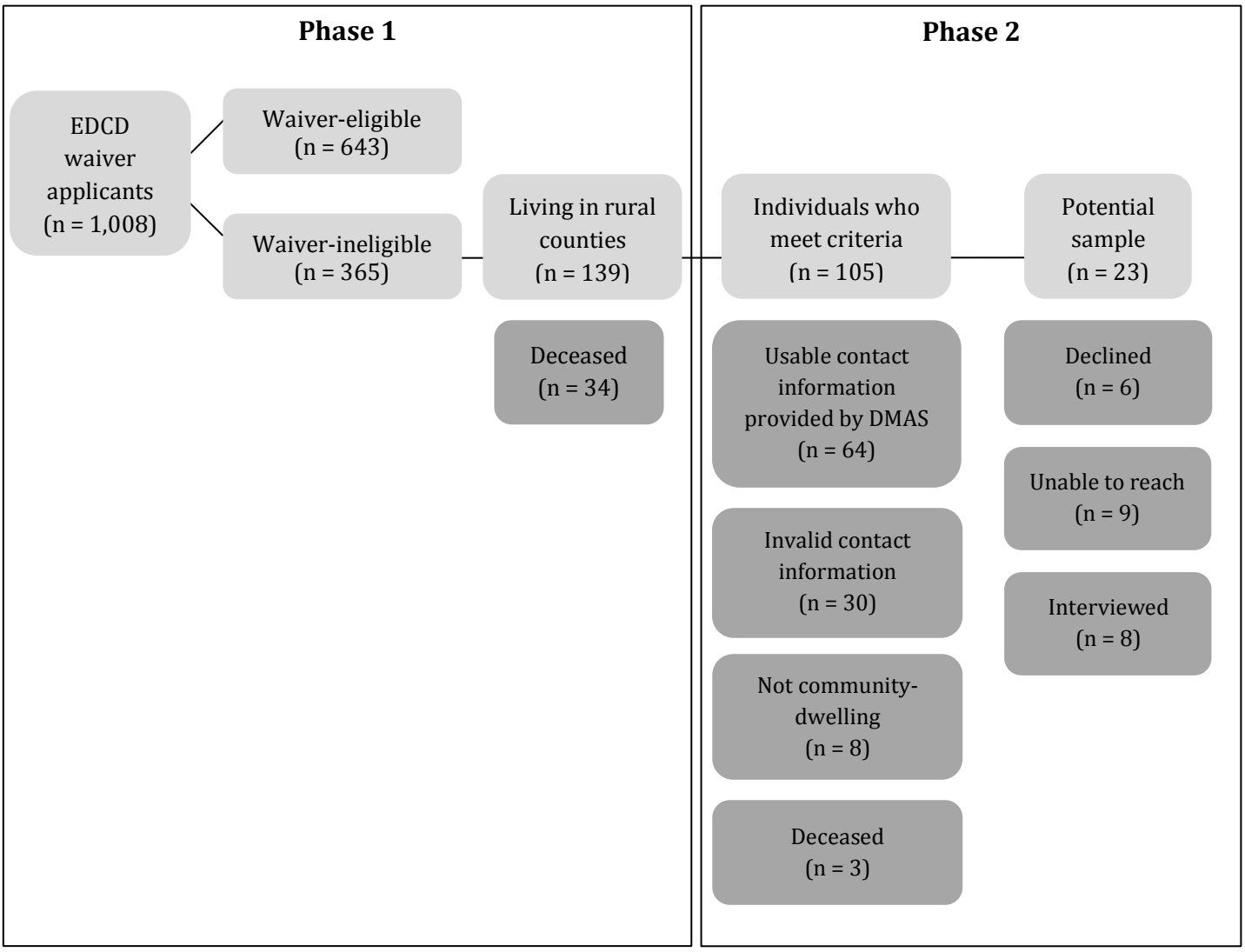


Figure 2. Visual representation of how available data sources were used to identify Phase 2 sample.

informed participants of the procedure, explained their rights, and obtained verbal informed consent and permission to audio record the interview. As standard practice, I also took notes during the interviews (Creswell, 2012; Patton, 2002). Interviews averaged 30 minutes (range: 13-75 minutes). Participants received a $25 gift card for a local retail store in appreciation for their time.

Interview Questions

The in-depth, semi-structured interviews were designed to further understanding of participants' daily challenges and experience with managing unmet needs (see Appendix B). The interview questions were theoretically grounded in Anderson's model regarding health behaviors and were derived from questions used in other studies on health self-management (Choi et al., 2014; Gallant et al., 2007; Leach & Schoenberg, 2008; Turcotte et al., 2015). Open-ended questions focused on daily challenges and self-management strategies (behavioral and environmental modification and assistance from others). Specifically, participants were asked about the ADL and IADL tasks for which they received assistance; who helped them; and how they managed if no or insufficient help is provided. I inquired about their most difficult challenge and expectations for assistance in the future. Participants also responded to structured standardized questions about perceived social support (Zimet, Dahlem, Zimet & Farley, 1988), loneliness (Russell, 1997), and depressive symptoms (CES-D 10; Radloff, 1977).

Data Analysis

Audio-recorded interviews were transcribed verbatim, verified for accuracy between the audio recording and the written transcription, and de-identified for coding purposes. I used content analysis to analyze the interviews (Potter & Levin-Donnerstein, 1999), with a framework for interpreting older adults' experiences based on theoretical underpinnings of primary and

secondary control theory (Heckhausen & Schulz, 1995). After initial open coding, four iterations of coding resulted in the final coding theme (LaRossa, 2005). Open codes were reduced to seven distinct categories through an in-depth process of axial coding. From these categories, three themes emerged. Potential validity concerns in data collection, data analysis, and interpretation were addressed using various techniques (Creswell & Plano Clark, 2011). For example, I asked others to examine the data and cross-check the final coding scheme. In collaboration with my dissertation advisor, Dr. Karen A. Roberto, we established trustworthiness of the coding process through immersion in the data through close multiple readings of the transcripts; when codes did not align, discrepancies were discussed until we reached consensus (Marshall & Rossman, 2011).

Descriptive Statistics

In Phase 2, six women and two men, ranging in age from 64 to 89 years old (see Table 5), were interviewed. All of them were currently either widowed, divorced, or separated. Four participants applied for assistance in both FY2014 and FY2015, while the others had applied only once. Only four individuals accessed the DARS agency. Most individuals' self-reported 4 to 8 IADL limitations and 2 to 4 ADL limitations (Katz, 1983), as presented in Table 6. The most salient limitations were mobility, transportation, chores, meal preparation, grocery shopping, and laundry.

Table 5.

Characteristics of rural-dwelling older adults, who were ineligible to receive waiver services

	Sex[1]	**Age**	**Race/ Ethnicity**	**Living[2]**	**Accessed DARS**	**Quality of Life**	**Lack Companionship**	**CES-D[4]**
Henrietta	F	70	Black	Alone	✓	Excellent	Sometimes	6
Alaina	F	68	White	Alone		Good	Sometimes	17
Mark	M	89	White	Son		Good	Sometimes	6
Diane	F	64	White	Alone	✓	Good	Often	17
Scott	M	75	White	Alone	✓	Good	Often	13
Olivia	F	67	White	Daughter[3]		Fair	Sometimes	25
Bertha	F	75	White	Alone	✓	Excellent	Hardly ever	0
Greta	F	64	White	Alone		Good	Sometimes	5

[1] F= female, M = male,
[2] Living arrangement
[3]Living with daughter and grandchild
[4] Score greater than 10 indicates probable depression

Table 6.

Expressed difficulty with needs of waiver-ineligible rural-dwelling older adults

	Activities of Daily Living (ADL)						Instrumental Activities of Daily Living (IADL)									
	Bathing	Getting Dressed	Using Bathroom	Transfer	Bathroom accidents	Eating	Mobility	Making food	Using phone	Going shopping	Doing laundry	Cleaning the house	Driving	Taking medication	Preparing bills	Home maintenance
Henrietta		✓	✓				✓	✓		✓	✓	✓	✓			
Alaina	✓				✓		✓	✓	✓	✓	✓	✓	✓			✓
Mark		✓			✓		✓	✓		✓		✓	✓			
Diane	✓	✓		✓			✓	✓			✓	✓	✓			
Scott					✓		✓			✓		✓	✓			✓
Olivia				✓	✓		✓	✓		✓	✓	✓	✓	✓		
Bertha	✓				✓		✓	✓		✓	✓	✓	✓	✓	✓	✓
Greta[1]																

[1] Greta received financial help to pay for cancer screening tests but reported no other functional limitations.

Chapter IV

Results

In this chapter, the results of this study are presented in the form of two manuscripts. See Appendix C for guidelines for submission to both journals.

The first manuscript, to be submitted to the *Journal of Aging & Health*, highlights factors associated with service use and adverse health outcomes among this near-risk population. This journal publishes manuscripts that deal with social and behavioral factors related to health and aging including disciplines such as behavioral and social sciences, public health, health services research, and related disciplines.

The second manuscript will be submitted to the *Journal of Health Care for the Poor and Underserved.* For this mixed methods analysis, I focused on rural-dwelling older adults' self-management of unmet needs. Papers submitted to this journal focus on rural health education, practice, and policy related to health service delivery in rural communities.

Article 1

Title: Service use and health outcomes of near-risk low-income older adults

Abstract

Objective: To determine factors associated with service use and health outcomes of low-income older adults who perceived a need for functional assistance but were deemed ineligible to receive services from Medicaid-funded waiver program. **Methods:** Using data from two independent State agencies, multiple logistic and zero-inflated Poisson regression analyses examined predictors of service use, hospitalization, and mortality. **Results:** Individuals who received assistance were less likely to experience hospitalization or death compared to individuals who were not receiving help. Rural-dwelling individuals were less likely to be waiver-eligible and more susceptible to mortality over a 2-year period than their urban counterparts. **Discussion:** Without financial means to pay for help, individuals with one or more functional limitation fall through the eligibility gap for receiving home and community-based services. To reduce adverse health outcomes experienced by this near-risk population, accessible preventive services, especially in rural communities, can address needs before they become unmanageable.

Keywords: service use, unmet needs, adverse health outcomes, near-risk, older adults

Service use and health outcomes of near-risk low-income older adults

A situation of unmet need is created when older individuals fail to receive assistance or receive insufficient assistance for daily self-care and functional activities (Quail, Wolfson, & Lippman, 2011). Although there is no standard measure of unmet care needs, researchers continue to develop algorithms to determine level of need (e.g., Davey, Takagi, Sundström, & Malmberg, 2013; Li, Kyrouac, McManus, Cranston, & Hughes, 2012; Quail et al., 2007). Most of what is known about unmet needs among older adults is based on study samples of individuals who are receiving services and supports (e.g., Davey et al., 2013; Hass, DePalma, Craig, Xu, & Sands, 2015; Komisar, Feder, & Kasper, 2005). Findings from studies using comparable definitions and measures of unmet needs suggest that prevalence of unmet need among older adults with functional disability is as high as 59% (e.g., Freedman & Spillman, 2014; Komisar et al., 2005). Individuals with unmet functional care needs are at risk for adverse health consequences, including hospitalization or potentially premature death (e.g., Li, Chadiha, & Morrow-Howell, 2005; Ronksley et al., 2013).

Typically, older adults turn first to family members to help with their daily care (Davey & Szinovacz, 2008). In addition, home and community-based services (HCBS) often are used to supplement the help and support provided by family members to allow older individuals to continue living in their own homes (Davey et al., 2005; Freedman & Spillman, 2014). However, many older adults cannot afford to pay for formal or private services (Casado, van Vulpen, & Davis, 2011) and are ineligible for government-supported service programs. Inability to pay for help is associated with increased risk for adverse health outcomes (Li, Covinsky et al., 2005).

Older adults who fall through the gap of not being eligible to receive state-funded assistance but being financially unable to pay for services themselves can be considered a near-

risk group of older adults. The purpose of this study was to examine service use and health outcomes among low-income individuals who sought state-level assistance, but were not yet functionally eligible for services. We assumed that by applying for Medicaid-funded services, older adults were acknowledging their need for help and consider this a proactive attempt to address unmet needs before they became unmanageable.

Conceptual Framework

Individuals engage in a complex decision-making process when deciding whether to seek help and determining what actions to take to solve problems associated with a decline in personal abilities (Cornally & McCarthy, 2011). First presented in 1968, Andersen's *Behavioral Model of Health Services Use* provides a framework for examining factors that contribute to service use and influence health outcomes (Andersen, 1995). Using this model, researchers have identified factors associated with help-seeking behaviors related to older adults' late life disability, unmet needs, and subsequent health outcomes. Specifically, predisposing characteristics (e.g., demographic characteristics, social structures, health beliefs), enabling resources (e.g., personal, family, and community supports; living arrangement), and need-based factors (both perceived and evaluated) influence health services use and outcomes (Andersen, 1995).

There is great variation in where variables are placed in Andersen's framework. Researchers operationalize predisposing, enabling, or need-based variables differently based on the data available and their specific research questions. For example, Hong (2010) used income as an enabling resource, but later considered income as a predisposing variable (Hong, Hasche, & Lee, 2011). Other variables such as availability of informal caregiving and length of caregiving have been conceptualized as enabling resources (Chen & Thompson, 2010; Weaver & Roberto, 2015), whereas family status and living arrangement have been considered predisposing

characteristics (Willis, Glaser, & Price, 2010).

For this study, we used Andersen's model to examine service use of government-supported programs and health outcomes (hospitalization, mortality) among low-income older adults. Income provides the context for this study; all individuals in the study sample qualified for Medicaid and had low-income. We selected various need-based factors (recommendation for assistance, source of clinical assessment), enabling resources (geographic residence), and predisposing characteristics (age, sex, race) based on their significance in previous research.

Health outcomes. Seeking formal support services often indicates individuals perceive a need for help (Chen & Thompson, 2010; Cornally & McCarthy, 2011). Using formal services has the potential to reduce adverse health outcomes (Kadowaki, Wister, & Chappel, 2015) and mitigate informal caregiver burden (Sussman & Regehr, 2009). HCBS users have reported improved quality of life (Ng, Harrington, & Kitchener, 2010) and fewer unmet needs (Schore, Foster, & Phillips, 2007). Many HCBS, such as personal care and home health are intended to help older adults with their functional care needs and supplement ongoing informal caregiving efforts. Individuals who received more hours of personal care and homemaking services had a lower risk of nursing home placement over a 2-year period, compared to individuals with fewer hours (Sands et al., 2012). Individuals with insufficient help are at increased risk of hospitalization (Hass et al., 2015; Sands et al., 2006; Xu, Covinsky, Stallard, Thomas, & Sands, 2012) and mortality (Blazer, Sachs-Ericsson, & Hybels, 2005; Carey et al., 2008; Ronksley et al., 2013). Characteristics of individuals with the highest risk for adverse consequences included minority status, low socioeconomic status (Freedman & Spillman, 2014), and living alone (LaPlante, Kaye, Kang, & Harrington, 2004).

Predisposing characteristics. Predisposing characteristics include demographics (age,

sex, race), social structures (e.g., education), and health beliefs (e.g., attitudes and knowledge about service use) and are associated with unmet need and service use (Andersen, 1995). Service use has been associated with being older and female (Laditka, Laditka, & Drake, 2006; Sands et al., 2012) and being female associated with increased risk for unmet needs (Davey et al., 2013; LaPlante et al., 2004). Other studies found no significant relationship between unmet need and sex or age (Ferris, Glicksman, & Kleban, 2014; Ronksley et al., 2013).

Service use varies across race and ethnic group, but study findings are inconsistent. Analysis of data collected in 1994 for the National Longitudinal Study of Aging showed that Black individuals were more likely to access a greater number of services and used services at a higher intensity than White and Hispanic individuals (Laditka et al., 2006). Data collected in 2004 for the National Long-term Care Survey showed that non-White individuals were more likely to receive formal care than their White counterparts (Davey et al., 2013). More recently, findings from the National Home and Hospice Care Survey (2000 and 2007) revealed White home health care recipients were more likely to be service users, compared to Black or other race recipients (Caffrey, Sengupta, Moss, Harris-Kojetin, & Valverde, 2011). Similarly, an Indiana statewide assessment of Medicaid HCBS users found that White individuals were more likely to use a higher volume of services (Sands et al., 2012) compared to non-White individuals.

Regarding functional and emotional unmet care needs of participants, researchers reported inconsistent findings associated with race and ethnicity. Findings from the National Health Interview Survey on Disability showed that non-White individuals were more likely to have unmet needs than White individuals (LaPlante et al., 2004). Black race/ethnicity was a consistent predictor of unmet need, but the authors speculated it was because Black caregivers were less aware of services than White caregivers (Casado et al., 2011). Conversely, Davey and

colleagues (2013) found that race did not predict unmet needs. Other researchers focused on unmet needs did not assess the effects of race (e.g., Quail et al., 2011; Ronksley et al., 2013) or had a predominately White sample (e.g., Li et al., 2012).

Enabling resources. Andersen (1995) considered enabling factors to include personal, family, and community resources, such as financial resources and geographic region. Being of lower socioeconomic status predicted increased likelihood of using services (Laditka et al., 2006) and unmet needs (Lai & Chau, 2007; Sachs-Ericsson, Schatschneider, & Blazer, 2006), as well as barriers to service use (Lai & Chau, 2007). Analysis of several longitudinal studies revealed that older individuals with less education and wealth had worse health, compared to their counterparts and poor individuals experienced more rapid health decline than non-poor individuals (Chatterji, Byles, Cutler, Seeman, & Verdes, 2015). Financial disability was associated with increased risk of physical disability and subsequent death (Carey et al., 2008; Li, Covinsky et al., 2005).

Geographic factors have been attributed to likelihood of using services. Lucke and colleagues (2006) found that rural residents were more likely to use services than their urban counterparts. Conversely, others have reported that rural older adults were less likely to use formal assistance than were urban older adults (McAuley, Spector, & Van Nostrand, 2009). Individuals in rural areas often face a number of access barriers to health services. Unavailability, unawareness, and affordability were the primary barriers to HCBS reported by rural older adults (Li, 2006). Authors have speculated low utilization in rural areas is associated with increased distance to service providers and health facilities (Nemet & Bailey, 2000).

Need-based factors. Care need is often determined by perceived or evaluated ability to complete activities of daily living (ADL) or instrumental activities of daily living (IADL). In the

absence of a standard needs assessment, federal and state programs frequently rely on a professional clinical health assessment of ability to perform ADLs and IADLs to determine need (Allin, Grignon, & Le Grand, 2010). Specific dependencies, such as toileting and dressing, were predictive of mortality among community-dwelling older adults (Carey et al., 2008).

Individuals' perception of needing help is often overlooked when allocating scarce resources for assistance. Researchers have conceptualized perception of need as subjective need (Allin et al., 2010) or felt need, which is based on an individual's own belief of the need for assistance (Vlachantoni et al., 2011). Older adults who perceived unmet needs regarding their basic physical functioning at baseline were more likely to have increased physical functioning problems 10 years later (Sachs-Ericsson et al., 2006). These findings held even when controlling for socioeconomic status, health problems, and behaviors at baseline, revealing that perceptions of insufficient help were an accurate reflection of needs and unmet needs lead to worse health over time. Using the same study sample, perceived inadequacy of having basic needs met was associated with older adults' increased risk of mortality (Blazer et al., 2005). Asking direct questions about *felt* needs complements conventional methods used to assess unmet need (Allin et al., 2010) and may predict nursing home admission or death better than other assessments (Gaugler, Kane, Kane, & Newcomer, 2005).

Insufficient help for self-care activities and mobility represents a serious public health concern because disability may limit older adults' opportunities for social and community engagement (Freedman et al., 2014). In a representative sample of 530 women aged 70 and older, more than 20% of women reported inadequate assistance meeting their ADLs (Quail et al., 2011). Approximately 22% of the 5,884 respondents of the National Long-Term Care Survey reported insufficient help for at least one ADL (Xu et al., 2012). When community-dwelling

older adults did not have enough help with ADL limitations, they had increased risk for hospitalization compared to individuals who had enough help to meet their ADL needs (Sands et al., 2006). Individuals with insufficient help were 14% more likely to be hospitalized than individuals who did not report insufficient help (Xu et al., 2012). In addition, having insufficient help increased the risk of emergency department admissions (Hass et al., 2015) and death (Blazer et al., 2005; Carey et al., 2008) for community-dwelling older adults.

Policy context

Older adults without the financial means to purchase formal services may be eligible for services through Medicaid-funded programs. For example, the Medicaid Section 1915(c) Home and Community-based waiver program offers assistance for purchasing a range of services, including personal care, emergency response system, respite, and adult day services to help older adults and their caregivers meet older adults' care needs. HCBS options are attractive because they acknowledge older adults' preference to remain in their home as they age (Casado et al., 2011). Individuals must meet functional criteria (i.e., care needs are at an institutional level, often determined by number of ADL limitations), which varies by state (Kaye, 2015; Komisar et al., 2005). This dual-level eligibility process based on financial need and physical functioning results in unequal access to benefits, depending on state of residence. Individuals who do not yet meet functional criteria but have limited financial ability to pay for services are at risk of having unmet needs and experiencing adverse health outcomes.

In Virginia, the Department of Medical Assistance Services (DMAS) administers Medicaid (DMAS, n.d.). The Virginia Elderly and Disabled Consumer Directed (EDCD) waiver program authorizes designated services to individuals who qualify financially for Medicaid (income limit 300% of the SSI payment limit for one person) and who are evaluated by a

hospital or community-based screening team to be at risk for nursing facility placement (DMAS, 2015). The Uniform Assessment Instrument (UAI) is the state-designated preadmission screening instrument used by hospital-based or community-based healthcare professionals to determine functional eligibility (DMAS, 2013). The UAI focuses on five dimensions of a person's situation: social resources, economic resources, mental health, physical health, and ADLs. In most states, nursing home eligibility is based on having at least two ADL limitations (Ng, Harrington, Musumeci, & Reeves, 2015). Virginia is one of 10 states with stricter eligibility criteria for Medicaid-funded nursing facility placement and thus waiver eligibility (Ng et al., 2015), requiring an individual to demonstrate four ADL limitations.

Using Virginia as the study site, we examined service use and health outcomes of low-income older adults who perceived a need for assistance with functional needs but were deemed ineligible to receive services from a federally funded Medicaid waiver program. Anecdotal agency data led us to believe that ineligible individuals may obtain services from alternative government-supported service agencies with lesser eligibility requirements. Other individuals may not receive any assistance because they cannot afford it or are unaware of services and remain at greater risk for adverse health outcomes. Study variables were operationalized as predisposing, enabling, and need-based factors associated with service use and health outcomes (see Figure 1). We addressed the following research questions based on available data: Controlling for predisposing variables, what enabling and need-based factors are associated with (RQ1) waiver eligibility; (RQ2) accessing alternative government-supported services; (RQ3) hospitalization; and (RQ4) mortality? We hypothesized that:

H1: living in rural areas and assessment by a hospital-based screening team was associated with being waiver-ineligible

H2: living in rural areas, assessment by a community-based screening team, and being waiver-ineligible was associated with accessing alternative government-funded services

H3: living in rural areas and being waiver-ineligible was associated with increased risk for greater hospitalizations

H4: living in rural areas and being waiver-ineligible was associated with increased risk for mortality

Method

Data source and sample

Data were from two independent State agencies archives: the Department of Medical Assistance Services (DMAS) and the Department for Aging and Rehabilitative Services (DARS) in the Commonwealth of Virginia. DMAS provided enrollment data from older adults who applied for the EDCD waiver program between October 1, 2013 and September 30, 2015 and were financially eligible. Health data (i.e., hospitalization occurrence and date of death, when applicable) were obtained for individuals through March 2016. Information on whether these individuals accessed services (October 2013-September 2015) was provided from the DARS agency. A total of 1,039 older adults (age 60+ years) applied for EDCD waiver assistance. Participants were excluded from the study sample if data for age, sex, or race/ethnicity were missing in the DMAS dataset. Thus, the analytical sample included 1,008 participants. The university's institutional review board approved this study.

Measures

Outcome Variables. The two primary health outcomes of interest were hospitalization and death. *Hospitalization* occurrence reflected the number of hospitalizations participants

experienced. *Mortality* indicated whether death had occurred (1) or not occurred (0). The two secondary outcomes related to service use were operationalized as *waiver eligibility*, coded as waiver-ineligible (0) or waiver-eligible (1) and *accessed DARS* as no (0) or yes (1).

Predictor Variables. Predisposing characteristics were age, sex, and race. *Age* was a continuous variable calculated based on individuals' date of birth. *Sex* was dummy-coded into male (0) and female (1) and *race* was categorically coded as White (0), Black (1), Asian (2), Hispanic/Latino (3), and other (4). *Geographic location* was operationalized and coded as rural (1) and non-rural (0) based on county of residence (Consumer Financial Protection Bureau, 2013). Two need-based factors were used in this study. *Assessment source* indicated whether individuals were assessed for the waiver with a hospital-based (0) or community-based (1) screening team of healthcare professionals. Based on level of need, individuals received a *service recommendation*, operationalized and coded as waiver-ineligible with no services (0), waiver-ineligible with limited Medicaid-funded services, (1) and waiver-eligible with full services (2).

Data Analysis

Bivariate Spearman correlations were examined between all pairs of independent variables; collinearity among multiple variables was addressed by removing one or more variables from analyses. Logistic regression was used to estimate the effects of enabling and need-based variables on waiver eligibility (RQ1), DARS access (RQ2), and mortality (RQ4). For the hospitalization outcome, we hypothesized there were two groups contributing to excessive zeros: (1) a group of individuals who reflect a true zero, i.e., they did not experience a hospitalization and (2) a group of individuals who did not experience a hospitalization in part because they are using services. The probability of belonging to each of these groups was modeled with geographic region and source of assessment as covariates using zero-inflated

Poisson regression model (Hilbe, 2007). Lastly, we controlled for predisposing variables (age, sex, and race) in all four models. Analyses were conducted in SPSS (IBM Version 22) and STATA (version 10).

Results

Descriptive Statistics

The 1,008 individuals applying for waiver assistance were predominately female (*n* = 757; 75.10%), and Black (*n* = 471; 46.73%) or White (*n* = 400; 39.68%), with a low number of individuals who identified themselves as Asian, Hispanic/Latino, or as other (see Table 1 for sample descriptive data). Individuals were on average 80 years old (SD = 1.04; range 62-105). Nearly three in 10 individuals lived in rural counties (*n* = 296; 29.37%). Only 44 (4.37%) individuals experienced a hospitalization, and 271 (26.88%) individuals had died. Overall, 643 (63.79%) individuals were waiver-eligible and 365 (36.21%) were waiver-ineligible. Of the waiver-ineligible individuals, 201 (55.07%) received a service recommendation to receive limited Medicaid services while 164 (44.93%) did not receive a recommendation for any type of Medicaid assistance. Nearly half of the individuals accessed DARS (*n* = 502, 49.80%).

Multivariate Results

The results of logistic regression analyses to assess waiver eligibility (RQ1) and DARS access (RQ2) outcomes are shown in Table 2. Older adults living in rural counties were 39% less likely to be waiver-eligible than older persons living in non-rural counties (OR = 0.61, p = .001). Individuals assessed by a community-based team were 2.1 times more likely to be waiver-eligible than persons assessed by a hospital-based team (OR = 2.13, $p < .001$). For a one-year increase in age, individuals were 3% more likely to be waiver-eligible (OR = 1.03, $p < .001$).

Compared to White older adults, Black older adults were 53% more likely to be waiver-eligible (OR = 1.53, p = .004).

When analyzing factors associated with accessing DARS, individuals living in rural counties, compared to living in non-rural counties, were 2.3 times more likely to access DARS (OR = 2.26, p = .001). Individuals assessed by a community-based, rather than a hospital-based team, were 1.5 times more likely to access DARS (OR = 1.51, p = .016). Waiver-eligible individuals were 43% less likely to access DARS compared to waiver-ineligible individuals receiving no services (OR = 0.57, p = .003). Females were 53% more likely than males to access DARS (OR = 1.53, p = .006). Compared to white older adults, Asians were 45% less likely to access DARS (OR = 0.55, p = .030).

Tables 3 and 4 contain the results of zero-inflated Poisson and logistic regression analyses for hospitalization (RQ3) and mortality (RQ4), respectively. We found that being waiver-eligible was significantly associated with having no hospitalizations ($\beta = 1.04$, p = .007), but accessing DARS was not associated with reduced risk of hospitalization ($\beta = 0.31$, p = .328). The only significant factor associated with hospitalization was source of assessment; individuals who were screened by a community-based team, compared to a hospital-based team, had fewer hospitalizations over time (β = -1.08, p = .003). We ran analyses to test interactions between geographic location, source of assessment, waiver eligibility, and DARS access but they were not significantly associated with hospitalization or mortality.

Mortality 6+ months after initially seeking assistance from the waiver program was significantly associated with geographic location, source of assessment, service recommendation, age, sex, and race. Individuals living in rural counties were 2.3 times more likely to have died (OR = 2.26, p = .001). Compared to waiver-ineligible individuals who did not use any Medicaid

services, waiver-ineligible individuals who used limited Medicaid services were 61% less likely to have died (OR = 0.39, $p < .001$) while waiver-eligible individuals were 52% less likely (OR = 0.48, $p < .001$). Using DARS services was not significantly associated with mortality (OR = 0.77, $p = .091$). For every year increase in age, individuals were 5% more likely to have died (OR = 1.05, $p < .001$). Risk of mortality was 33% less for females (OR = 0.67, $p = .017$). Compared to individuals who were White, individuals who were Black (OR = .67, $p = .012$) or of other race (OR = 0.32, $p = .026$) were 33% and 68% less likely to have died, respectively.

Discussion

Older adults who requested but were deemed ineligible to receive formal services are an invisible population, falling through the gaps for service delivery and at risk for adverse health outcomes. Study findings suggest that this near-risk population of older individuals is more likely to experience hospitalization and mortality. As hypothesized, waiver-eligible individuals were less likely to be hospitalized and individuals using at least some type of Medicaid assistance had reduced risk of mortality.

Although waiver eligibility was determined based on functional need, our findings show that being eligible was associated with the team of healthcare professionals that evaluated applicants. Older adults who were screened by a hospital-based team were less likely to be eligible for waiver services than individuals screened by a community-based team. This finding may reflect the hospital-based screening team's perception that after a hospitalization, individuals' immediate care needs are addressed. As such, individuals are assessed to have less need for immediate services and supports without considering help with their current situation may prevent future care needs.

Older adults with financial limitations may experience increased vulnerability as they face uncertainty regarding how they will pay for post-hospital needs (Li, Covinsky et al., 2005). If enrolled in community services after discharge, individuals' health can be monitored to deter adverse health outcomes. Our findings extend research on the relationship between low-income individuals and risk of unmet need (e.g., Quail et al., 2007; Sachs-Ericsson et al., 2006) by identifying the increased risk of hospitalization and mortality among ineligible individuals. Without financial means to pay for additional help, these older individuals must rely on their current support system. Being assessed as waiver-ineligible exposed older adults' vulnerability of not having available enabling resources such as expendable income to purchase needed services to meet their perceived functional needs.

Older individuals in rural areas are less likely than their non-rural counterparts to have adequate access to services to assist them with daily care needs (Glasgow & Brown, 2012; McAuley et al., 2009; Nemet & Bailey, 2000), creating a situation where "vulnerable people [live] in vulnerable places" (Keating & Fletcher, 2012). Our findings suggest a geographic disparity in that rural older adults who perceive themselves to be in need are at a disadvantage for waiver eligibility compared with non-rural older adults. As with our sample, individuals living in rural communities are economically disadvantaged (Lobao, Zhou, Partridge, & Betz, 2016; Ziliak, 2012), making it difficult to pay for help if they are not eligible for assistance. Of great concern is that individuals living in rural areas were more than twice as likely to die during the study duration compared to those not living in rural areas. Living in rural areas was significantly associated with accessing alternative services. Thus, for this near-risk population of low-income older adults, our findings reinforce the importance of increasing access to available alternative services in rural communities.

Source of assessment was also associated with seeking alternative government-supported services through DARS. Individuals who accessed DARS were more likely to be assessed by a community-based team than a hospital-based team. We speculate that professionals who comprise community-based screening teams work within the community and therefore are more connected to and aware of local services. Therefore, they may be more likely than hospital-based professionals to recommend alternative community services to help alleviate ongoing challenges.

Virginia's approach to service access through strict functional criteria can be interpreted as an effort to target individuals with greatest disability, and may reflect budgetary concerns. Although Medicaid HCBS users had increased risk for hospitalizations compared to the general Medicaid population (Konetzka, Karon, & Potter, 2012), waiver services were effective and deterred adverse health outcomes. Many older individuals who were waiver-ineligible had a level of need that would deem them eligible in other states with less strict functional eligibility criteria. Thus, the system tends to be generous to some, meager for others, and devoid for the rest (Kaye, 2015). Rather than rewarding individuals' behavior to address care needs before an unmanageable situation arises, prevention services are not readily available and individuals cannot benefit from services. To reduce hospitalization and mortality risk, policymakers should advocate for preventive services that assist older adults before care needs become unmanageable.

Limitations & Future Research. The current study provided new insights about factors associated with service use and health outcomes among low-income older adults by combining data from two independent agencies serving older adults. However, a limitation is that data were collected for determining service eligibility, not for research purposes, thus constraining the research questions that could be assessed. For example, only one enabling resource (geographic location) was available across datasets. We also had limited knowledge of individuals' specific

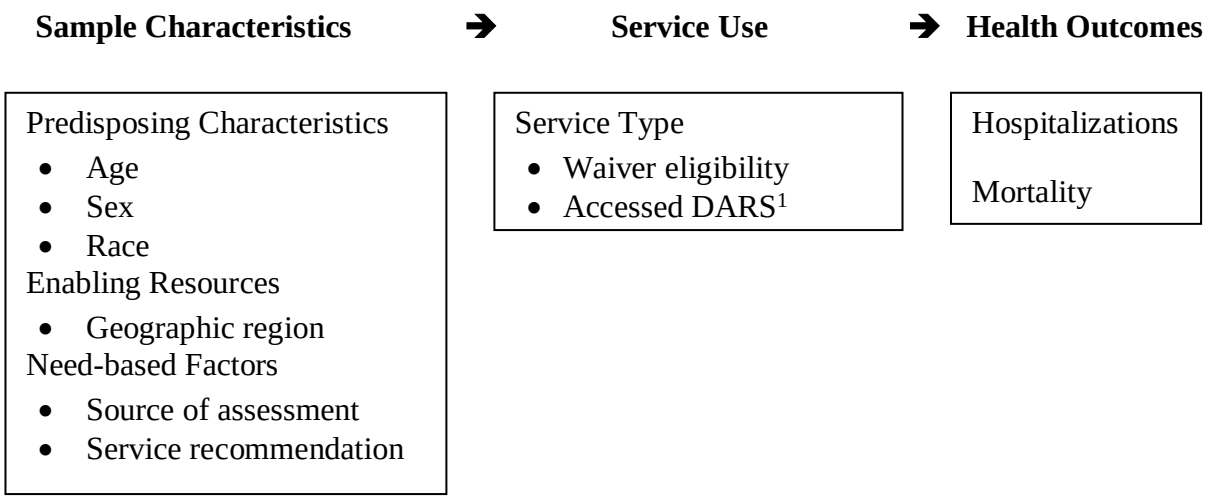
functional limitations. Advancing this line of research requires building partnerships with state agencies that facilitate collection of health data over time to reveal trends in service use associated with functional limitations. Gaining access to longitudinal clinical assessment data on functional ability would enable researchers to identify specific IADL and ADL limitations associated with specific service use and subsequent health outcomes. Similarly, having a better understanding of enabling resources, such as living arrangement and availability of caregivers, would provide greater social context surrounding perceived needs of near-risk older adults and how individuals may address unmet needs.

A second limitation was the restricted range of primary health outcomes: hospitalization and mortality. To address the consequences of older adults experiencing unmet needs, future research should assess predictors of other health (e.g., falls, nursing facility placement) and psychosocial (e.g., depression, loneliness) outcomes. Including a broader array of outcome measures would help contextualize the effects of having unmet needs and how near-risk populations manage them. Policy provisions should include preventive services and supports to reduce risk of a broad range of adverse health outcomes among near-risk populations. One way to enhance prevention is to incorporate an element of self-reported perceived unmet need in clinical assessments, which reflects a person-centered approach that goes beyond a typical clinical health assessment (Xu et al., 2012). Individuals' perceptions of health can and do affect actual health (Heuberger, van Eeden-Moorefield, & Wong, 2013) and may reveal physical, mental, and emotional dimensions that contribute to the complexity of unmet needs (Sands et al., 2006; Vlachantoni et al., 2011).

A third limitation of the study is the data source, which came from a sample living in a state with strict functional eligibility criteria. Comparisons across states with strict and less strict

criteria may reveal different risk and protective factors associated with health outcomes. Such information about the advantages and disadvantages of divergent eligibility criteria is critical to inform policy decisions, particularly preventive efforts for near-risk low-income and rural populations.

In sum, the current literature reports high prevalence of older adults with unmet needs, which highlights the shortcoming of program initiatives and inadequacy of reliance on only informal caregiving. Using waiting lists and deeming individuals ineligible for services because of strict criteria demonstrate the demand for programs that provide services and supports to individuals with functional care needs (Ng & Harrington, 2012). Findings from this study support the recent emphasis on preventive services to address older adults' needs prior to them becoming unmanageable. We suggest that agencies responsible for service delivery target their efforts toward near-risk, low-income older adults, particularly those residing in rural areas. Thus, we echo Jurkowski's (2015) call for policies to increase service access in rural communities because even if services exist, they may not be available to this near-risk population of older adults.



[1]DARS = Department of Aging and Rehabilitative Services

Figure 1. Variables available to examine adverse health outcomes of vulnerable older adults. Framework adapted from Andersen (1995).

Table 1.

Demographic characteristics of EDCD waiver applicants (*N*=1008)

	m (SD) *n* (%)
Age	80.08 (1.04)
Sex	
Female	757 (75.10)
Male	251 (24.90)
Race	
White	400 (39.68)
Black	471 (46.73)
Asian	84 (8.33)
Hispanic/Latino	22 (2.18)
Other	31 (3.07)
Geographic region	
Rural	296 (29.37)
Non-rural	712 (70.63)
Assessment source	
Hospital-based	190 (18.85)
Community-based	818 (81.15)
Waiver eligibility	
Eligible	643 (63.79)

Ineligible	365 (36.21)
Service recommendation[1]	
No services	164 (16.27)
Other services	201 (19.94)
Full services	643 (63.79)
Accessed DARS	
Yes	502 (49.80)
No	506 (50.20)
Hospitalization	
Yes	44 (4.37)
No	964 (95.63)
Mortality	
Yes	271 (26.88)
No	737 (73.12)

[1] No services = waiver-ineligible and received no services; Other services = waiver-ineligible but received limited Medicaid-funded services; Full services = waiver-eligible and received services

Table 2.

Logistic regression results for service use outcomes (N = 1,008)

	EDCD Eligibility			**Accessed DARS**		
Predictor (ref.)	OR (SE)	*p*	95% CI	OR (SE)	*p*	95% CI
Age						
	1.03 (.01)	< .001*	[1.02, 1.05]	1.00 (.01)	.486	[0.98, 1.01]
Sex (male)						
	1.05 (.17)	.782	[0.77, 1.42]	1.53 (.24)	.006*	[1.13, 2.07]
Race (White)						
Black	1.53 (.23)	.004*	[1.15, 2.05]	1.00 (.14)	.975	[0.75, 1.32]
Asian	1.22 (.24)	.483	[0.70, 2.12]	0.55 (.15)	.030*	[0.33, 0.95]
Hispanic/Latino	1.92 (1.03)	.225	[0.67, 5.52]	1.47 (.66)	.388	[0.61, 3.55]
Other	7.64 (5.68)	.006*	[1.78, 32.78]	1.02 (.40)	.953	[1.08, 2.11]
Rural (non-rural)						
	0.61 (.09)	.001*	[0.45, 0.82]	2.26 (.34)	.001*	[1.68, 3.05]
Assessment source (hospital-based)						
	2.13 (.36)	< .001*	[1.53, 2.97]	1.51 (.26)	.016*	[1.08, 2.11]
Service recommendation[1] (no services)						
Limited services	–	–	–	0.86 (.19)	.496	[0.56, 1.33]
Full services	–	–	–	0.57 (.11)	.003*	[0.40, 0.83]

[1] No services = waiver-ineligible and received no services; Limited services = waiver-ineligible but received limited Medicaid services; Full services = waiver-eligible and received services

Table 3.

Zero-inflated Poisson regression results for hospitalization (N = 1,008)

	Hospitalizations		
Predictor (ref.)	β (SE)	*p*	95% CI
Age			
	-0.04 (0.01)	.010*	[-0.07, -0.01]
Sex (male)			
	0.11 (0.32)	.720	[-0.51, 0.74]
Race (White)			
Black	-0.24 (0.29)	.584	[-0.81, 0.34]
Asian	0.45 (0.55)	.418	[-0.63, 1.53]
Hispanic/Latino	0.96 (0.57)	.092	[-0.16, 2.08]
Other	-0.28 (1.33)	.835	[-2.89, 2.34]
Rural (non-rural)			
	0.53 (0.31)	.086	[-0.07, 1.13]
Assessment source (hospital-based)			
	-1.08 (0.36)	.003*	[-1.79, -0.37]
Inflate			
Service recommendation[1] (no services)			
Limited services	0.46 (0.43)	.276	[-0.37, 1.30]
Full services	1.04 (0.38)	.007*	[0.29, 1.79]
DARS (did not access)			
	0.31 (0.32)	.328	[-0.31, 0.94]

[1] No services = waiver-ineligible and received no services; Limited services = waiver-ineligible but received limited Medicaid services; Full services = waiver-eligible and received services

Table 4.

Multiple logistic regression results for mortality (N = 1,008)

		Mortality		
Predictor (ref.)		OR (SE)	*p*	95% CI
Age				
		1.05 (0.01)	< .001*	[1.03, 1.06]
Sex (ref. male)				
		0.67 (0.11)	.017*	[0.48, 0.93]
Race (ref. White)				
	Black	0.67 (0.11)	.012*	[0.49, 0.92]
	Asian	0.62 (0.18)	.099	[0.35, 1.09]
	Hispanic/Latino	0.55 (0.29)	.263	[0.19, 1.57]
	Other	0.32 (0.16)	.026*	[0.12, 0.83]
Rural (ref. non-rural)				
		2.26 (0.34)	.001*	[1.68, 3.05]
Assessment source (ref. hospital-based)				
		1.51 (0.26)	.016*	[1.08, 2.11]
Service recommendation [1] (ref. no services)				
	Limited services	0.39 (0.10)	< .001*	[0.24, 0.63]
	Full services	0.48 (0.10)	< .001*	[0.32, 0.70]
DARS (ref. did not access)				
		0.77 (0.12)	.091	[0.51, 1.04]

[1] No services = waiver-ineligible and received no services; Limited services = waiver-ineligible but received limited Medicaid services; Full services = waiver-eligible and received services

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Article 2

Title: Health risks and self-management strategies of low-income, rural older adults with unmet care needs

Abstract

This purpose of this study was to explore how older individuals living in rural areas address their ongoing care needs. **Methods:** A mixed-method design identified factors associated with service use and health outcomes of 1,008 older adults (60+) who applied for Medicaid waiver assistance. Eight rural waiver-ineligible individuals were interviewed to explore self-management strategies for confronting functional care needs. **Results:** Regression techniques revealed waiver-ineligible individuals were at risk for hospitalization and mortality; rural-dwelling individuals were more likely to be waiver-ineligible and had increased risk of mortality. Analysis of interviews revealed individuals had ongoing unmet needs and relied on family and community services and used internal and external strategies to manage them; plans were not in place should their health continue to decline. **Discussion:** When faced with adversity, individuals relied on various strategies to confront ongoing daily challenges. Preventive services are needed to reduce health risks, especially in rural communities.

Key words: low-income older adults, self-management, unmet needs, adverse health outcomes

Older adults most often turn to family members for assistance when their personal care needs become too difficult to manage alone (Silverstein & Wang, 2015). But even when family members provide help, older adults commonly report insufficient assistance with activities of daily living (ADL) (Davey, Takagi, Sundström, & Malmberg, 2013; Kaye, Harrington, & LaPlante, 2010). Having unmet or undermet needs (i.e., receiving an insufficient amount of care) can lead to undesirable health outcomes that undermine an individual's ability to manage their daily functioning.

Older adults often seek formal care to help meet their care needs and supplement care provided by family (Davey et al., 2005). A continuum of community services, supported through funds from the Older American's Act (OAA), is available in most communities to help older adults manage their care needs (Roberto, Weaver, & Wacker, 2014). Low-income individuals may be eligible for government-funded services if they financially qualify for Medicaid (i.e., income limit is 300% of the Supplemental Security Insurance payment limit for one person) and meet functional eligibility criteria set by each state.

In the Commonwealth of Virginia, the Medicaid Elderly and Disabled Consumer Directed (EDCD) waiver provides assistance for individuals who have four or more ADL limitations. This waiver program is administered by the Virginia Department of Medical Assistance Services (DMAS). A hospital- or community-based assessment team of healthcare professionals evaluate individuals for EDCD waiver eligibility using the Uniform Assessment Instrument (UAI, 2005). The UAI is the standardized questionnaire used to determine if an individual meets level of care criteria for long-term services and supports funded through Medicaid. The Virginia Department of Aging and Rehabilitative Services (DARS) is another government-supported agency that, under the auspice of the OAA and in collaboration with

community partners, provides resources and services to enhance the independence of older adults (DARS, n.d.). There is anecdotal agency data evidence that most individuals that seek DARS assistance receive some type of help, as the agency has less restrictive eligibility criteria than the EDCD waiver. How low-income older adults manage their care needs when they are deemed ineligible for Medicaid-funded services has yet to be addressed in the research literature. The purpose of this study was to advance understanding of help-seeking behaviors of a near-risk population of low-income older adults who were deemed ineligible to receive state-funded assistance.

Behavioral health service use model. First presented in 1968, Andersen's Behavioral Health Services Use Model provides a broad framework for examining factors that contribute to service use (Andersen, 1995). According to Andersen, there are three domains that influence health behavior and use of services that ultimately influence health outcomes: (1) predisposing characteristics (e.g., demographic characteristics, health beliefs), (2) enabling resources (e.g., personal, family, and community supports), and (3) need-based factors (both perceived and evaluated). There is great variability in how researchers operationalize variables included in the model as well as in where they place variables within the model (Babitsch, Gohl, & von Lengeke, 2012).

Health outcomes. When older adults have unmet needs, they are at risk for various adverse health outcomes, including increased anxiety and depressive symptoms. Unmet need for assistance with ADL and instrumental activities of daily living (IADL) predicted symptoms of depression among older adults (Allen & Mor, 1997; Quail, Wolfson, & Lippman, 2011). When rural homebound older adults expressed difficulty with completing ADL and IADL tasks, they were more likely to report symptoms of depression compared with individuals who did not

express difficulty (Tanner, Martinez, & Harris, 2014). Older adults who have difficulty maintaining functional independence also are at increased risk for other adverse health outcomes. Having insufficient help with care needs was associated with the increased risk of hospital admissions (Xu, Covinsky, Stallard, Thomas, & Sands, 2012; Sands et al., 2006) and mortality (Blazer, Sachs-Ericsson, & Hybels, 2005; Carey et al., 2008; Li et al., 2012). To avoid adverse health outcomes, it is critical individuals receive sufficient help.

Rural risk. Having unmet functional care needs is a critical health concern for all older adults, but especially for individuals living in rural communities. There are specific challenges to addressing the needs of rural populations who are often older, poorer, and less healthy and who have restricted access to services (Hash, Jurkowski, & Krout, 2015). Older adults living in rural areas have been referred to as "vulnerable people in vulnerable places" (Keating & Fletcher, 2012). This label reflects the challenges associated with service access in rural communities (Glasgow & Brown, 2012; McAuley, Spector, & Van Nostrand, 2009; Nemet & Bailey, 2000). For example, after controlling for other factors, rural community residents received less formal homecare than their urban counterparts (McAuley et al., 2009). In another study, for rural elders the most distressing factors associated with seeking healthcare were transportation difficulties and lack of quality health care (Goins et al., 2005).

Self-management and unmet needs. When faced with challenges, individuals use a variety of strategies to navigate their current circumstances. One such strategy is self-management, a process by which individuals learn and use skills to improve their physical and emotional well-being (Cramm et al., 2012; Lorig, 1993). Self-management strategies help individuals minimize decline in physical functioning (Cramm et al., 2012) and cope with psychosocial consequences of managing illness (Gallant, Spitze, & Prohaska, 2007). Since the groundbreaking study by

Langer and Rodin (1976) on the role of enhanced personal responsibility and choice on older adults' general sense of well-being, control has "been an underlying theme in theoretical discussions of health" across the life course (Umberson, Crosnoe, & Reczek, 2010, p. 145). Research continues to show that a low sense of personal control negatively influences health outcomes while a high sense of personal control positively influences health outcomes in late life. To maintain a sense of control over declining health circumstances and to maintain functioning, older adults often adjust their expectations and modify behaviors.

Although the literature on how individuals self-manage the challenge of unmet care needs is sparse, we identified two related studies based on older adult samples. When individuals are financially vulnerable and unable to pay for help, they face even more challenges. A qualitative study with 41 low-income individuals aged 50 years and older with multiple morbidities revealed three primary strategies used by participants to help them feel more in control of their health (Leach & Schoenberg, 2008). Participants used cognitive structuring techniques that normalized the situation as part of the aging process, made social comparison to others in worse situations, and relinquished some control to others, like their doctor. Other strategies included modification of self-care activities like dietary intake, exercise, and other existing activities, and faith-oriented strategies that encompass prayer and church as a central part of life. The second study interviewed 35 older adults aged 65 years and older and found that self-management strategies used depended on socioeconomic status and life expectations (Clark et al., 2008). For low-income older adults, their priority was to experience comfort, rest, and elimination of pain in their remaining years. They focused their efforts on taking medication and going to doctor's appointments. Conversely, for older adults who had more financial resources, self-management

strategies were central to reaching family, work, and social milestones through good health (Clark et al., 2008).

Study Purpose. We drew upon Andersen's model to develop our research questions and identify enabling and need-based factors associated with service use and health outcomes while controlling for predisposing characteristics of age, sex, and race. In the first phase of the study, we focused on enabling and need-based risk factors associated with adverse health outcomes. Follow-up interviews were then conducted to explore how rural older adults managed after being deemed ineligible for assistance, as we suspected self-management strategies may be particularly challenged when accessing limited services available. In this phase of the research, the focus was on internal and external individualized strategies for managing functional care needs. The following research questions (RQ) guided our investigation.

1. How are enabling resources (place of resident) and need-based factors (waiver eligibility) associated with service use, hospitalization, and death?
2. How do older individuals who live in rural counties manage their unmet care needs?

We hypothesized that rural-dwelling older adults would be less likely to receive services and have greater risk for hospitalization and death and that waiver-eligible individuals would have lower risk for hospitalization and death (RQ1). We also anticipated that individuals not eligible for Medicaid services would rely on their existing social network and engage in self-management strategies to address their daily needs (RQ2).

Methods

Study Design. We used a sequential mixed method design (Creswell & Plano Clark, 2011) to address the overall research question: *How do older adults manage unmet needs*? In this approach, methods are implemented sequentially starting with statistical analyses of quantitative

data in Phase 1, followed by qualitative data collection and analysis in Phase 2 (Creswell & Plano Clark, 2011; Morgan, 1998). The interview data provided context for understanding how older adults managed unmet need in their daily lives. The mix of quantitative and qualitative methods furthered understanding of the daily lives of individuals with greatest risk for adverse health outcomes when not eligible for government-supported programs. The university's institutional review board approved this study.

Study Sample and Procedures for Data Collection. The target population for Phase 1 of the study were adults aged 60 and older who applied for the Medicaid EDCD waiver program through DMAS (N=1,039). Participants were excluded from the analysis if age, sex, or race/ethnicity were missing in the DMAS dataset. Thus, the analytical sample included 1,008 participants.

Two state agencies provided Phase 1 data: DMAS and DARS. We obtained enrollment data from DMAS for individuals who applied for the EDCD waiver between October 1, 2013 and September 30, 2015 and obtained health data from DMAS on hospitalization occurrence and date of death (when applicable) through March, 2016. DARS provided information on whether these individuals accessed services during the same time frame (October, 2013 – September, 2015).

For phase 2 of the study, we used a nested sampling strategy (Yin, 2009) where individuals from Phase 1 were identified for follow-up semi-structured telephone interviews. We identified 105 participants who were (1) deemed waiver-ineligible and (2) living in rural counties. DMAS provided some contact information for 64 of these individuals. Even after using multiple methods to confirm addresses and phone numbers, 30 individuals had invalid contact information. Eight older adults were no longer living independently in the community and three

people had died. Based on attempts to contact the remaining 23 participants, 9 individuals could not be reached despite making five telephone calls, and 6 older adults declined to be interviewed, citing reasons such as challenges associated with talking on the phone or disinterest in the project. The final interview sample comprised eight persons who met the criteria and agreed to participate. Interviews were conducted October through December, 2016.

Participants were sent an initial recruitment letter describing the research and a study consent form; the first author contacted individuals by telephone within 10 days of mailing the letter and followed standard practice for establishing rapport with participants and describing the purpose of the study (Bogdan & Biklen, 1998; Patton, 2002). Before proceeding with the interview, the first author informed participants of the procedure, explained their rights, and obtained verbal informed consent and permission to audio record the interview. Manual notes were also taken during the interviews. Interviews averaged 30 minutes (range, 13-75 minutes). All eight participants received a $25 gift card for a local retail store in appreciation for their time.

Phase 1 Study Measures. *Outcome variables*. DMAS provided data on who was eligible for the waiver, and the occurrence of hospitalizations and mortality. Individuals were either waiver-ineligible, coded as 0, or waiver-eligible, coded as 1. Hospitalization was a count variable that reflected the number of hospitalizations individuals experienced during the study period. Mortality was coded to indicate whether death had not occurred (0) or occurred (1). DARS provided data on who accessed their services (0 = not accessed, 1 = accessed) and who used specific services, including transportation and home modification (0 = service was not used, 1 = service was used).

Predictor variables. Based on available data, we identified enabling, need-based, and predisposing variables. County of residence was operationalized into the variable geographic

location and coded as non-rural (0) and rural (1), based on the designation provided by the Consumer Financial Protection Bureau (2013). The two need-based variables were source of screening assessment (0 = hospital-based team, 1 = community-based team), and service recommendation (0 = waiver-ineligible and received no services, 1 = waiver-ineligible but received limited Medicaid services, 2= waiver-eligible and received services). Service recommendation served as a proxy for level of need. In the analysis, we controlled for the predisposing variables of age (continuous), sex (0 = male, 1 = female), and race (0 = White, 1 = Black, 2 = Asian, 3 = Hispanic/Latino, 4 = other).

Phase 2 Study Measures. Influenced by theoretical perspectives on control, the in-depth, semi-structured interviews were designed to further understanding of the participants' experience with managing unmet needs. Open-ended questions focused on daily challenges and self-management strategies (behavioral and environmental modification and assistance from others). Specifically, participants were asked about the ADL and IADL tasks for which they received assistance, who helped them, and how they managed if no or insufficient help was provided. We inquired about their most difficult challenge and expectations for assistance in the future. Participants also responded to structured standardized questions about loneliness (Russell, 1996) and depressive symptoms (CES-D 10; Radloff, 1977).

Data Analysis. We computed summary statistics for categorical predictors and binary outcomes, examined bivariate correlations between all pairs of independent variables, and addressed collinearity among multiple variables by removing one or more variables from analyses. To estimate the effects of enabling and need-based variables on service use and mortality, we used logistic regression. Zero-inflated Poisson regression was used to estimate the effects of variables on hospitalization (Hilbe, 2007). We used the IMB SPSS Version 22

software to run descriptive statistics (frequencies, percentages, means, correlations) and chi-square test of independence to characterize the study sample. The STATA 10 statistical package was used for regression analyses.

In preparation for Phase 2 analyses, audio-recorded interviews were transcribed verbatim, verified for accuracy between the audio recording and the written transcription, and de-identified for coding purposes. We used content analysis to analyze the interviews (Potter & Levine-Donnerstein, 1999), with a framework for interpreting older adults' experiences based on theoretical underpinnings of primary and secondary control theory (Heckhausen & Schulz, 1995). After initial open coding, four iterations of coding resulted in the final coding theme (LaRossa, 2005). Open codes were reduced to seven distinct categories through an in-depth process of axial coding. From these categories, three themes emerged. Potential validity concerns in data collection, data analysis, and interpretation were addressed using various techniques (Creswell & Plano Clark, 2011). For example, the second author examined the data and verified the coding scheme. The authors established trustworthiness of the coding process through immersion in the data through close multiple readings of the transcripts; when codes did not align, discrepancies were discussed until we reached consensus (Marshall & Rossman, 2011).

Results

Demographic characteristics. The 1,008 older adults ranged in age from 62 to 105 years, with a mean of 80.08 years (SD = 1.04; see Table 1). More than three-quarters of the older adults were female (*n* = 757; 75.10%) and predominately Black (*n* = 471; 46.73%) or White (*n* = 400; 39.68%). Nearly three in 10 individuals lived in rural counties (*n* = 296; 29.37%). Although all older adults were financially eligible for services, 365 were deemed waiver-ineligible because they were assessed as having fewer than the minimum of four functional limitations required by

Virginia to receive waiver services. Of the 1,008 individuals who applied for the EDCD waiver, nearly half also applied for assistance through DARS within the same study period (n = 502; 49.80%).

In Phase 2, six women and two men ranging in age from 64 to 89 years old (M=71.5; SD = 8.26; see Table 2), were interviewed. All of the older adults were currently widowed, divorced, or separated. Four participants applied for assistance in both FY2014 and FY2015, while the others had applied only once. Four of the eight participants also applied for assistance through DARS. Individuals' self-reported IADL and ADL limitations (Katz, 1983) at the time of the study interview are presented in Table 3.

In the following section, we present the results from both phases of the study concurrently. Three themes emerged from the qualitative data analysis highlighting the unique and shared experiences of the older adults as they managed their functional care needs. We use the emergent themes from the interview data to explain and elaborate on the results from the agency data (see Table 4).

Getting help. A strong relationship existed between waiver eligibility and geographic location: X^2 (1, 1007) = 20.96, $p < .001$. Individuals living in rural areas were 39% less likely to be eligible for the waiver (OR = .61, p = .001). The interviews revealed that the older adults initially sought assistance for ongoing needs rather than a sudden health event that precipitated the need for additional help. They were unsatisfied with their current situation and, thus, applied for the waiver to receive additional help with daily activities. For example, Alaina, who lived alone and relied on her daughter for many care needs, explained she needed more help with personal care, housework, shopping, and meal preparation. "I got angry, and I told my daughter. And she said, 'Mom, you cannot continue like this. We've got to get you some help.'" Similarly,

Olivia indicated, "I tried to get a waiver to have somebody help take care of me because I've had a lot of health issues over the years, and I seem to be getting more the older I get."

Waiver-ineligible older adults did not give up after initial help-seeking behavior was not rewarded. Rather, they continued their various ways of *getting help* to manage 5 to 10 limitations. The older adults managed their care needs by continuing to rely on family, formal services, or a mixture of both. For example, Mark relied on family and friends for help.

> [My son] chauffeurs me around when we're going different places … I have a friend, he's a neighbor, and he's been very helpful over the years. He is still able physically to do a lot of things that I can't do.

In addition to relying on her daughter, Alaina reluctantly had started receiving agency help. She had had a previous negative experience with a service agency that caused her concern.

> We had home health. . . I've had people in my home that have stolen. I have a trust issue with people. That's the only way I know to say it. You've got to understand, once these people come into your home, they're a stranger to you. You don't know what they're going to do.

Bertha indicated that she was fortunate to have a strong support system of formal and informal helpers to help with her many limitations. Her insurance covered the costs of the help she received from a nurse's aide five days a week. Bertha also had two daughters who lived close by. "If I call them for something really important, they would be right here. I'm really blessed you know. I'm well taken care of and fed."

In contrast, Diane, Henrietta, and Scott had limited family involvement and relied on formal agencies to provide some help. Scott lived independently, despite a lifelong disability. For many years, he received help on a voluntary basis from a friend. Within the last year, this friend

began working for the county's department of social services. She became a paid caregiver for Scott, providing help with household chores and companionship five hours a day, three days a week. In addition, several local service organizations provided him with occasional meals and help with home modification projects.

Navigating daily tasks. Rural older adults were 2.3 times more likely to access services through the government-supported DARS agency than individuals living in urban counties (OR = 2.26, p = .001). Although disadvantaged with respect to waiver-eligibility, they continued to seek assistance to address ongoing needs. Assessment by a community-based screening team of healthcare professionals was a significant predictor of DARS access (OR = 1.51, p = .016).

Analysis of the interview data revealed that study participants used a variety of internal strategies and external behavioral and environmental modifications for *navigating daily tasks*. Internal strategies were reflected in the older adults' positive outlook on how they managed their daily lives and the advice they had for others in a similar situation: For Scott, it was all about motivation.

> You've got to be able to be self-motivated to say "I can." I wasn't allowed to say "I can't" all of my life…The key to everything in life, in marriage, and in work, and in everything you're doing: you've got to have enough willpower to do it…A person has got to want to.

Diane's comments about her attitude and behaviors reflected the sentiments of several participants.

> Think positive and don't give up, and keep the good spirits up, and just try to do what you can and don't overdo yourself. And if you can't get it done, then just let it go until

you are able to do it. If you need to rest, rest. Your body tells you when you need to rest, but don't lay in the bed all the time. Get up and move around.

Having inner strength helped the older adults persevere when unable to secure additional help. All participants, except for Olivia, assessed their quality of life as good or excellent. Olivia reported low levels of well-being on all measures and indicated the most severe score of depressive symptoms. She lived with her daughter and grandson and indicated that the family dynamics were exhausting, "A lot of the times I lock myself in my bedroom because I can't deal with the [things] I go through."

The older adults adjusted their expectations to maintain control over declining health circumstances. Alaina captured the sentiment of many of the participants: "I'm doing the best I can because when the helps not here… basically I'm doing it all myself. But I thank the Lord that I can do it." The older adults expressed an internal strength or faith that enabled them to persevere in light of difficult health-related circumstances.

External strategies reflected the implementation of behavioral modifications to adjust to disruptions in daily life. For example, Diane had some difficulty with shopping, but viewed it as a form of exercise. "I do the shopping. That's one of my exercises. I do the walking and if I get tired…when my legs start giving out I ride the little cart." Challenges with mobility undergirded subsequent challenges that most older adults discussed. Seven of the eight participants had mobility issues. They relied on assistive devices such as a cane, walker, or a motorized wheelchair to address functional difficulties.

The older individuals learned to listen to their body and, like Olivia explained, limit themselves as they navigate their circumstances.

> I have somebody that helps me with [grocery shopping]. I used to ride the buggy in the store all the time, but that just made me hurt more in my back, so I walk, and I just don't go as long as I used to. I have to limit myself. In other words, if I go overdo it, I get to hurtin' and get tired, and have to come home and lay down pretty much as soon as I get home. It's the same thing with walking too much.

By changing their environment to promote safety and independence, the older adults were better equipped to manage challenges associated with increasing levels of disability. Making modifications to the home environment helped several of them manage their functional care needs, including the installation of ramps and grab bars throughout their homes. Bertha benefitted from home modification projects completed by local non-profit organizations.

> [A community service organization] had come out 6 or 7 years ago…they had put me up a ramp between my kitchen and my den going out through the back door. So then they put up all these handles for me to get in and out of the tub, get up the ramp. They've got that fixed up real good for me.

Similarly, Mark now benefited from grab bars that he made and installed several years ago when caregiving for his late wife.

To explore the link between well-being and unmet needs, we asked participants about companionship, feeling left out, isolation, and symptoms of depression. While feeling left out and isolated were not concerns for participants, seven older adults reported that they lacked companionship at least some of the time. Four of these individuals also reported symptoms indicative of probable depression (CESD-R-10 score of >10). Bertha was an outlier, reporting high levels of well-being on all measures. While she had the greatest difficulty with care needs, she perceived receiving adequate informal and formal help.

Ongoing unmet needs. We assume that at the time of application for waiver services, individuals believed they could benefit from additional assistance. While we found that being deemed waiver-ineligible did not 'break' them, their unmet needs persisted. Our interviews with near-risk older adults revealed that although self-management strategies were helpful, they were not enough. Individuals had *ongoing unmet needs.*

Participants expressed having anywhere from four to eight IADL limitations. Underlying mobility issues hindered individuals' ability to carry out daily tasks. The most salient challenges were related to transportation, household chores, preparing food, grocery shopping, and doing laundry. Scott had difficulty standing long enough to prepare a meal or do household chores. He wanted physical therapy "to get back on my feet." Olivia also struggled to complete daily tasks, which she explained meant giving up certain activities: "I had to give up doing the vacuum cleaner because that really wore me out. Or standing and doing dishes. Pretty much standing any length or amount of time, it wears me out. It hurts. Causes me pain." For Olivia, not "being able to get up and do stuff" was her biggest frustration and source of distress.

> That's the thing that upsets me the most is not being able to do the things I used to do. That makes me cry. I've [been] very depressed at times. Because I want to cook and do the things that I used to do, and my body just says not.

The problems older adults had with daily tasks were ongoing and indicative of a progression toward higher a level of disability. Yet, preventive services with potential to help participants complete daily responsibilities and delay forthcoming functional care needs were unavailable or insufficient.

Adequate transportation was a challenge for seven participants, whether it was scheduling issues or lack of available transportation services. The interviews confirmed the quantitative

findings that older adults living in rural areas were 72% less likely to receive transportation services (OR = .28, p = .012). Participants explained how reliable services would reduce the burden on family members to provide transportation and ensure transport for doctor visits, grocery shopping, and other engagements. For Alaina, transportation was her most challenging unmet need, but she remained optimistic about her situation. "It [transportation] would make for less anxiety on my part for trying to worry and figure how … [my daughter and I] have to reschedule appointments. But all in all, we… get it done."

Although Bertha received adequate help with her basic care needs, she too expressed frustrations with transportation, indicating that not much had changed since she moved to the community nearly three decades ago:

> We have called [the bus company] and they said they don't come out in this area. They come up to the four way where I live, where if you could get somebody to get you up there, and let them know, and make an appointment or a call, then they'll meet you at the four way stop.

Another ongoing need for Bertha was home modifications. Her family encouraged her to weatherize her home, but the application had extensive paperwork, which was a deterrence. She explained, "It would make my house better, warmer. I've got a window that's rotten and falling out and I had snow coming through my kitchen window." Phase 1 analyses revealed that rural older adults were 87% less likely to receive home modification services (OR = .13, p = .004) compared with their urban counterparts.

Reflecting on what would happen if they continued to receive insufficient help and their care needs were to spiral out of control, the older adults were either resigned to nursing home placement or refused to consider it an option. Resignation was linked to family burden and not

wanting to infringe on family's time and responsibilities. Scott, who was receiving help through an agency, stated:

> If I ever get down to where I cannot take care of myself, I'll sign myself into a nursing home so fast [my daughters'] heads will spin. For this simple reason, my daughter told me one time, "Daddy, I'll take care of you." I said, "Let me tell you something, …I know what it is to be tied up 24/7. If you start taking care of me, you're tied 24 hours a day, 7 days a week, you can't go nowhere, you can't do nothing. You're tied up taking care of me and I don't want to put that responsibility on you."

Henrietta's family did not live nearby and she believed that she would not be able to afford more help if her needs increased. She stated, "I would probably have to check myself into a nursing home." Similarly, Bertha felt that if her care need were to increase, she would "have to go to a nursing home." However, she had developed a kin-like relationship with her caregiver overtime and went on to say that "[caregiver] said I'll never go to a nursing home. She adopted me as her mother."

Other participants expressed strong feelings against moving to a nursing facility. Greta initially applied for the waiver program to cover expensive cancer screening costs. Although she did not have any current care needs, she anticipated that her adult children and grandchildren would continue to take care of her: "I have somebody here to help me if I need anything." Olivia said a nursing home was the last place she wanted to go. "I had to put my mother in one… and I don't want to go. I pray it never happens to me. I'd just rather die than to go to a nursing home."

Risk of hospitalization was higher for older adults who were deemed ineligible for services ($\beta = 1.04$, $p = .007$). Individuals who were not receiving help were more likely to have died compared with individuals who received limited Medicaid services or waiver services (OR

= 0.39, $p < .001$; OR = 0.48, $p < .001$). Living in rural versus non-rural areas also predicted increased risk of mortality (OR = 1.51, $p = .016$). As rural-dwelling older adults were more likely to be waiver-ineligible, this may reflect challenges associated with having limited finances and being unable to afford additional services.

Discussion

Study findings offer new insights about how low-income individuals who often cannot afford to pay for additional services self-manage unmet needs. When faced with adversity, the older adults confronted their ongoing daily challenges and relied on various alternative care strategies. For most participants, family members remained their primary source of help. Other individuals sought assistance through alternative government-supported programs (Chen & Thompson, 2010).

Restrictive state-level policies limited eligibility for services and contributed to older adults' need to develop alternative strategies to perform ADLs. Similar to other studies of unmet needs, we found that individuals who were not receiving sufficient help experienced adverse health outcomes such as hospitalization and mortality (Carey et al., 2008; Li et al., 2005; Xu et al., 2012). They were deemed ineligible for waiver services because their needs were considered less substantial (e.g., limitations with IADLs like meal preparation, household chores, grocery shopping, and transportation). We identified mobility difficulties as the root of subsequent IADLs. However, IADLs are not taken into consideration as part of the eligibility criteria for waiver services. With financial limitations, individuals cannot afford to pay for more help; yet, efforts to intervene with IADL limitations have potential to reduce risks of such consequences and avoid costly hospitalizations (Konetzka, Karon, & Potter, 2012).

Rural older adults were more likely to be deemed ineligible for waiver services than their non-rural counterparts. Despite the challenges associated with living with unmet needs, study participants exhibited resilience through physical and psychological strategies to navigate daily challenges and maintain health and well-being (Wells, 2010; Wagnild & Collins, 2009). Internal and external individualized self-management strategies allowed individuals to carry on as usual, even when not receiving enough help. Individuals relied on their existing structures of support as well, supplementing family assistance with alternative government-supported services. However, transportation and housing services were less likely to be used by rural individuals than non-rural counterparts. We speculate that the older adults faced problems related to access and availability of service that are common challenges of service use in rural communities (Glasgow & Brown, 2012; Goins et al., 2005; McAuley et al., 2009).

Future Research and Practice. This study provides initial insight into how low-income older adults in rural areas manage their care needs. Future research is necessary to expand upon the findings and address study limitations. Using a mixed method sequential explanatory study helped us identify risk factors associated with service use and health outcomes among a near-risk population of older adults with unmet need. We had the opportunity to examine service use data from two agencies within one state. However, Phase 1 analyses were limited to data available in pre-existing data, collected for purposes other than research. For example, we did not have information about IADL limitations, which would inform appropriate service delivery for near-risk individuals. With the emergence of "big data" where archival and real-time health and service use data from large populations is more readily available, there are opportunities to triangulate information to advance understanding of care needs and service use (Roberto & Blieszner, 2015). Although there are various challenges associated with combining existing data,

including data integrity and privacy concerns that require further attention, developing strong partnerships with state-level agencies is a critical step first step in accessing data; collaboration may expand opportunities to access additional information from data collected by agencies or forge opportunities for researchers to gather additional data that provides greater social context about clients' situations.

Although the sample size for Phase 1 was large, there were constraints on the sample pool for Phase 2 that yielded a small number of follow-up participants. Previous studies have documented problems with conducting telephone interviews with state-Medicaid beneficiaries, including accessing valid contact information (Clark, Rogers, & Allen, 2010). Although we contend that theoretical sufficiency was met, even within our small sample (Marshall & Rossman, 2011), interviews with a larger number of participants would strengthen understanding of how older adults in rural areas manage their care needs and promote culture competency in service delivery (Sörensen, Hirsch, & Lyness, 2014). For example, besides an expectation for family to provide help, rural older adults did not consider future care arrangements if their health were to decline (Pinquart & Sörensen, 2002). More research is needed to explore expectations for care and develop appropriate interventions that enable service agencies to provide support and services that align with near-risk older adults' preferences for care.

Cross-sectional studies about unmet needs of older adults dominate the literature, making it difficult to assess causality and risk for adverse health outcomes over time. While we assessed health outcomes 6 months after individuals applied for assistance, more research is needed to examine patterns of service use and self-management over a longer duration. This information is necessary to advance knowledge about the benefits of specific services and strategies in

mitigating adverse consequences. Subsequently, it will inform the development of preventive services that target specific limitations and effectively reduce risk of adverse health outcomes.

Receiving assistance through the EDCD waiver was an effective care option for individuals enrolled in the program. Although follow-up interviews with waiver-eligible participants was beyond the scope of this study, preliminary evidence exists that even for individuals eligible for waiver services, unmet needs remain (Glass, Teaster, Roberto, & Brossoie, 2005). Future research needs to assess effectiveness of the current approach to service delivery and consider implementing preventive services to address IADL limitations. Preventive services not only support older adults' health, functioning, and well-being, but may be cost-effective for public programs (Freedman & Spillman, 2014; Sands et al., 2008). Researchers need to continue forging partnerships that enable use of health services data to identify when and how older adults use services, and explore how self-management strategies influence health and functioning over time.

Table 1.

Demographic characteristics of EDCD Waiver applicants (N = 1008)

	Total *n* (%) *n* (SD)
Sex	
Female	757 (75.10)
Male	351 (24.90)
Age	
	80.08 (1.04)
Race/Ethnicity	
White	400 (39.68)
Black	471 (46.73)
Asian	84 (8.33)
Hispanic/Latino	22 (2.18)
Other	31 (3.07)
Rural region	
Yes	296 (29.37)
No	712 (70.63)
Assessment team	
Hospital-based	190 (18.85)
Community-based	818 (81.15)
Waiver eligibility	

Eligible	643 (63.79)
Ineligible	365 (36.21)
Service recommendation[1]	
No services	164 (16.27)
Limited services	201 (19.94)
Full services	643 (63.79)
Accessed DARS	
Yes	502 (49.80)
No	506 (50.20)
Hospitalization	
Yes	44 (4.37)
No	964 (95.63)
Death	
Yes	271 (26.88)
No	737 (73.12)

[1] No services = waiver-ineligible and received no services; Limited services = waiver-ineligible but received limited Medicaid services; Full services = waiver-eligible and received services

Table 2.

Sample characteristics of older rural-dwelling older adults who were waiver-ineligible

	Sex[1]	Age	Race/ Ethnicity	Living[2]	Accessed DARS	Quality of Life	Lack Companionship	Depression[4]
Henrietta	F	70	Black	Alone	✓	Excellent	Sometimes	6
Alaina	F	68	White	Alone		Good	Sometimes	17
Mark	M	89	White	Son		Good	Sometimes	6
Diane	F	64	White	Alone	✓	Good	Often	17
Scott	M	75	White	Alone	✓	Good	Often	13
Olivia	F	67	White	Daughter[3]		Fair	Sometimes	25
Bertha	F	75	White	Alone	✓	Excellent	Hardly ever	0
Greta	F	64	White	Alone		Good	Sometimes	5

[1] F= female, M = male

[2] Living arrangement

[3]Living with daughter and grandchild

[4] Score greater than 10 on the CESD-R indicates probable depression

Table 3.

Expressed difficulty with needs of older, waiver-ineligible rural-dwelling adults

	Activities of Daily Living (ADL)						**Instrumental Activities of Daily Living (IADL)**									
	Bathing	Getting Dressed	Using Bathroom	Transfer	Bathroom accidents	Eating	Mobility	Making food	Using phone	Going shopping	Doing laundry	Cleaning the house	Driving	Taking medication	Preparing bills	Home maintenance
Henrietta		✓	✓				✓	✓		✓	✓	✓	✓			
Alaina	✓				✓		✓	✓	✓	✓	✓	✓	✓			✓
Mark		✓			✓		✓	✓		✓		✓	✓			
Diane	✓	✓		✓			✓	✓			✓	✓	✓			
Scott					✓		✓			✓		✓	✓			✓
Olivia				✓	✓		✓	✓		✓	✓	✓	✓	✓		
Bertha	✓				✓		✓	✓		✓	✓	✓	✓	✓	✓	✓
Greta[1]																

[1] Greta received financial help to pay for cancer screening tests but reported no other functional limitations.

Table 4.

Regression results for service use and health outcomes (controlling for age, sex, and race)

	EDCD Eligibility			**Accessed DARS**		
	OR (SE)	*p* value	95% CI	OR (SE)	*p* value	95% CI
Rural (ref. non-rural)						
	0.61 (.09)	.001*	[0.45, 0.82]	2.26 (.34)	<.001*	[1.68, 3.05]
Assessment (ref. hospital)						
	2.13 (.36)	<.001*	[1.53, 2.97]	1.51 (.26)	.016*	[1.08, 2.11]
Service Rec.[1] (ref. no services)						
Limited services	–	–	–	0.86 (.19)	.496	[0.56, 1.33]
Full services	–	–	–	0.57 (.11)	.003*	[0.40, 0.83]

	Hospitalization			**Mortality**		
	β (SE)	*p* value	95% CI	OR (SE)	*p* value	95% CI
Rural (ref. non-rural)						
	0.53 (.31)	.086	[-0.07, 1.13]	2.26 (.34)	.001*	[1.68, 3.05]
Assessment (ref. hospital)						
	-1.08 (.36)	.003*	[-1.79, -0.37]	1.51 (.26)	.016*	[1.08, 2.11]
Service rec.[1, 2] (ref. no services)						
Limited services	0.46 (.43)	.28	[-0.37, 1.30]	0.39 (.10)	<.001*	[0.24, 0.63]
Full services	1.04 (.38)	.007*	[0.29, 1.79]	0.48 (.10)	<.001*	[0.32, 0.70]
DARS[2] (ref. did not access)						
	0.31 (.32)	.328	[-0.31, 0.94]	0.77 (.12)	.091	[0.57, 1.04]

[1] No services = waiver-ineligible and received no services; Limited services = waiver-ineligible but received limited Medicaid services; Full services = waiver-eligible and received services

[2] Variable was inflated in ZIP regression analyses predicting hospitalization

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Chapter V

Discussion

The purpose of this research was to advance understanding of help-seeking behaviors of a near-risk population of low-income older adults who were deemed ineligible to receive state-funded assistance. I used health services data from two independent state agencies to assess predictors of service use and health status; follow-up interviews were conducted to explore self-management strategies of rural older adults. Interview data were used to enhance the interpretation of results from statistical analyses about the risks faced by low-income rural older adults with unmet needs.

This near-risk population of low-income older adults perceived a need for help but did not yet qualify for assistance through the government-supported EDCD waiver. They were at increased risk for hospitalization and mortality compared to individuals who received helped. Receiving insufficient help is a serious public health concern because disability limits older adults' opportunities for social and community engagement (Freedman et al., 2014) and contributes to adverse health outcomes (e.g., Carey et al., 2008; Tanner et al., 2014; Sands et al., 2006). The older adults in this study did not have available enabling resources, such as expendable income, to purchase needed services to help them with daily activities like meal preparation, transportation, and household chores. Ineligible individuals were more likely to access alternative services through the DARS agency to meet their needs. While this finding confirmed DMAS' suspicion that individuals receive other types of assistance when deemed ineligible for the Medicaid waiver program, it also validated self-reported perception of needs.

Rural older adults were significantly more likely to be waiver-ineligible and at increased risk for mortality, placing them in a vulnerable position. This group of near-risk older adults, like

many other older individuals living in rural communities, were economically disadvantaged (Lobao, Zhou, Partridge, & Betz, 2016; Ziliak, 2012), making it difficult for them to pay for help. Among the interviewees, family remained a primary source of help, and others sought assistance through alternative government-supported programs. Rural-dwelling individuals were more likely to access the DARS agency to receive services compared to non-rural counterparts. When comparing the use of specific services, transportation and housing services were less likely to be used by rural individuals than non-rural counterparts. However, among the ineligible individuals who were interviewed, transportation and housing were frequently mentioned as an area of need. Perhaps these discrepant findings are reflective of the availability and accessibility of services within rural communities and reinforce the importance of considering locality in the funding of services (Hash, Jurkowski, & Krout, 2015).

Despite challenges associated with living with unmet needs, interviews with waiver-ineligible rural-dwelling older adults revealed resilience through their use of physical and psychological coping mechanisms to navigate daily challenges and maintain health and well-being (Wells, 2010; Wagnild & Collins, 2009). Being ineligible for waiver services did not upend participants lives, but they had to deal with numerous IADL difficulties that are not taken into consideration as part of the eligibility criteria for waiver services. Mobility was an underlying problem that led to subsequent IADL limitations, such as difficulty with household chores and meal preparation.

Older adults who were screened by a hospital-based team were less likely to be eligible for waiver services than individuals screened by a community-based team. This may reflect a perception of hospital-based healthcare professionals that individuals' immediate health concerns are addressed and therefore, they are less in need of services and supports. Typically, a

hospitalization is not related to daily functional needs. Individuals with financial constraints face uncertainty about how to pay for post-hospital care (Li, Covinsky et al, 2005) intended to deter subsequent adverse health outcomes. Conversely, individuals assessed by a community-based team were more likely to access DARS services to help alleviate ongoing challenges. Perhaps this is because community-based healthcare professionals work within the community and are more aware of local services.

Limitations and Future Research

Using a mixed method sequential explanatory study, new insights about factors associated with service use and health outcomes and self-management strategies of low-income older adults emerged. This study is not without limitations. While findings support and extend previous research, it is not without its limitations, which point to new directions for future investigations.

Availability of Data. Phase 1 analyses were limited to secondary data collected for service eligibility purposes and not for research purposes. The type of research questions that could be assessed were constrained to available variables of interest. For example, DARS provided insufficient data on several variables of interest, including education (predisposing characteristic) and living arrangement and relationship of caregiver (enabling resources). In addition, only two primary health outcomes were available: hospitalization and mortality. Future research is needed that considers other health (e.g., falls, nursing facility placement) and psychosocial (e.g., depression, loneliness) outcomes. Including a broader array of outcome measures, as well as enabling and need-based variables (e.g., caregiver availability and specific functional limitations), would help contextualize the effects of having and self-managing unmet needs. Including self-reported perceived unmet need in clinical assessments may reveal physical,

mental, and emotional dimensions that contribute to the complexity of unmet needs (Sands et al., 2006; Vlachantoni et al., 2011).

Data Integrity and Availability. When using secondary data, researchers are often unable to verify data collection processes (Mroczek, Pitzer, Miller, Turiano, & Finderman, 2011). The quality assurance processes of data entry for DMAS or DARS was not shared. I found several incidences of inaccuracy within and between agencies. For example, race of individuals did not always align between agencies so I developed a decision tree to resolve discrepancies. If data were missing from one agency, I relied on available data from the other agency. When individuals had multiple entries, which mostly occurred in the DARS system, I used the most frequent code (e.g., for race, if White was indicated 3 of 4 times, I considered the individual White). While using this process helped complete individual records, 31 individuals were eliminated from the sample because race, sex, or age could not be determined. Similarly, DARS provided data on functional limitations (i.e., ADLs and IADLs) and enabling resources (i.e., living arrangement and availability of caregiver), but for many of the records, I could not ascertain whether data were missing or individuals were not assessed on these variables. For this reason, variables such as limitations with personal care and household chores, living arrangement, and availability of caregiver were not included in most analyses.

Although there are various challenges associated with bringing together existing data and triangulating information, including data integrity and privacy concerns that require further attention, developing strong partnerships with state agencies is a critical step first step in accessing data. Using principles of community-based participatory research (CBPR) may help facilitate an active exchange between researcher and community or agency representatives (Minkler & Wallerstein, 2011). Building collaborative partnerships may expand opportunities to

access additional information collected by agencies or forge opportunities for researchers to gather additional data to provide greater context about clients' situations. Advancement in the field of health services research will ultimately improve the lives of older adults by expanding their capabilities to self-manage and prevent avoidable declines in health and functioning.

Gaining access to clinical assessment data on functional ability would enable researchers to identify specific IADL and ADL limitations associated with specific service use and subsequent risk of experiencing health outcomes. In addition, while I assessed health outcomes 6 months after individuals applied for assistance, research inquiries that assess health data over a longer duration may reveal trends in service use and self-management associated with functional limitations. Interviews with a larger number of participants would strengthen understanding of how older adults in rural areas manage their care needs and promote culture competency in service delivery (Sörensen, Hirsch, & Lyness, 2014). This type of information is necessary to inform the development of service user profiles based on enrollment characteristics that help service providers in identifying appropriate services for clients.

Study Sample. The sample for Phase 1 came from Virginia, a state with strict functional eligibility criteria. Future research that compared individuals in states with strict versus less strict criteria may reveal different risk and protective factors associated with health outcomes. Such information about the advantages and disadvantages of divergent eligibility criteria is critical to inform policy decisions, particularly preventive efforts for near-risk low-income and rural populations

Although the sample size for Phase 1 was large, the sample pool for Phase 2 yielded a small number of follow-up participants. Recruiting participants for interview was challenging, mostly because of invalid contact information, a challenge previously documented by Clark,

Rogers, and Allen (2010). Although I contend that theoretical sufficiency was met by the eight interviews (Marshall & Rossman, 2011), increasing the number of interviewees would strengthen understanding of how older adults in rural areas manage their care needs. It may also inform the delivery of culturally competent service options in rural areas (Sörensen, Hirsch, & Lyness, 2014).

Although beyond the scope of this study, future research needs to consider not only individual level variables but community level variables and broader societal events. For example, the financial recession on the late 2000s affected retirement accounts of many older adults and may have influenced the relative health and need for services. Likewise, the implementation (and potential repeal of) the Affordable Care Act must be taken into consideration when researching service use and perceived health care needs.

Policy Implications

Virginia's approach to service access through strict functional criteria can be interpreted as an effort to target individuals with greatest disability and may reflect budgetary concerns. Receiving assistance through the EDCD waiver was an effective care option for individuals enrolled in the program. Although follow-up interviews with waiver-eligible participants was beyond the scope of this study, preliminary evidence exists that even for individuals eligible for waiver services, unmet needs remain (Glass, Teaster, Roberto, & Brossoie, 2005). When individuals' unmet needs are deemed less substantial, they are overlooked for services that could help them manage their functional health. Future research on the effectiveness of services such as those intended to address IADL functional care needs should inform policy decisions.

The findings from this study and the current literature on older adults with unmet needs bring to light the shortcoming of program initiatives and inadequacy of reliance on only informal

caregiving. Waiting lists, or having individuals deemed ineligible for services because of strict criteria, demonstrate the demand for programs that provide services and supports to individuals with functional care needs (Ng & Harrington, 2012). Policymakers need to advocate for services that allow older adults to address preemptively their care needs before they become unmanageable. Ensuring the availability of services for near-risk older adults who are proactive in addressing their functional care needs would benefit individuals and caregivers on whom they rely. Such services not only support older adults' health, functioning, and well-being but may be cost-effective for public programs (Freedman & Spillman, 2014; Sands et al., 2008). Researchers and policymakers alike agree on the importance of addressing the consequences of older adults experiencing unmet needs. Thus, I echo Jurkowski's (2015) call for policies to increase service access in rural communities because even if services exist, they may not be available to this near-risk population of older adults.

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Ziliak, J. P. (2012). *Appalachian legacy: Economic opportunity after the war on poverty*. Washington, D.C.: Brookings Institution Press.

Appendix A

Syntax and Output

SPSS Syntax and Output

```
DATASET ACTIVATE DataSet1.
CROSSTABS
  /TABLES=EDCD_Eligibility_DMAS BY SEX_DMAS Race_chisquare_recode Rural_recode
SOURCE_DMAS
  /FORMAT=AVALUE TABLES
  /STATISTICS=CHISQ
  /CELLS=COUNT ROW COLUMN ASRESID
  /COUNT ROUND CELL.

CROSSTABS
  /TABLES=DMAS_eligibility_type BY Access_DARS_recode Hospitalization_simple_recode
Died_DMAS SEX_DMAS
  /FORMAT=AVALUE TABLES
  /STATISTICS=CHISQ
  /CELLS=COUNT ROW COLUMN ASRESID
  /COUNT ROUND CELL.

CROSSTABS
  /TABLES=Access_DARS_recode BY SOURCE_DMAS
  /FORMAT=AVALUE TABLES
  /STATISTICS=CHISQ
  /CELLS=COUNT ROW COLUMN ASRESID
  /COUNT ROUND CELL.

DATASET ACTIVATE DataSet2.
COMPUTE Chi_square=adj_z_score * adj_z_score .
COMPUTE p_value=SIG.CHISQ(Chi_square, 4).
EXECUTE.


DATASET ACTIVATE DataSet1.
FREQUENCIES VARIABLES=EDCD_Eligibility_DMAS DMAS_eligibility_type
Access_DARS_recode
  /ORDER=ANALYSIS.

FREQUENCIES VARIABLES= SEX_DMAS Race_final Rural_recode SOURCE_DMAS
  /STATISTICS=STDDEV MEAN MEDIAN
  /ORDER=ANALYSIS.

FREQUENCIES VARIABLES=Hospitalizations_count_DMAS Hospitalization_simple_recode
Died_DMAS
  /STATISTICS=STDDEV MEAN MEDIAN
  /ORDER=ANALYSIS.

DESCRIPTIVES VARIABLES=Age_Recode
  /STATISTICS=MEAN STDDEV MIN MAX.
```

DARS- 502

```
USE ALL.
COMPUTE filter_$=(Access_DARS_recode = 1).
VARIABLE LABELS filter_$ 'Access_DARS_recode = 1 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.

FREQUENCIES VARIABLES=SEX_DMAS Race_final Rural_recode SOURCE_DMAS
  /STATISTICS=STDDEV MEAN MEDIAN
  /ORDER=ANALYSIS.

DESCRIPTIVES VARIABLES=Age_Recode
  /STATISTICS=MEAN STDDEV MIN MAX.

FREQUENCIES VARIABLES=CURRENT_ADULT_DAY_CARE CURRENT_CHORE_HOME
CURRENT_HOME_MEALS
    CURRENT_PERS_CARE CURRENT_CASE_MANAGE CURRENT_MEAL_SENIORCENTER
CURRENT_HOME_HEALTH CURRENT_HOUSING
    CURRENT_TRANSPORT CURRENT_any_service CURRENT_sum_rating
CURRENT_sum_rating_combined_at_4
  /STATISTICS=STDDEV MEAN MEDIAN
  /ORDER=ANALYSIS.

FREQUENCIES VARIABLES=Hospitalizations_count_DMAS Hospitalization_simple_recode
Died_DMAS
  /STATISTICS=STDDEV MEAN MEDIAN
  /ORDER=ANALYSIS.

FREQUENCIES VARIABLES=Edu_level_final Caregiver_relationship_final Available_caregiver
    Living_arrange Marital_status_binary ADL_Bath_simple ADL_Dress_simple ADL_Toilet_simple
    ADL_Transfer_simple ADL_Eat_simple ADL_continence ADL_ambulation
IADL_routine_house_tasks
    IADL_Money_Mgmt_simple IADL_Transport_simple IADL_HomeMaintenance_simple Total_ADL
Total_IADL
  /STATISTICS=STDDEV MEAN MEDIAN
  /ORDER=ANALYSIS.

DESCRIPTIVES VARIABLES=Total_ADL Total_IADL
  /STATISTICS=MEAN STDDEV MIN MAX.


DATASET ACTIVATE DataSet1.
CROSSTABS
  /TABLES=EDCD_Eligibility_DMAS BY SEX_DMAS Race_chisquare_recode Rural_recode SOURCE_DMAS
  /FORMAT=AVALUE TABLES
  /STATISTICS=CHISQ
  /CELLS=COUNT ROW COLUMN ASRESID
  /COUNT ROUND CELL.
```

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Is client eligible for EDCD * Sex of client	1008	100.0%	0	0.0%	1008	100.0%
Is client eligible for EDCD * Race_chisquare_recode	1008	100.0%	0	0.0%	1008	100.0%
Is client eligible for EDCD * Indication of county as rural and/or Appalachian	1008	100.0%	0	0.0%	1008	100.0%
Is client eligible for EDCD * Source of Assessment	1008	100.0%	0	0.0%	1008	100.0%

Is client eligible for EDCD * Sex of client

Crosstab

			Sex of client		
			male	female	Total
Is client eligible for EDCD	No	Count	98	267	365
		% within Is client eligible for EDCD	26.8%	73.2%	100.0%
		% within Sex of client	39.0%	35.3%	36.2%
		Adjusted Residual	1.1	-1.1	
	Yes	Count	153	490	643
		% within Is client eligible for EDCD	23.8%	76.2%	100.0%
		% within Sex of client	61.0%	64.7%	63.8%
		Adjusted Residual	-1.1	1.1	
Total		Count	251	757	1008
		% within Is client eligible for EDCD	24.9%	75.1%	100.0%
		% within Sex of client	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.162[a]	1	.281		
Continuity Correction[b]	1.004	1	.316		
Likelihood Ratio	1.154	1	.283		
Fisher's Exact Test				.289	.158
Linear-by-Linear Association	1.161	1	.281		
N of Valid Cases	1008				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 90.89.
b. Computed only for a 2x2 table

Is client eligible for EDCD * Race_chisquare_recode

Crosstab

			Race_chisquare_recode		
			1.00	2.00	3.00
Is client eligible for EDCD	No	Count	178	157	30
		% within Is client eligible for EDCD	48.8%	43.0%	8.2%
		% within Race_chisquare_recode	44.5%	33.3%	21.9%
		Adjusted Residual	4.4	-1.8	-3.7
	Yes	Count	222	314	107
		% within Is client eligible for EDCD	34.5%	48.8%	16.6%
		% within Race_chisquare_recode	55.5%	66.7%	78.1%
		Adjusted Residual	-4.4	1.8	3.7
Total		Count	400	471	137

	% within Is client eligible for EDCD	39.7%	46.7%	13.6%
	% within Race_chisquare_recode	100.0%	100.0%	100.0%

Crosstab

			Total
Is client eligible for EDCD	No	Count	365
		% within Is client eligible for EDCD	100.0%
		% within Race_chisquare_recode	36.2%
		Adjusted Residual	
	Yes	Count	643
		% within Is client eligible for EDCD	100.0%
		% within Race_chisquare_recode	63.8%
		Adjusted Residual	
Total		Count	1008
		% within Is client eligible for EDCD	100.0%
		% within Race_chisquare_recode	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	25.738[a]	2	.000
Likelihood Ratio	26.429	2	.000
Linear-by-Linear Association	25.710	1	.000
N of Valid Cases	1008		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 49.61.

Is client eligible for EDCD * Indication of county as rural and/or Appalachian

Crosstab

			Indication of county as rural and/or Appalachian	
			No	Yes
Is client eligible for EDCD	No	Count	226	139
		% within Is client eligible for EDCD	61.9%	38.1%
		% within Indication of county as rural and/or Appalachian	31.7%	47.0%
		Adjusted Residual	-4.6	4.6
	Yes	Count	486	157
		% within Is client eligible for EDCD	75.6%	24.4%
		% within Indication of county as rural and/or Appalachian	68.3%	53.0%
		Adjusted Residual	4.6	-4.6
Total		Count	712	296
		% within Is client eligible for EDCD	70.6%	29.4%
		% within Indication of county as rural and/or Appalachian	100.0%	100.0%

Crosstab

			Total
Is client eligible for EDCD	No	Count	365
		% within Is client eligible for EDCD	100.0%
		% within Indication of county as rural and/or Appalachian	36.2%
		Adjusted Residual	
	Yes	Count	643
		% within Is client eligible for EDCD	100.0%
		% within Indication of county as rural and/or Appalachian	63.8%

	Adjusted Residual	
Total	Count	1008
	% within Is client eligible for EDCD	100.0%
	% within Indication of county as rural and/or Appalachian	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	20.962[a]	1	.000		
Continuity Correction[b]	20.309	1	.000		
Likelihood Ratio	20.597	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	20.941	1	.000		
N of Valid Cases	1008				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 107.18.
b. Computed only for a 2x2 table

Is client eligible for EDCD * Source of Assessment

Crosstab

			Source of Assessment: Acute Care Hospital/PSAC	Source of Assessment: Community-based team/PSLH
Is client eligible for EDCD	No	Count	99	266
		% within Is client eligible for EDCD	27.1%	72.9%
		% within Source of Assessment	52.1%	32.5%
		Adjusted Residual	5.1	-5.1
	Yes	Count	91	552
		% within Is client eligible for EDCD	14.2%	85.8%
		% within Source of Assessment	47.9%	67.5%
		Adjusted Residual	-5.1	5.1
Total		Count	190	818
		% within Is client eligible for EDCD	18.8%	81.2%
		% within Source of Assessment	100.0%	100.0%

Crosstab

			Total
Is client eligible for EDCD	No	Count	365
		% within Is client eligible for EDCD	100.0%
		% within Source of Assessment	36.2%
		Adjusted Residual	
	Yes	Count	643
		% within Is client eligible for EDCD	100.0%
		% within Source of Assessment	63.8%
		Adjusted Residual	
Total		Count	1008
		% within Is client eligible for EDCD	100.0%
		% within Source of Assessment	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	25.609[a]	1	.000		
Continuity Correction[b]	24.768	1	.000		
Likelihood Ratio	24.803	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	25.584	1	.000		
N of Valid Cases	1008				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 68.80.
b. Computed only for a 2x2 table

```
CROSSTABS
  /TABLES=DMAS_eligibility_type BY Access_DARS_recode Hospitalization_simple_recode Died_DMAS SEX_DMAS
  /FORMAT=AVALUE TABLES
  /STATISTICS=CHISQ
  /CELLS=COUNT ROW COLUMN ASRESID
  /COUNT ROUND CELL.
```

Crosstabs

Case Processing Summary

	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
DMAS-eligibility outcome * Did client access DARS services	1008	100.0%	0	0.0%	1008	100.0%
DMAS-eligibility outcome * Hospitalization, yes or no	1008	100.0%	0	0.0%	1008	100.0%
DMAS-eligibility outcome * Yes or No, whether client has died	1008	100.0%	0	0.0%	1008	100.0%
DMAS-eligibility outcome * Sex of client	1008	100.0%	0	0.0%	1008	100.0%

DMAS-eligibility outcome * Did client access DARS services

Crosstab

			Did client access DARS services no
DMAS-eligibility outcome	not eligible, no services	Count	67
		% within DMAS-eligibility outcome	44.1%
		% within Did client access DARS services	13.2%
		Adjusted Residual	-1.6
	not eligible, received other services	Count	85
		% within DMAS-eligibility outcome	39.9%
		% within Did client access DARS services	16.8%
		Adjusted Residual	-3.4
	eligible, received services	Count	354
		% within DMAS-eligibility outcome	55.1%
		% within Did client access DARS services	70.0%
		Adjusted Residual	4.1
Total		Count	506
		% within DMAS-eligibility outcome	50.2%
		% within Did client access DARS services	100.0%

Crosstab

			Did client access DARS services yes
DMAS-eligibility outcome	not eligible, no services	Count	85
		% within DMAS-eligibility outcome	55.9%
		% within Did client access DARS services	16.9%
		Adjusted Residual	1.6
		Count	128

	not eligible, received other services	% within DMAS-eligibility outcome	60.1%
		% within Did client access DARS services	25.5%
		Adjusted Residual	3.4
	eligible, received services	Count	289
		% within DMAS-eligibility outcome	44.9%
		% within Did client access DARS services	57.6%
		Adjusted Residual	-4.1
Total		Count	502
		% within DMAS-eligibility outcome	49.8%
		% within Did client access DARS services	100.0%

Crosstab

			Total
DMAS-eligibility outcome	not eligible, no services	Count	152
		% within DMAS-eligibility outcome	100.0%
		% within Did client access DARS services	15.1%
		Adjusted Residual	
	not eligible, received other services	Count	213
		% within DMAS-eligibility outcome	100.0%
		% within Did client access DARS services	21.1%
		Adjusted Residual	
	eligible, received services	Count	643
		% within DMAS-eligibility outcome	100.0%
		% within Did client access DARS services	63.8%
		Adjusted Residual	
Total		Count	1008
		% within DMAS-eligibility outcome	100.0%
		% within Did client access DARS services	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	17.367[a]	2	.000
Likelihood Ratio	17.443	2	.000
Linear-by-Linear Association	11.807	1	.001
N of Valid Cases	1008		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 75.70.

DMAS-eligibility outcome * Hospitalization, yes or no

Crosstab

			Hospitalization, yes or no No
DMAS-eligibility outcome	not eligible, no services	Count	139
		% within DMAS-eligibility outcome	91.4%
		% within Hospitalization, yes or no	14.4%
		Adjusted Residual	-2.7
	not eligible, received other services	Count	201
		% within DMAS-eligibility outcome	94.4%
		% within Hospitalization, yes or no	20.9%
		Adjusted Residual	-1.0
		Count	624

	eligible, received services	% within DMAS-eligibility outcome	97.0%
		% within Hospitalization, yes or no	64.7%
		Adjusted Residual	2.9
Total		Count	964
		% within DMAS-eligibility outcome	95.6%
		% within Hospitalization, yes or no	100.0%

Crosstab

			Hospitalization, yes or no Yes	Total
DMAS-eligibility outcome	not eligible, no services	Count	13	152
		% within DMAS-eligibility outcome	8.6%	100.0%
		% within Hospitalization, yes or no	29.5%	15.1%
		Adjusted Residual	2.7	
	not eligible, received other services	Count	12	213
		% within DMAS-eligibility outcome	5.6%	100.0%
		% within Hospitalization, yes or no	27.3%	21.1%
		Adjusted Residual	1.0	
	eligible, received services	Count	19	643
		% within DMAS-eligibility outcome	3.0%	100.0%
		% within Hospitalization, yes or no	43.2%	63.8%
		Adjusted Residual	-2.9	
Total		Count	44	1008
		% within DMAS-eligibility outcome	4.4%	100.0%
		% within Hospitalization, yes or no	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.269[a]	2	.006
Likelihood Ratio	9.237	2	.010
Linear-by-Linear Association	10.254	1	.001
N of Valid Cases	1008		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.63.

DMAS-eligibility outcome * Yes or No, whether client has died

Crosstab

			Yes or No, whether client has died no
DMAS-eligibility outcome	not eligible, no services	Count	89
		% within DMAS-eligibility outcome	58.6%
		% within Yes or No, whether client has died	12.1%
		Adjusted Residual	-4.4
	not eligible, received other services	Count	170
		% within DMAS-eligibility outcome	79.8%
		% within Yes or No, whether client has died	23.1%
		Adjusted Residual	2.5
	eligible, received services	Count	478
		% within DMAS-eligibility outcome	74.3%
		% within Yes or No, whether client has died	64.9%
		Adjusted Residual	1.2
Total		Count	737
		% within DMAS-eligibility outcome	73.1%
		% within Yes or No, whether client has died	100.0%

Crosstab

			Yes or No, whether client has died: yes
DMAS-eligibility outcome	not eligible, no services	Count	63
		% within DMAS-eligibility outcome	41.4%
		% within Yes or No, whether client has died	23.2%
		Adjusted Residual	4.4
	not eligible, received other services	Count	43
		% within DMAS-eligibility outcome	20.2%
		% within Yes or No, whether client has died	15.9%
		Adjusted Residual	-2.5
	eligible, received services	Count	165
		% within DMAS-eligibility outcome	25.7%
		% within Yes or No, whether client has died	60.9%
		Adjusted Residual	-1.2
Total		Count	271
		% within DMAS-eligibility outcome	26.9%
		% within Yes or No, whether client has died	100.0%

Crosstab

			Total
DMAS-eligibility outcome	not eligible, no services	Count	152
		% within DMAS-eligibility outcome	100.0%
		% within Yes or No, whether client has died	15.1%
		Adjusted Residual	
	not eligible, received other services	Count	213
		% within DMAS-eligibility outcome	100.0%
		% within Yes or No, whether client has died	21.1%
		Adjusted Residual	
	eligible, received services	Count	643
		% within DMAS-eligibility outcome	100.0%
		% within Yes or No, whether client has died	63.8%
		Adjusted Residual	
Total		Count	1008
		% within DMAS-eligibility outcome	100.0%
		% within Yes or No, whether client has died	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	21.748[a]	2	.000
Likelihood Ratio	20.660	2	.000
Linear-by-Linear Association	8.232	1	.004
N of Valid Cases	1008		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 40.87.

DMAS-eligibility outcome * Sex of client

Crosstab

			Sex of client: male	female
DMAS-eligibility outcome	not eligible, no services	Count	43	109

		% within DMAS-eligibility outcome	28.3%	71.7%
		% within Sex of client	17.1%	14.4%
		Adjusted Residual	1.0	-1.0
	not eligible, received other services	Count	55	158
		% within DMAS-eligibility outcome	25.8%	74.2%
		% within Sex of client	21.9%	20.9%
		Adjusted Residual	.3	-.3
	eligible, received services	Count	153	490
		% within DMAS-eligibility outcome	23.8%	76.2%
		% within Sex of client	61.0%	64.7%
		Adjusted Residual	-1.1	1.1
Total		Count	251	757
		% within DMAS-eligibility outcome	24.9%	75.1%
		% within Sex of client	100.0%	100.0%

Crosstab

			Total
DMAS-eligibility outcome	not eligible, no services	Count	152
		% within DMAS-eligibility outcome	100.0%
		% within Sex of client	15.1%
		Adjusted Residual	
	not eligible, received other services	Count	213
		% within DMAS-eligibility outcome	100.0%
		% within Sex of client	21.1%
		Adjusted Residual	
	eligible, received services	Count	643
		% within DMAS-eligibility outcome	100.0%
		% within Sex of client	63.8%
		Adjusted Residual	
Total		Count	1008
		% within DMAS-eligibility outcome	100.0%
		% within Sex of client	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.451[a]	2	.484
Likelihood Ratio	1.428	2	.490
Linear-by-Linear Association	1.445	1	.229
N of Valid Cases	1008		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 37.85.

```
CROSSTABS
  /TABLES=Access_DARS_recode BY SOURCE_DMAS
  /FORMAT=AVALUE TABLES
  /STATISTICS=CHISQ
  /CELLS=COUNT ROW COLUMN ASRESID
  /COUNT ROUND CELL.
```

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Did client access DARS services * Source of Assessment	1008	100.0%	0	0.0%	1008	100.0%

Did client access DARS services * Source of Assessment Crosstabulation

Source of Assessment

			Acute Care Hospital/PSAC	Community-based team/PSLH
Did client access DARS services	no	Count	104	402
		% within Did client access DARS services	20.6%	79.4%
		% within Source of Assessment	54.7%	49.1%
		Adjusted Residual	1.4	-1.4
	yes	Count	86	416
		% within Did client access DARS services	17.1%	82.9%
		% within Source of Assessment	45.3%	50.9%
		Adjusted Residual	-1.4	1.4
Total		Count	190	818
		% within Did client access DARS services	18.8%	81.2%
		% within Source of Assessment	100.0%	100.0%

Did client access DARS services * Source of Assessment Crosstabulation

			Total
Did client access DARS services	no	Count	506
		% within Did client access DARS services	100.0%
		% within Source of Assessment	50.2%
		Adjusted Residual	
	yes	Count	502
		% within Did client access DARS services	100.0%
		% within Source of Assessment	49.8%
		Adjusted Residual	
Total		Count	1008
		% within Did client access DARS services	100.0%
		% within Source of Assessment	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.929[a]	1	.165		
Continuity Correction[b]	1.712	1	.191		
Likelihood Ratio	1.932	1	.165		
Fisher's Exact Test				.172	.095
Linear-by-Linear Association	1.927	1	.165		
N of Valid Cases	1008				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 94.62.
b. Computed only for a 2x2 table

```
DATASET ACTIVATE DataSet1.
FREQUENCIES VARIABLES=EDCD_Eligibility_DMAS DMAS_eligibility_type Access_DARS_recode
  /ORDER=ANALYSIS.
```

Frequencies

Statistics

		Is client eligible for EDCD	DMAS-eligibility outcome	Did client access DARS services
N	Valid	1008	1008	1008
	Missing	0	0	0

Frequency Table

Is client eligible for EDCD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	365	36.2	36.2	36.2
	Yes	643	63.8	63.8	100.0

	Total	1008	100.0	100.0	

DMAS-eligibility outcome

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not eligible, no services	152	15.1	15.1	15.1
	not eligible, received other services	213	21.1	21.1	36.2
	eligible, received services	643	63.8	63.8	100.0
	Total	1008	100.0	100.0	

Did client access DARS services

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	506	50.2	50.2	50.2
	yes	502	49.8	49.8	100.0
	Total	1008	100.0	100.0	

```
FREQUENCIES VARIABLES= SEX_DMAS Race_final Rural_recode SOURCE_DMAS
  /STATISTICS=STDDEV MEAN MEDIAN
  /ORDER=ANALYSIS.
```

Frequencies

Statistics

		Sex of client	Race of client DMAS	Indication of county as rural and/or Appalachian	Source of Assessment
N	Valid	1008	1008	1008	1008
	Missing	0	0	0	0
Mean		.75	1.82	.29	.81
Median		1.00	2.00	.00	1.00
Std. Deviation		.433	.902	.456	.391

Frequency Table

Sex of client

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	251	24.9	24.9	24.9
	female	757	75.1	75.1	100.0
	Total	1008	100.0	100.0	

Race of client DMAS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	White	401	39.8	39.8	39.8
	Black/African American	470	46.6	46.6	86.4
	Asian	84	8.3	8.3	94.7
	Hispanic/Latino	22	2.2	2.2	96.9
	Other	31	3.1	3.1	100.0
	Total	1008	100.0	100.0	

Indication of county as rural and/or Appalachian

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	712	70.6	70.6	70.6
	Yes	296	29.4	29.4	100.0
	Total	1008	100.0	100.0	

Source of Assessment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Acute Care Hospital/PSAC	190	18.8	18.8	18.8
	Community-based team/PSLH	818	81.2	81.2	100.0
	Total	1008	100.0	100.0	

```
FREQUENCIES VARIABLES=Hospitalizations_count_DMAS Hospitalization_simple_recode Died_DMAS
  /STATISTICS=STDDEV MEAN MEDIAN
  /ORDER=ANALYSIS.
```

Frequencies

Statistics

		Count of hospitalizations	Hospitalization, yes or no	Yes or No, whether client has died
N	Valid	1008	1008	1008
	Missing	0	0	0
Mean		.09	.04	.27
Median		.00	.00	.00
Std. Deviation		.551	.204	.444

Frequency Table

Count of hospitalizations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	964	95.6	95.6	95.6
	1	25	2.5	2.5	98.1
	2	7	.7	.7	98.8
	3	5	.5	.5	99.3
	4	2	.2	.2	99.5
	5	2	.2	.2	99.7
	6	1	.1	.1	99.8
	7	2	.2	.2	100.0
	Total	1008	100.0	100.0	

Hospitalization, yes or no

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	964	95.6	95.6	95.6
	Yes	44	4.4	4.4	100.0
	Total	1008	100.0	100.0	

Yes or No, whether client has died

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	737	73.1	73.1	73.1
	yes	271	26.9	26.9	100.0
	Total	1008	100.0	100.0	

```
DESCRIPTIVES VARIABLES=Age_Recode
  /STATISTICS=MEAN STDDEV MIN MAX.
```

Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation

Age of client	1008	62	105	80.09	10.046
Valid N (listwise)	1008				

```
USE ALL.
COMPUTE filter_$=(Access_DARS_recode = 1).
VARIABLE LABELS filter_$ 'Access_DARS_recode = 1 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.

FREQUENCIES VARIABLES=SEX_DMAS Race_final Rural_recode SOURCE_DMAS
  /STATISTICS=STDDEV MEAN MEDIAN
  /ORDER=ANALYSIS
```

Frequencies

Statistics

		Sex of client	Race of client DMAS	Indication of county as rural and/or Appalachian	Source of Assessment
N	Valid	502	502	502	502
	Missing	0	0	0	0
Mean		.78	1.75	.38	.83
Median		1.00	2.00	.00	1.00
Std. Deviation		.413	.878	.487	.377

Frequency Table

Sex of client

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	109	21.7	21.7	21.7
	female	393	78.3	78.3	100.0
	Total	502	100.0	100.0	

Race of client DMAS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	White	217	43.2	43.2	43.2
	Black/African American	233	46.4	46.4	89.6
	Asian	26	5.2	5.2	94.8
	Hispanic/Latino	12	2.4	2.4	97.2
	Other	14	2.8	2.8	100.0
	Total	502	100.0	100.0	

Indication of county as rural and/or Appalachian

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	309	61.6	61.6	61.6
	Yes	193	38.4	38.4	100.0
	Total	502	100.0	100.0	

Source of Assessment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Acute Care Hospital/PSAC	86	17.1	17.1	17.1
	Community-based team/PSLH	416	82.9	82.9	100.0
	Total	502	100.0	100.0	

```
DESCRIPTIVES VARIABLES=Age_Recode
  /STATISTICS=MEAN STDDEV MIN MAX.
```

Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation

Age of client	502	62	105	79.59	9.698
Valid N (listwise)	502				

```
FREQUENCIES VARIABLES=CURRENT_ADULT_DAY_CARE CURRENT_CHORE_HOME CURRENT_HOME_MEALS
  CURRENT_PERS_CARE CURRENT_CASE_MANAGE CURRENT_MEAL_SENIORCENTER CURRENT_HOME_HEALTH
CURRENT_HOUSING
  CURRENT_TRANSPORT CURRENT_any_service CURRENT_sum_rating CURRENT_sum_rating_combined_at_4
 /STATISTICS=STDDEV MEAN MEDIAN
 /ORDER=ANALYSIS.
```

Frequencies

Statistics

		Current use of...ADS	Current use of...chore/homemaker	Current use of...home meals	Current use of...personal care	Current use of...care management
N	Valid	334	337	343	340	334
	Missing	168	165	159	162	168
Mean		.01	.16	.23	.26	.08
Median		.00	.00	.00	.00	.00
Std. Deviation		.122	.370	.422	.440	.273

Statistics

		Current use of...meals/senior center	Current use of...home health	Current use of...housing	Current use of...transportation	Indication of whether at least one service is currently being used
N	Valid	338	336	336	339	357
	Missing	164	166	166	163	145
Mean		.10	.21	.20	.24	.74
Median		.00	.00	.00	.00	1.00
Std. Deviation		.297	.409	.402	.427	.440

Statistics

		Count of services	Count of services (0, 1, 2, 3, 4+)
N	Valid	357	357
	Missing	145	145
Mean		1.42	1.41
Median		1.00	1.00
Std. Deviation		1.196	1.149

Frequency Table

Current use of...ADS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	329	65.5	98.5	98.5
	Yes	5	1.0	1.5	100.0
	Total	334	66.5	100.0	
Missing	System	168	33.5		
Total		502	100.0		

Current use of...chore/homemaker

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	282	56.2	83.7	83.7
	Yes	55	11.0	16.3	100.0
	Total	337	67.1	100.0	
Missing	System	165	32.9		
Total		502	100.0		

Current use of...home meals

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	264	52.6	77.0	77.0
	Yes	79	15.7	23.0	100.0

	Total	343	68.3	100.0	
Missing	System	159	31.7		
Total		502	100.0		

Current use of...personal care

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	251	50.0	73.8	73.8
	Yes	89	17.7	26.2	100.0
	Total	340	67.7	100.0	
Missing	System	162	32.3		
Total		502	100.0		

Current use of...care management

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	307	61.2	91.9	91.9
	Yes	27	5.4	8.1	100.0
	Total	334	66.5	100.0	
Missing	System	168	33.5		
Total		502	100.0		

Current use of...meals/senior center

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	305	60.8	90.2	90.2
	Yes	33	6.6	9.8	100.0
	Total	338	67.3	100.0	
Missing	System	164	32.7		
Total		502	100.0		

Current use of...home health

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	265	52.8	78.9	78.9
	Yes	71	14.1	21.1	100.0
	Total	336	66.9	100.0	
Missing	System	166	33.1		
Total		502	100.0		

Current use of...housing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	268	53.4	79.8	79.8
	Yes	68	13.5	20.2	100.0
	Total	336	66.9	100.0	
Missing	System	166	33.1		
Total		502	100.0		

Current use of...transportation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	258	51.4	76.1	76.1
	Yes	81	16.1	23.9	100.0
	Total	339	67.5	100.0	
Missing	System	163	32.5		
Total		502	100.0		

Indication of whether at least one service is currently being used

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	93	18.5	26.1	26.1
	Yes	264	52.6	73.9	100.0
	Total	357	71.1	100.0	
Missing	System	145	28.9		
Total		502	100.0		

Count of services

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	93	18.5	26.1	26.1
	1	108	21.5	30.3	56.3
	2	91	18.1	25.5	81.8
	3	48	9.6	13.4	95.2
	4	12	2.4	3.4	98.6
	5	4	.8	1.1	99.7
	6	1	.2	.3	100.0
	Total	357	71.1	100.0	
Missing	System	145	28.9		
Total		502	100.0		

Count of services (0, 1, 2, 3, 4+)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	93	18.5	26.1	26.1
	1	108	21.5	30.3	56.3
	2	91	18.1	25.5	81.8
	3	48	9.6	13.4	95.2
	4	17	3.4	4.8	100.0
	Total	357	71.1	100.0	
Missing	System	145	28.9		
Total		502	100.0		

```
FREQUENCIES VARIABLES=Hospitalizations_count_DMAS Hospitalization_simple_recode Died_DMAS
  /STATISTICS=STDDEV MEAN MEDIAN
  /ORDER=ANALYSIS.
```

Frequencies

Statistics

		Count of hospitalizations	Hospitalization, yes or no	Yes or No, whether client has died
N	Valid	502	502	502
	Missing	0	0	0
Mean		.09	.04	.24
Median		.00	.00	.00
Std. Deviation		.567	.196	.429

Frequency Table

Count of hospitalizations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	482	96.0	96.0	96.0
	1	9	1.8	1.8	97.8
	2	6	1.2	1.2	99.0
	3	2	.4	.4	99.4
	4	1	.2	.2	99.6
	7	2	.4	.4	100.0

	Total	502	100.0	100.0	

Hospitalization, yes or no

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	482	96.0	96.0	96.0
	Yes	20	4.0	4.0	100.0
	Total	502	100.0	100.0	

Yes or No, whether client has died

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	380	75.7	75.7	75.7
	yes	122	24.3	24.3	100.0
	Total	502	100.0	100.0	

```
FREQUENCIES VARIABLES=Edu_level_final Caregiver_relationship_final Available_caregiver
  Living_arrange Marital_status_binary ADL_Bath_simple ADL_Dress_simple ADL_Toilet_simple
  ADL_Transfer_simple ADL_Eat_simple ADL_continence ADL_ambulation IADL_routine_house_tasks
  IADL_Money_Mgmt_simple IADL_Transport_simple IADL_HomeMaintenance_simple Total_ADL Total_IADL
 /STATISTICS=STDDEV MEAN MEDIAN
 /ORDER=ANALYSIS.
```

Frequencies

Statistics

		Level of education obtained (DARS)	Relationship of Caregiver (DARS)	Availability of caregiver indicated (DARS)	Living arrangement (DARS)	Current marital status of older adult (DARS)
N	Valid	299	120	120	338	315
	Missing	203	382	382	164	187
Mean		1.05	2.58	1.00	1.40	.19
Median		1.00	2.00	1.00	1.00	.00
Std. Deviation		1.081	1.051	.000	1.329	.396

Statistics

		Client receiving help with...Bathing	Client receiving help with...Dressing	Client receiving help with...Toileting	Client receiving help with...Transferring	Client receiving help with...Eating
N	Valid	502	502	502	502	502
	Missing	0	0	0	0	0
Mean		.49	.32	.37	.41	.15
Median		.00	.00	.00	.00	.00
Std. Deviation		.500	.467	.483	.492	.359

Statistics

		Client receiving help with Bowel & Bladder	Client receiving help with...Walking, Wheeling, Stairclimbing, Mobility	Client receiving help with...meal prep, laundry, shopping, phone use	Client receiving help with...Money Management	Client receiving help with...Transportation
N	Valid	502	502	502	502	502
	Missing	0	0	0	0	0
Mean		.29	.57	.62	.34	.57
Median		.00	1.00	1.00	.00	1.00
Std. Deviation		.456	.495	.485	.476	.496

Statistics

		Client receiving help with...Home Maintenance	Sum score of ADLs (0-7)	Sum score of IADLS (0-4)
N	Valid	502	502	502
	Missing	0	0	0
Mean		.54	2.6076	2.0737
Median		1.00	2.0000	2.0000
Std. Deviation		.499	2.56792	1.68963

Frequency Table

Level of education obtained (DARS)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than high schoool	128	25.5	42.8	42.8
	some high school	67	13.3	22.4	65.2
	high school graduate	65	12.9	21.7	87.0
	at least some college	39	7.8	13.0	100.0
	Total	299	59.6	100.0	
Missing	System	203	40.4		
Total		502	100.0		

Relationship of Caregiver (DARS)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Spouse	16	3.2	13.3	13.3
	Adult child/in-laws	54	10.8	45.0	58.3
	Extended family & friends	15	3.0	12.5	70.8
	Professional caregiver, other	35	7.0	29.2	100.0
	Total	120	23.9	100.0	
Missing	System	382	76.1		
Total		502	100.0		

Availability of caregiver indicated (DARS)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	120	23.9	100.0	100.0
Missing	System	382	76.1		
Total		502	100.0		

Living arrangement (DARS)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	alone	137	27.3	40.5	40.5
	with spouse	48	9.6	14.2	54.7
	with spouse and others	33	6.6	9.8	64.5
	with others only	120	23.9	35.5	100.0
	Total	338	67.3	100.0	
Missing	System	164	32.7		
Total		502	100.0		

Current marital status of older adult (DARS)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	254	50.6	80.6	80.6
	yes	61	12.2	19.4	100.0
	Total	315	62.7	100.0	
Missing	System	187	37.3		
Total		502	100.0		

Client receiving help with...Bathing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	256	51.0	51.0	51.0
	Yes	246	49.0	49.0	100.0
	Total	502	100.0	100.0	

Client receiving help with...Dressing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	341	67.9	67.9	67.9
	Yes	161	32.1	32.1	100.0
	Total	502	100.0	100.0	

Client receiving help with...Toileting

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	317	63.1	63.1	63.1
	Yes	185	36.9	36.9	100.0
	Total	502	100.0	100.0	

Client receiving help with...Transferring

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	296	59.0	59.0	59.0
	Yes	206	41.0	41.0	100.0
	Total	502	100.0	100.0	

Client receiving help with...Eating

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	426	84.9	84.9	84.9
	Yes	76	15.1	15.1	100.0
	Total	502	100.0	100.0	

Client receiving help with Bowel & Bladder

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	354	70.5	70.5	70.5
	Yes	148	29.5	29.5	100.0
	Total	502	100.0	100.0	

Client receiving help with...Walking, Wheeling, Stairclimbing, Mobility

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	215	42.8	42.8	42.8
	Yes	287	57.2	57.2	100.0
	Total	502	100.0	100.0	

Client receiving help with...meal prep, laundry, shopping, phone use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	189	37.6	37.6	37.6
	Yes	313	62.4	62.4	100.0
	Total	502	100.0	100.0	

Client receiving help with...Money Management

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	329	65.5	65.5	65.5
	Yes	173	34.5	34.5	100.0
	Total	502	100.0	100.0	

Client receiving help with...Transportation

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	No	218	43.4	43.4	43.4
	Yes	284	56.6	56.6	100.0
	Total	502	100.0	100.0	

Client receiving help with...Home Maintenance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	231	46.0	46.0	46.0
	Yes	271	54.0	54.0	100.0
	Total	502	100.0	100.0	

Sum score of ADLs (0-7)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	196	39.0	39.0	39.0
	1.00	38	7.6	7.6	46.6
	2.00	29	5.8	5.8	52.4
	3.00	34	6.8	6.8	59.2
	4.00	54	10.8	10.8	69.9
	5.00	50	10.0	10.0	79.9
	6.00	62	12.4	12.4	92.2
	7.00	39	7.8	7.8	100.0
	Total	502	100.0	100.0	

Sum score of IADLS (0-4)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	173	34.5	34.5	34.5
	1.00	23	4.6	4.6	39.0
	2.00	56	11.2	11.2	50.2
	3.00	94	18.7	18.7	68.9
	4.00	156	31.1	31.1	100.0
	Total	502	100.0	100.0	

```
DESCRIPTIVES VARIABLES=Total_ADL Total_IADL
  /STATISTICS=MEAN STDDEV MIN MAX.
```

Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Sum score of ADLs (0-7)	502	.00	7.00	2.6076	2.56792
Sum score of IADLS (0-4)	502	.00	4.00	2.0737	1.68963
Valid N (listwise)	502				

STATA Syntax and Output

```
use "G:\Diss_exploratory_111016"
browse

drop if missing(race)
histogram hospitalization_count
tabulate hospitalization_count

***CORRELATIONS
*n=1008
spearman hospitalization_count died sex rural source_DMAS elgibility_EDCD alt_servicesDMAS
accessDARS, stats(rho p)

*n=~325
spearman hospitalization_count died sex rural source_DMAS elgibility_EDCD personal_care
chore_home home_meals homehealth transport housing adl_bath adl_dress adl_toilet adl_transfer adl_eat
adl_continence adl_ambulation iadl_routine_housetasks iadl_money_mgmt iadl_transport
iadl_homemaintenance, stats(rho p)

****Syntax-121416
*RQ2
logit elgibility_EDCD age i.race sex rural source_DMAS, or
*RQ3
logit accessDARS age i.race sex rural source_DMAS i.recommend_DMAS, or

*RQ4
***H4: when combined (Obs=211)
logit personal_care age sex i.race i.edu_level i.living_arrange rural elgibility_EDCD adl_bath adl_dress
adl_toilet adl_transfer adl_eat adl_continence adl_ambulation iadl_routine_housetasks iadl_money_mgmt
iadl_transport iadl_homemaintenance, or
***H5: when combined (Obs=205)
logit chore_home age sex i.race i.edu_level i.living_arrange rural elgibility_EDCD adl_bath adl_dress
adl_toilet adl_transfer adl_eat adl_continence adl_ambulation iadl_routine_housetasks iadl_money_mgmt
iadl_transport iadl_homemaintenance, or
***decision to ELIMINATE adult_day_services due to low usage (n=5)
***H6:
logit home_meals age sex i.race i.edu_level i.living_arrange rural elgibility_EDCD adl_bath adl_dress
adl_toilet adl_transfer adl_eat adl_continence adl_ambulation iadl_routine_housetasks iadl_money_mgmt
iadl_transport iadl_homemaintenance, or
tabulate home_meals iadl_routine_housetasks
logit home_meals age sex i.race i.edu_level i.living_arrange rural elgibility_EDCD adl_bath adl_dress
adl_toilet adl_transfer adl_eat adl_continence adl_ambulation iadl_money_mgmt iadl_transport
iadl_homemaintenance, or

*Post-hoc analyses for RQ4
***transport obs=270)
logit transport age sex i.race i.edu_level i.living_arrange rural elgibility_EDCD adl_bath adl_dress
adl_toilet adl_transfer adl_eat adl_continence adl_ambulation iadl_routine_housetasks iadl_money_mgmt
iadl_transport iadl_homemaintenance, or
***housing obs=270)
```

```
logit housing age sex i.race i.edu_level i.living_arrange rural elgibility_EDCD adl_bath adl_dress
adl_toilet adl_transfer adl_eat adl_continence adl_ambulation iadl_routine_housetasks iadl_money_mgmt
iadl_transport iadl_homemaintenance, or
***homehealth (obs=265)
logit homehealth age sex i.edu_level i.race rural i.living_arrange elgibility_EDCD adl_bath adl_dress
adl_toilet adl_transfer adl_eat adl_continence adl_ambulation iadl_routine_housetasks iadl_money_mgmt
iadl_transport iadl_homemaintenance, or

**RQ4: only need based factors
logit personal_care adl_bath adl_dress adl_toilet adl_transfer adl_eat adl_continence adl_ambulation
iadl_routine_housetasks iadl_money_mgmt iadl_transport iadl_homemaintenance, or
logit chore_home adl_bath adl_dress adl_toilet adl_transfer adl_eat adl_continence adl_ambulation
iadl_routine_housetasks iadl_money_mgmt iadl_transport iadl_homemaintenance, or
logit home_meals adl_bath adl_dress adl_toilet adl_transfer adl_eat adl_continence adl_ambulation
iadl_routine_housetasks iadl_money_mgmt iadl_transport iadl_homemaintenance, or
logit transport adl_bath adl_dress adl_toilet adl_transfer adl_eat adl_continence adl_ambulation
iadl_routine_housetasks iadl_money_mgmt iadl_transport iadl_homemaintenance, or
logit housing adl_bath adl_dress adl_toilet adl_transfer adl_eat adl_continence adl_ambulation
iadl_routine_housetasks iadl_money_mgmt iadl_transport iadl_homemaintenance, or
logit homehealth adl_bath adl_dress adl_toilet adl_transfer adl_eat adl_continence adl_ambulation
iadl_routine_housetasks iadl_money_mgmt iadl_transport iadl_homemaintenance, or

*RQ#5 (Zero-inflated Poisson Reg)
***H7
zip hospitalization_count age i.race sex rural source_DMAS, inflate(elgibility_EDCD accessDARS)
vuong
zip hospitalization_count age i.race sex rural source_DMAS, inflate(i.eligibility_typeDMAS
accessDARS) vuong

***H8
logit hospitalization_simple c.age##i.race, or
logit hospitalization_simple c.age##source_DMAS, or
logit hospitalization_simple c.age##i.eligibility_typeDMAS, or
logit hospitalization_simple rural##eligibility_typeDMAS, or
logit hospitalization_simple source_DMAS##i.eligibility_typeDMAS, or
logit hospitalization_simple source_DMAS##accessDARS, or
logit hospitalization_simple i.eligibility_typeDMAS##accessDARS, or

***H9
logit died age i.race sex rural source_DMAS i.eligibility_typeDMAS accessDARS, or

***H10
logit died c.age##i.race, or
logit died c.age##source_DMAS, or
logit died c.age##i.eligibility_typeDMAS, or
logit died rural##eligibility_typeDMAS, or
logit died source_DMAS##i.eligibility_typeDMAS, or
logit died source_DMAS##accessDARS, or
logit died i.eligibility_typeDMAS##accessDARS, or

*RQ#6
```

```
***H11
zip hospitalization_count personal_care chore_home home_meals transport housing homehealth,
inflate(i.eligibility_typeDMAS) vuong

***H12
logit died personal_care chore_home home_meals transport housing homehealth, or

***H13
logit hospitalization_simple personal_care##c.age, or
logit hospitalization_simple personal_care##sex, or
logit hospitalization_simple personal_care##rural, or
logit hospitalization_simple personal_care##source_DMAS, or

logit hospitalization_simple chore_home##c.age, or
logit hospitalization_simple chore_home##sex, or
logit hospitalization_simple chore_home##rural, or
logit hospitalization_simple chore_home##source_DMAS, or

logit hospitalization_simple home_meals##c.age, or
logit hospitalization_simple home_meals##sex,or
logit hospitalization_simple home_meals##rural,or
logit hospitalization_simple home_meals##source_DMAS, or

logit hospitalization_simple homehealth##c.age, or
logit hospitalization_simple homehealth##sex, or
logit hospitalization_simple homehealth##rural, or
logit hospitalization_simple homehealth##source_DMAS, or

logit hospitalization_simple transport##c.age, or
logit hospitalization_simple transport##sex, or
logit hospitalization_simple transport##rural, or
logit hospitalization_simple transport##source_DMAS, or

logit hospitalization_simple housing##c.age, or
logit hospitalization_simple housing##sex, or
logit hospitalization_simple housing##rural, or
logit hospitalization_simple housing##source_DMAS, or

***H14
logit died personal_care##c.age, or
logit died personal_care##sex, or
logit died personal_care##rural, or
logit died personal_care##source_DMAS, or

logit died chore_home##c.age, or
logit died chore_home##sex, or
logit died chore_home##rural, or
logit died chore_home##source_DMAS, or

logit died home_meals##c.age, or
logit died home_meals##sex,or
```

```
logit died home_meals##rural,or
logit died home_meals##source_DMAS, or

logit died homehealth##c.age, or
logit died homehealth##sex, or
logit died homehealth##rural, or
logit died homehealth##source_DMAS, or

logit died transport##c.age, or
logit died transport##sex, or
logit died transport##rural, or
logit died transport##source_DMAS, or

logit died housing##c.age, or
logit died housing##sex, or
logit died housing##rural, or
logit died housing##source_DMAS, or
```

Correlations

```
. do "C:\Users\wangzhe\AppData\Local\Temp\STD00000000.tmp"

. ***CORRELATIONS
. *n=1008
. spearman hospitalization_count died sex rural source_DMAS elgibility_EDCD alt_servicesDMAS accessDARS, stats(rho p)
(obs=1008)
```

Key
rho
Sig. level

	hospit~t	died	sex	rural	source~S	elgibi~D	alt_se~S	access~S
hospitaliz~t	1.0000							
died	0.1336 0.0000	1.0000						
sex	-0.0008 0.9803	-0.0596 0.0585	1.0000					
rural	0.0116 0.7130	0.0266 0.3983	-0.0519 0.0999	1.0000				
source_DMAS	-0.0096 0.7616	-0.0281 0.3721	0.0099 0.7535	-0.0346 0.2729	1.0000			
elgibility~D	-0.0925 0.0033	-0.0366 0.2451	0.0339 0.2816	-0.1442 0.0000	0.1594 0.0000	1.0000		
alt_servic~S	-0.0878 0.0053	-0.1384 0.0000	0.0330 0.2949	-0.0996 0.0015	0.0946 0.0026	0.5593 0.0000	1.0000	
accessDARS	-0.0179 0.5710	-0.0580 0.0656	0.0734 0.0197	0.1986 0.0000	0.0437 0.1652	-0.1289 0.0000	-0.0516 0.1017	1.0000

```
. *n=~325
. spearman hospitalization_count died sex rural source_DMAS elgibility_EDCD personal_care chore_home home_meals homehealth tra
> nsport housing adl_bath adl_dress adl_toilet adl_transfer adl_eat adl_continence adl_ambulation iadl_routine_housetasks iadl
> _money_mgmt iadl_transport iadl_homemaintenance, stats(rho p)
(obs=325)
```

Key
rho
Sig. level

	hospit~t	died	sex	rural	source~S	elgibi~D	person~e	chore_~e	home_m~s	homehe~h	transp~t	housing
hospitaliz~t	1.0000											
died	0.1634	1.0000										
	0.0031											
sex	-0.0268	0.0542	1.0000									
	0.6308	0.3298										
rural	0.0342	0.0064	-0.0850	1.0000								
	0.5387	0.9091	0.1261									
source_DMAS	-0.0039	-0.0015	-0.0435	0.0547	1.0000							
	0.9447	0.9789	0.4349	0.3259								
elgibility~D	-0.0692	-0.0133	0.0285	-0.0604	0.0882	1.0000						
	0.2133	0.8115	0.6091	0.2779	0.1123							
personal_c~e	-0.0330	0.0767	0.0461	0.1337	-0.0711	0.1069	1.0000					
	0.5533	0.1677	0.4073	0.0159	0.2014	0.0541						
chore_home	0.0070	0.0062	0.0610	0.0040	-0.0036	-0.0614	0.0963	1.0000				
	0.9006	0.9114	0.2726	0.9428	0.9484	0.2700	0.0829					
home_meals	0.0235	-0.0440	0.0769	0.1488	-0.1187	0.0157	0.2667	0.0391	1.0000			
	0.6735	0.4294	0.1668	0.0072	0.0325	0.7780	0.0000	0.4820				
homehealth	0.1053	0.1367	-0.0193	0.1022	0.0285	-0.0310	0.0706	-0.0881	-0.0457	1.0000		
	0.0579	0.0136	0.7290	0.0657	0.6083	0.5780	0.2046	0.1131	0.4117			
transport	0.0527	0.0684	0.0626	-0.1694	0.0295	-0.0469	-0.0472	0.1588	-0.0334	0.0032	1.0000	
	0.3438	0.2185	0.2606	0.0022	0.5962	0.3996	0.3966	0.0041	0.5480	0.9540		
housing	0.0658	-0.0218	-0.0232	-0.2966	0.0465	0.0094	-0.0861	0.2132	-0.1568	-0.1568	0.3023	1.0000
	0.2371	0.6953	0.6767	0.0000	0.4032	0.8661	0.1214	0.0001	0.0046	0.0046	0.0000	
adl_bath	0.0632	0.0638	-0.0047	0.0642	0.1061	0.0652	0.1393	0.0522	0.0151	0.2288	0.0338	-0.0727
	0.2558	0.2511	0.9326	0.2484	0.0560	0.2410	0.0119	0.3485	0.7866	0.0000	0.5433	0.1908
adl_dress	0.1240	0.1031	-0.0349	0.1818	0.0875	0.0972	0.2710	0.0397	-0.0098	0.2680	-0.0100	-0.1428
	0.0254	0.0634	0.5310	0.0010	0.1154	0.0800	0.0000	0.4756	0.8606	0.0000	0.8578	0.0100
adl_toilet	0.0623	0.0933	-0.0079	0.0682	0.1166	0.0942	0.2137	-0.0066	-0.0078	0.2064	0.0876	-0.0769
	0.2631	0.0932	0.8878	0.2201	0.0356	0.0901	0.0001	0.9062	0.8891	0.0002	0.1151	0.1665
adl_transfer	0.0407	0.0436	-0.0744	0.0954	0.0491	-0.0467	0.1053	0.0463	-0.0519	0.1950	0.0397	-0.0435
	0.4645	0.4335	0.1809	0.0861	0.3781	0.4010	0.0580	0.4052	0.3505	0.0004	0.4754	0.4349
adl_eat	0.0623	0.0599	-0.0537	0.2187	0.0107	0.0993	0.1722	0.0146	-0.1060	0.2154	-0.0556	-0.0647
	0.2628	0.2818	0.3348	0.0001	0.8470	0.0739	0.0018	0.7932	0.0563	0.0001	0.3179	0.2451
adl_contin~e	0.0603	0.0696	0.1436	0.1222	0.0968	-0.0067	0.1517	0.0478	-0.0159	0.1389	0.0000	-0.1027
	0.2782	0.2111	0.0095	0.0276	0.0815	0.9048	0.0061	0.3906	0.7758	0.0122	0.9993	0.0644
adl_ambula~n	0.0032	0.0828	0.0565	0.0768	0.0235	-0.0218	0.1293	0.0397	0.0116	0.1926	-0.0038	-0.0526
	0.9546	0.1366	0.3102	0.1673	0.6733	0.6951	0.0197	0.4760	0.8354	0.0005	0.9453	0.3446
iadl_routi~s	0.0744	0.0567	-0.0017	0.1886	0.0144	-0.0901	0.1505	0.0593	0.1688	0.1688	-0.1286	-0.0880
	0.1810	0.3086	0.9753	0.0006	0.7956	0.1051	0.0066	0.2867	0.0023	0.0023	0.0204	0.1132
iadl_money~t	0.1049	0.0221	-0.0508	0.1150	0.1944	0.0606	0.1017	0.0171	-0.0257	0.0661	-0.0596	-0.1109
	0.0589	0.6912	0.3613	0.0383	0.0004	0.2758	0.0672	0.7592	0.6441	0.2344	0.2839	0.0458
iadl_trans~t	0.0998	0.1018	0.0728	0.1209	0.0102	-0.0219	0.0760	0.0697	0.1249	0.0682	0.0191	0.0076
	0.0725	0.0667	0.1905	0.0294	0.8551	0.6935	0.1717	0.2099	0.0243	0.2203	0.7313	0.8914
iadl_homem~e	0.1109	0.0589	0.0621	0.1574	-0.0078	-0.0194	0.0870	0.0627	0.0721	0.1791	0.0128	-0.0933
	0.0457	0.2900	0.2642	0.0044	0.8882	0.7276	0.1175	0.2597	0.1949	0.0012	0.8182	0.0933

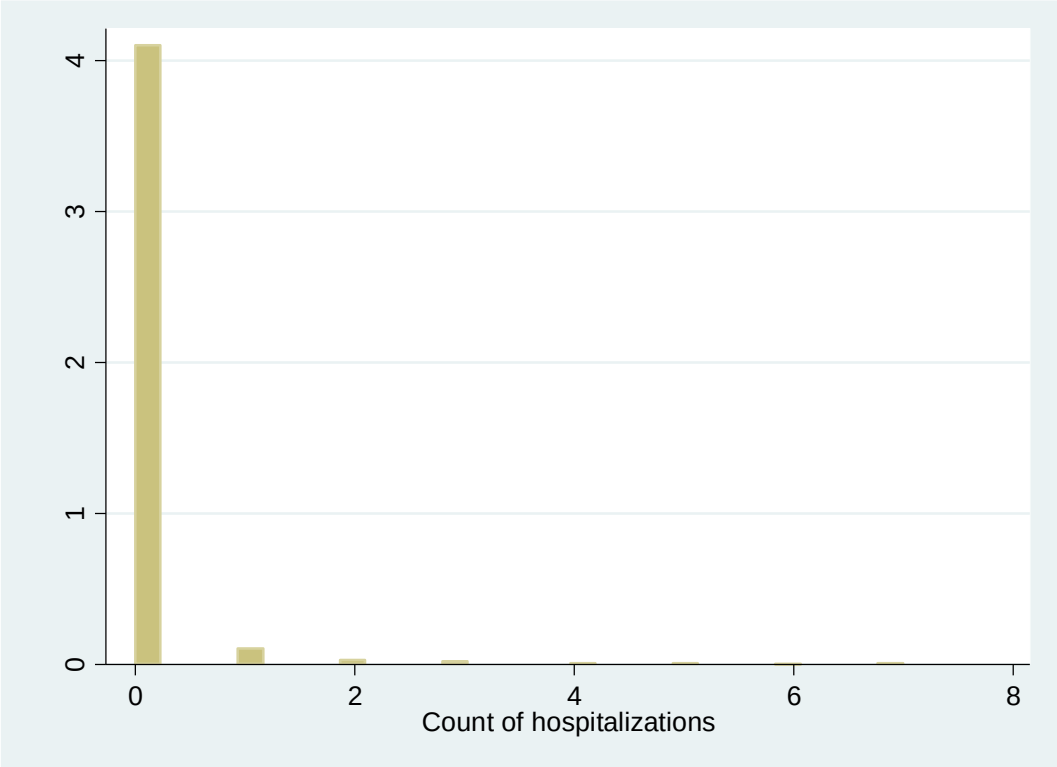
	adl_bath	adl_dr~s	adl_to~t	adl_tr~r	adl_eat	adl_co~e	adl_am~n	iadl_r~s	iadl_m~t	iadl_t~t	iadl_h~e
adl_bath	1.0000										
adl_dress	0.5696 0.0000	1.0000									
adl_toilet	0.6520 0.0000	0.5764 0.0000	1.0000								
adl_transfer	0.5513 0.0000	0.4907 0.0000	0.5785 0.0000	1.0000							
adl_eat	0.2654 0.0000	0.4287 0.0000	0.3345 0.0000	0.2926 0.0000	1.0000						
adl_contin~e	0.3845 0.0000	0.4036 0.0000	0.4101 0.0000	0.3124 0.0000	0.2701 0.0000	1.0000					
adl_ambula~n	0.5379 0.0000	0.3384 0.0000	0.4360 0.0000	0.4779 0.0000	0.1950 0.0004	0.3307 0.0000	1.0000				
iadl_routi~s	0.3985 0.0000	0.2952 0.0000	0.3117 0.0000	0.3218 0.0000	0.1936 0.0004	0.2327 0.0000	0.5071 0.0000	1.0000			
iadl_money~t	0.3103 0.0000	0.3395 0.0000	0.3178 0.0000	0.2321 0.0000	0.2868 0.0000	0.2462 0.0000	0.2488 0.0000	0.3280 0.0000	1.0000		
iadl_trans~t	0.3558 0.0000	0.2312 0.0000	0.2589 0.0000	0.2752 0.0000	0.1093 0.0490	0.2070 0.0002	0.3450 0.0000	0.5394 0.0000	0.3830 0.0000	1.0000	
iadl_homem~e	0.3540 0.0000	0.3513 0.0000	0.2885 0.0000	0.2855 0.0000	0.1824 0.0010	0.2256 0.0000	0.3988 0.0000	0.4328 0.0000	0.3865 0.0000	0.4737 0.0000	1.0000

Histogram: Hospitalization

```
. do "C:\Users\wangzhe\AppData\Local\Temp\STD01000000.tmp"

. drop if missing(race)
(0 observations deleted)

. histogram hospitalization_count
(bin=30, start=0, width=.23333333)

. tabulate hospitalization_count
```

Count of hospitalizations	Freq.	Percent	Cum.
0	964	95.63	95.63
1	25	2.48	98.12
2	7	0.69	98.81
3	5	0.50	99.31
4	2	0.20	99.50
5	2	0.20	99.70
6	1	0.10	99.80
7	2	0.20	100.00
Total	1,008	100.00	

```
.
end of do-file

.
```



RQ2:

```
. do "C:\Users\wangzhe\AppData\Local\Temp\STD01000000.tmp"

. logit elgibility_EDCD age i.race sex rural source_DMAS, or

Iteration 0:   log likelihood = -659.85564
Iteration 1:   log likelihood = -617.89404
Iteration 2:   log likelihood = -616.84862
Iteration 3:   log likelihood = -616.82604
Iteration 4:   log likelihood = -616.82604

Logistic regression                             Number of obs     =      1,008
                                                LR chi2(8)        =      86.06
                                                Prob > chi2       =     0.0000
Log likelihood = -616.82604                     Pseudo R2         =     0.0652
```

elgibility_EDCD	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	1.031075	.0073621	4.29	0.000	1.016746	1.045606
race						
Black/African American	1.535453	.2255203	2.92	0.004	1.151372	2.047656
Asian	1.218861	.3438892	0.70	0.483	.7011267	2.118908
Hispanic/Latino	1.921446	1.033863	1.21	0.225	.6693087	5.516072
Other	7.635528	5.6765	2.73	0.006	1.778394	32.7831
sex	1.04475	.1651145	0.28	0.782	.7664547	1.424092
rural	.6059176	.0921155	-3.30	0.001	.4497886	.8162415
source_DMAS	2.128301	.3603791	4.46	0.000	1.527219	2.965955
_cons	.073205	.0429104	-4.46	0.000	.0232056	.2309338

```
.
end of do-file

.
```

RQ3:

```
  ___  ____  ____  ____  ____ (R)
 /__    /   ____/   /   ____/
___/   /   /___/   /   /___/   14.2   Copyright 1985-2015 StataCorp LP
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Notes:
      1.  Unicode is supported; see help unicode_advice.
      2.  Maximum number of variables is set to 5000; see help set_maxvar.

. doedit "G:\Dissertation_Syntax_111016.do"

. do "C:\Users\wangzhe\AppData\Local\Temp\STD01000000.tmp"

. use "G:\Diss_exploratory_111016"
( )

.
end of do-file

. do "C:\Users\wangzhe\AppData\Local\Temp\STD01000000.tmp"

. logit accessDARS age i.race sex rural source_DMAS i.recommend_DMAS, or

Iteration 0:   log likelihood = -698.68442
Iteration 1:   log likelihood =  -663.3215
Iteration 2:   log likelihood = -663.20884
Iteration 3:   log likelihood = -663.20883

Logistic regression                             Number of obs     =      1,008
                                                LR chi2(10)       =      70.95
                                                Prob > chi2       =     0.0000
Log likelihood = -663.20883                     Pseudo R2         =     0.0508

------------------------------------------------------------------------------
  accessDARS | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .9952342   .0068316    -0.70   0.486     .9819342    1.008714
             |
        race |
Black/Afric~n |   .9954736   .1426924    -0.03   0.975     .7516532    1.318384
       Asian |   .5540609   .1509267    -2.17   0.030     .3248548    .9449866
Hispanic/La~o |   1.473551   .6615947     0.86   0.388     .6112132    3.552528
       Other |   1.022929   .3962941     0.06   0.953     .4787187      2.1858
             |
         sex |   1.529468   .2354118     2.76   0.006     1.131164    2.068022
       rural |   2.261778   .3438016     5.37   0.000     1.679047     3.04675
  source_DMAS |   1.509954   .2579033     2.41   0.016      1.08038    2.110331
             |
recommend_DMAS |
other servi~s |   .8593904   .1913137    -0.68   0.496     .5555202    1.329478
waiver servi~s |   .5733216   .1091448    -2.92   0.003     .3947779    .8326142
             |
       _cons |   .9167218   .5157238    -0.15   0.877     .3043503    2.761222
------------------------------------------------------------------------------

.
end of do-file

.
```

RQ4:

```
. do "C:\Users\wangzhe\AppData\Local\Temp\STD00000000.tmp"

. *RQ4
. ***H4: when combined (Obs=211)
. logit personal_care age sex i.race i.edu_level i.living_arrange rural elgibility_EDCD adl_bath adl_dress adl_toilet adl_tran
> sfer adl_eat adl_continence adl_ambulation iadl_routine_housetasks iadl_money_mgmt iadl_transport iadl_homemaintenance, or

note: 4.race != 0 predicts failure perfectly
      4.race dropped and 3 obs not used

Iteration 0:   log likelihood = -120.00634
Iteration 1:   log likelihood = -101.59325
Iteration 2:   log likelihood = -100.05198
Iteration 3:   log likelihood = -100.04151
Iteration 4:   log likelihood =  -100.0415

Logistic regression                             Number of obs     =        211
                                                LR chi2(24)       =      39.93
                                                Prob > chi2       =     0.0218
Log likelihood =  -100.0415                     Pseudo R2         =     0.1664
```

personal_care	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	.9620334	.0198623	-1.87	0.061	.9238811	1.001761
sex	1.312646	.6669226	0.54	0.592	.4849235	3.553218
race						
Black/African American	.62477	.2619801	-1.12	0.262	.274658	1.421177
Asian	.8662994	.7847314	-0.16	0.874	.1467617	5.113557
Hispanic/Latino	1	(empty)				
Other	.1949581	.2696296	-1.18	0.237	.0129634	2.932001
edu_level						
some high school	1.615666	.800069	0.97	0.333	.6121264	4.264439
high school graduate	1.482307	.7467033	0.78	0.435	.5522684	3.978559
at least some college	2.58059	1.46194	1.67	0.094	.8501616	7.833152
living_arrange						
with spouse	.4754579	.262256	-1.35	0.178	.1612876	1.401597
with spouse and others	1.158376	.7183283	0.24	0.813	.3435622	3.905655
with others only	.3412445	.1565365	-2.34	0.019	.1388675	.8385535
rural	.7997536	.331281	-0.54	0.590	.3551109	1.801144
elgibility_EDCD	1.783524	.7130471	1.45	0.148	.8146504	3.90469
adl_bath	.2856935	.1981858	-1.81	0.071	.0733536	1.112704
adl_dress	6.018581	3.675073	2.94	0.003	1.81858	19.91846
adl_toilet	3.348816	2.143443	1.89	0.059	.9551493	11.74117
adl_transfer	.417231	.2301068	-1.58	0.113	.1415569	1.229765
adl_eat	2.078101	1.002547	1.52	0.129	.8072684	5.349526
adl_continence	.5689051	.2756272	-1.16	0.244	.2201119	1.470402
adl_ambulation	.9969107	.6372623	-0.00	0.996	.2847978	3.489602
iadl_routine_housetasks	2.613536	2.120325	1.18	0.236	.5329184	12.81729
iadl_money_mgmt	.7689006	.3607943	-0.56	0.575	.306519	1.928781
iadl_transport	1.247099	.7462017	0.37	0.712	.3859973	4.029187
iadl_homemaintenance	.4781674	.2654994	-1.33	0.184	.1610481	1.419725
_cons	3.603472	6.767457	0.68	0.495	.0908097	142.9914

```
. ***H5: when combined (Obs=205)
. logit chore_home age sex i.race i.edu_level i.living_arrange rural elgibility_EDCD adl_bath adl_dress adl_toilet adl_transfe
> r adl_eat adl_continence adl_ambulation iadl_routine_housetasks iadl_money_mgmt iadl_transport iadl_homemaintenance, or

note: 4.race != 0 predicts failure perfectly
      4.race dropped and 3 obs not used

Iteration 0:   log likelihood = -85.343579
Iteration 1:   log likelihood = -71.545631
Iteration 2:   log likelihood = -69.180598
Iteration 3:   log likelihood = -69.113496
Iteration 4:   log likelihood = -69.113325
Iteration 5:   log likelihood = -69.113325

Logistic regression                             Number of obs     =        205
                                                LR chi2(24)       =      32.46
                                                Prob > chi2       =     0.1160
Log likelihood = -69.113325                     Pseudo R2         =     0.1902
```

chore_home	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	1.028416	.0264141	1.09	0.275	.9779266	1.081512
sex	1.762551	1.276591	0.78	0.434	.4262142	7.288787
race						
Black/African American	.9496753	.4910201	-0.10	0.920	.3447227	2.616257
Asian	.58043	.5985263	-0.53	0.598	.0769148	4.380157
Hispanic/Latino	1	(empty)				
Other	1.786378	2.748346	0.38	0.706	.0875787	36.43747
edu_level						
some high school	.1360818	.1172471	-2.31	0.021	.0251427	.7365274
high school graduate	.5596533	.3330379	-0.98	0.329	.1743359	1.796599
at least some college	1.320966	.8360988	0.44	0.660	.3820568	4.567256
living_arrange						
with spouse	.35175	.3074691	-1.20	0.232	.0634144	1.951102
with spouse and others	.1065967	.1270537	-1.88	0.060	.0103083	1.1023
with others only	.4942857	.2648012	-1.32	0.188	.1729689	1.412499
rural	.5232055	.2952243	-1.15	0.251	.1731302	1.581146
elgibility_EDCD	1.234043	.6204097	0.42	0.676	.4606725	3.305736
adl_bath	2.676282	2.094858	1.26	0.209	.5771043	12.41107
adl_dress	3.09933	2.079886	1.69	0.092	.8318539	11.54752
adl_toilet	.3592824	.2436788	-1.51	0.131	.0950865	1.35754
adl_transfer	1.0182	.6468561	0.03	0.977	.2931369	3.536682
adl_eat	2.283807	1.465677	1.29	0.198	.649209	8.034048
adl_continence	.5860906	.3271997	-0.96	0.339	.1962276	1.750529
adl_ambulation	.605978	.4562198	-0.67	0.506	.1385533	2.650311
iadl_routine_housetasks	1.759316	1.751357	0.57	0.570	.2500305	12.37926
iadl_money_mgmt	.364148	.2206032	-1.67	0.095	.1110746	1.193827
iadl_transport	1.638622	1.283475	0.63	0.528	.3529898	7.606682
iadl_homemaintenance	1.551869	1.202628	0.57	0.571	.3397913	7.087578
_cons	.0110452	.0279642	-1.78	0.075	.0000773	1.578485

```
. ***decision to ELIMINATE adult_day_services due to low usage (n=5)
. ***H6:
. logit home_meals age sex i.race i.edu_level i.living_arrange rural elgibility_EDCD adl_bath adl_dress adl_toilet adl_transfe
> r adl_eat adl_continence adl_ambulation iadl_routine_housetasks iadl_money_mgmt iadl_transport iadl_homemaintenance, or

note: 3.race != 0 predicts failure perfectly
      3.race dropped and 12 obs not used

note: 4.race != 0 predicts failure perfectly
      4.race dropped and 3 obs not used

note: iadl_routine_housetasks != 1 predicts failure perfectly
      iadl_routine_housetasks dropped and 25 obs not used

Iteration 0:   log likelihood = -103.76683
Iteration 1:   log likelihood = -92.686546
Iteration 2:   log likelihood = -92.273047
Iteration 3:   log likelihood = -92.269833
Iteration 4:   log likelihood = -92.269833

Logistic regression                             Number of obs     =        175
                                                LR chi2(22)       =      22.99
                                                Prob > chi2       =     0.4021
Log likelihood = -92.269833                     Pseudo R2         =     0.1108
```

home_meals	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	.9805441	.0211553	-0.91	0.362	.939945	1.022897
sex	1.641825	.9103867	0.89	0.371	.5537814	4.867606
race						
Black/African American	.7225116	.3021288	-0.78	0.437	.3183482	1.639786
Asian	1	(empty)				
Hispanic/Latino	1	(empty)				
Other	4.534695	6.353984	1.08	0.281	.2909713	70.67178
edu_level						
some high school	1.16902	.54904	0.33	0.740	.4656379	2.934917
high school graduate	.8761395	.4333919	-0.27	0.789	.3322899	2.310092
at least some college	.3382617	.2459935	-1.49	0.136	.081327	1.406925
living_arrange						
with spouse	.6440748	.3745501	-0.76	0.449	.2060323	2.013433
with spouse and others	1.30637	.8742602	0.40	0.690	.351899	4.849697
with others only	.5704431	.2680353	-1.19	0.232	.2271206	1.432743
rural	1.282363	.5514489	0.58	0.563	.5520424	2.978855
elgibility_EDCD	1.138703	.4547391	0.33	0.745	.5205763	2.490786
adl_bath	1.02756	.6235092	0.04	0.964	.312831	3.375239
adl_dress	1.047394	.543156	0.09	0.929	.3790488	2.894176
adl_toilet	.9607754	.5241195	-0.07	0.942	.3298199	2.798768
adl_transfer	.8671384	.4376461	-0.28	0.778	.3224672	2.331799
adl_eat	.6524019	.3656769	-0.76	0.446	.217475	1.957136
adl_continence	.7666576	.3573064	-0.57	0.569	.3075337	1.911218
adl_ambulation	.242247	.1438762	-2.39	0.017	.0756327	.7759025
iadl_routine_housetasks	1	(omitted)				
iadl_money_mgmt	.6520602	.3000132	-0.93	0.353	.2646363	1.606667
iadl_transport	1.662995	1.026071	0.82	0.410	.4962473	5.572934
iadl_homemaintenance	1.014802	.5384471	0.03	0.978	.3587065	2.870933
_cons	5.362013	10.98878	0.82	0.413	.096582	297.6868

```
. tabulate home_meals iadl_routine_housetasks
```

Current use of...home meals	Client receiving help with...meal prep, laundry, shopping, phone use: No	Yes	Total
No	41	223	264
Yes	3	76	79
Total	44	299	343

```
. logit home_meals age sex i.race i.edu_level i.living_arrange rural elgibility_EDCD adl_bath adl_dress adl_toilet adl_transfe
> r adl_eat adl_continence adl_ambulation iadl_money_mgmt iadl_transport iadl_homemaintenance, or

note: 3.race != 0 predicts failure perfectly
      3.race dropped and 12 obs not used

note: 4.race != 0 predicts failure perfectly
      4.race dropped and 3 obs not used

Iteration 0:   log likelihood = -111.35502
Iteration 1:   log likelihood = -101.51792
Iteration 2:   log likelihood = -101.01432
Iteration 3:   log likelihood = -101.01293
Iteration 4:   log likelihood = -101.01293

Logistic regression                             Number of obs     =        200
                                                LR chi2(22)       =      20.68
                                                Prob > chi2       =     0.5403
Log likelihood = -101.01293                     Pseudo R2         =     0.0929
```

home_meals	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	.9923038	.0200318	-0.38	0.702	.9538088	1.032352
sex	1.351959	.7201385	0.57	0.571	.4759483	3.840317
race						
Black/African American	.7182964	.2892782	-0.82	0.411	.3262127	1.581636
Asian	1	(empty)				
Hispanic/Latino	1	(empty)				
Other	1.500009	1.638466	0.37	0.710	.1763288	12.76041
edu_level						
some high school	1.077208	.4853169	0.17	0.869	.4454574	2.604914
high school graduate	.9663889	.4473148	-0.07	0.941	.3900804	2.394141
at least some college	.3048012	.2146654	-1.69	0.092	.0766536	1.211995
living_arrange						
with spouse	.6606374	.3632635	-0.75	0.451	.2248612	1.940939
with spouse and others	1.729345	1.111754	0.85	0.394	.4905294	6.09675
with others only	.6790177	.3035585	-0.87	0.387	.2827137	1.630855
rural	1.452981	.5994313	0.91	0.365	.6472836	3.261561
elgibility_EDCD	1.000589	.3802865	0.00	0.999	.4750568	2.10749
adl_bath	1.118996	.6456271	0.19	0.845	.3611693	3.46694
adl_dress	1.096424	.558506	0.18	0.857	.4040044	2.975575
adl_toilet	1.129505	.617191	0.22	0.824	.3870521	3.296149
adl_transfer	.9181453	.4668554	-0.17	0.867	.3389186	2.487296
adl_eat	.6443108	.3599245	-0.79	0.431	.2155746	1.92572
adl_continence	.7030815	.321097	-0.77	0.440	.2872515	1.720874
adl_ambulation	.3862521	.2146639	-1.71	0.087	.1299589	1.147983
iadl_money_mgmt	.6394586	.2884798	-0.99	0.322	.2641245	1.548161
iadl_transport	3.069553	1.836017	1.88	0.061	.9504714	9.913141
iadl_homemaintenance	1.404701	.7437097	0.64	0.521	.4976464	3.965034
_cons	.5119136	.961108	-0.36	0.721	.0129146	20.29137

```
.
. *Post-hoc analyses for RQ4
. ***transport obs=270)
. logit transport age sex i.race i.edu_level i.living_arrange rural elgibility_EDCD adl_bath adl_dress adl_toilet adl_transfer
>  adl_eat adl_continence adl_ambulation iadl_routine_housetasks iadl_money_mgmt iadl_transport iadl_homemaintenance, or

Iteration 0:   log likelihood = -120.75836
Iteration 1:   log likelihood = -97.028148
Iteration 2:   log likelihood =  -95.33273
Iteration 3:   log likelihood = -95.318605
Iteration 4:   log likelihood =   -95.3186

Logistic regression                             Number of obs     =        210
                                                LR chi2(25)       =      50.88
                                                Prob > chi2       =     0.0017
Log likelihood =   -95.3186                     Pseudo R2         =     0.2107
```

transport	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	1.004164	.0220994	0.19	0.850	.9617707	1.048426
sex	1.341247	.7486467	0.53	0.599	.4491505	4.005214
race						
Black/African American	1.326893	.5856311	0.64	0.522	.5586678	3.151506
Asian	1.998192	1.636226	0.85	0.398	.401447	9.945949
Hispanic/Latino	2.682843	3.833906	0.69	0.490	.1630005	44.15719
Other	.1674929	.2316361	-1.29	0.196	.0111383	2.51869
edu_level						
some high school	.2183902	.1261771	-2.63	0.008	.070379	.6776776
high school graduate	.3681032	.1918648	-1.92	0.055	.1325262	1.022439
at least some college	1.120568	.5897999	0.22	0.829	.3994075	3.143835
living_arrange						
with spouse	2.824885	1.514627	1.94	0.053	.9876648	8.07964
with spouse and others	.6070962	.559548	-0.54	0.588	.0997063	3.696514
with others only	.6526137	.3072561	-0.91	0.365	.2593602	1.642136
rural	.2804689	.1416515	-2.52	0.012	.1042277	.7547202
elgibility_EDCD	.5738292	.2301615	-1.38	0.166	.2614374	1.259498
adl_bath	1.179081	.7252958	0.27	0.789	.3531331	3.936849
adl_dress	1.087579	.6069154	0.15	0.880	.3642956	3.24689
adl_toilet	2.631506	1.641442	1.55	0.121	.7749156	8.93623
adl_transfer	1.116655	.6027841	0.20	0.838	.3876415	3.216682
adl_eat	1.022059	.6071847	0.04	0.971	.3190024	3.274596
adl_continence	.7247329	.3398958	-0.69	0.492	.2890474	1.817134
adl_ambulation	1.398293	.9397328	0.50	0.618	.3745779	5.219805
iadl_routine_housetasks	.0773654	.058315	-3.40	0.001	.0176581	.3389608
iadl_money_mgmt	.4632958	.2244548	-1.59	0.112	.1792558	1.197411
iadl_transport	2.077288	1.358312	1.12	0.264	.5766431	7.483183
iadl_homemaintenance	1.419342	.8518899	0.58	0.560	.4377193	4.60234
_cons	1.207422	2.461705	0.09	0.926	.0222035	65.65953

```
. ***housing obs=270)
. logit housing age sex i.race i.edu_level i.living_arrange rural elgibility_EDCD adl_bath adl_dress adl_toilet adl_transfer a
> dl_eat adl_continence adl_ambulation iadl_routine_housetasks iadl_money_mgmt iadl_transport iadl_homemaintenance, or

Iteration 0:   log likelihood =  -121.0612
Iteration 1:   log likelihood = -93.941533
Iteration 2:   log likelihood = -90.676655
Iteration 3:   log likelihood = -90.541235
Iteration 4:   log likelihood = -90.540775
Iteration 5:   log likelihood = -90.540775

Logistic regression                             Number of obs     =        211
                                                LR chi2(25)       =      61.04
                                                Prob > chi2       =     0.0001
Log likelihood = -90.540775                     Pseudo R2         =     0.2521
```

housing	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	.9856678	.0221093	-0.64	0.520	.9432732	1.029968
sex	.6553444	.3661485	-0.76	0.449	.2192267	1.959051
race						
Black/African American	1.048012	.4599167	0.11	0.915	.4434237	2.476928
Asian	2.234134	1.820458	0.99	0.324	.452395	11.03318
Hispanic/Latino	2.392401	3.611012	0.58	0.563	.1241818	46.09033
Other	.4131472	.5774887	-0.63	0.527	.0266878	6.39583
edu_level						
some high school	.1725012	.1064939	-2.85	0.004	.05144	.5784727
high school graduate	.380879	.2049804	-1.79	0.073	.1326446	1.093665
at least some college	1.73755	.8903188	1.08	0.281	.6364764	4.743425
living_arrange						
with spouse	.3813092	.2431396	-1.51	0.131	.1092732	1.33058
with spouse and others	.125701	.151192	-1.72	0.085	.0118993	1.327871
with others only	.7243765	.3284955	-0.71	0.477	.2978209	1.761868
rural	.1299257	.0711513	-3.73	0.000	.0444172	.3800486
elgibility_EDCD	1.018405	.4181911	0.04	0.965	.4553954	2.277468
adl_bath	1.309661	.7761197	0.46	0.649	.4099465	4.183988
adl_dress	.5068428	.2825471	-1.22	0.223	.1699645	1.511431
adl_toilet	.5004071	.2927385	-1.18	0.237	.15899	1.574987
adl_transfer	1.203943	.6343478	0.35	0.725	.4286615	3.381405
adl_eat	2.866599	1.793235	1.68	0.092	.841178	9.768909
adl_continence	1.084857	.5017573	0.18	0.860	.4382108	2.685726
adl_ambulation	.6553589	.3929463	-0.70	0.481	.2023521	2.122515
iadl_routine_housetasks	.4261383	.2869083	-1.27	0.205	.1138828	1.594569
iadl_money_mgmt	.6254595	.3157009	-0.93	0.353	.2325707	1.682068
iadl_transport	3.452956	2.33972	1.83	0.067	.9149925	13.0306
iadl_homemaintenance	.917239	.5112422	-0.15	0.877	.3076434	2.734748
_cons	8.826911	18.54192	1.04	0.300	.1438016	541.8183

```
. ***homehealth (obs=265)
. logit homehealth age sex i.edu_level i.race rural i.living_arrange elgibility_EDCD adl_bath adl_dress adl_toilet adl_transfe
> r adl_eat adl_continence adl_ambulation iadl_routine_housetasks iadl_money_mgmt iadl_transport iadl_homemaintenance, or

note: 4.race != 0 predicts failure perfectly
      4.race dropped and 3 obs not used

Iteration 0:   log likelihood = -109.89981
Iteration 1:   log likelihood = -86.413608
Iteration 2:   log likelihood = -82.898993
Iteration 3:   log likelihood = -82.744613
Iteration 4:   log likelihood =  -82.74423
Iteration 5:   log likelihood =  -82.74423

Logistic regression                             Number of obs     =        208
                                                LR chi2(24)       =      54.31
                                                Prob > chi2       =     0.0004
Log likelihood =  -82.74423                     Pseudo R2         =     0.2471
```

homehealth	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	.9874961	.0235061	-0.53	0.597	.9424832	1.034659
sex	.8773607	.4953848	-0.23	0.817	.2901107	2.653339
edu_level						
some high school	2.143566	1.124842	1.45	0.146	.7664195	5.995249
high school graduate	.6094663	.3485374	-0.87	0.387	.1986875	1.869515
at least some college	.9712753	.6383133	-0.04	0.965	.26788	3.521635
race						
Black/African American	.4276061	.1981133	-1.83	0.067	.1724549	1.06026
Asian	.2211423	.3008621	-1.11	0.267	.0153681	3.182173
Hispanic/Latino	1	(empty)				
Other	.7888363	1.10728	-0.17	0.866	.0503693	12.35402
rural	.4600204	.2267622	-1.58	0.115	.1750597	1.208838
living_arrange						
with spouse	1.110553	.6110658	0.19	0.849	.3777272	3.265132
with spouse and others	.7056161	.5003359	-0.49	0.623	.1757929	2.832277
with others only	.1779239	.0989871	-3.10	0.002	.0597961	.5294147
elgibility_EDCD	.6244846	.2677107	-1.10	0.272	.2695377	1.446851
adl_bath	2.411021	1.828125	1.16	0.246	.5454921	10.65647
adl_dress	2.628958	1.509974	1.68	0.092	.852876	8.103665
adl_toilet	1.209467	.7398553	0.31	0.756	.3646671	4.011356
adl_transfer	.6109605	.3661726	-0.82	0.411	.1887359	1.977751
adl_eat	1.726063	.8969343	1.05	0.294	.623357	4.779434
adl_continence	.7397638	.3670911	-0.61	0.544	.2797071	1.956513
adl_ambulation	1.323522	1.234952	0.30	0.764	.2125654	8.240812
iadl_routine_housetasks	8.541388	10.46673	1.75	0.080	.7734905	94.3196
iadl_money_mgmt	.4954693	.2495585	-1.39	0.163	.1846216	1.329691
iadl_transport	.4140786	.2801977	-1.30	0.193	.1099243	1.55981
iadl_homemaintenance	2.736751	1.867532	1.48	0.140	.7184288	10.42526
_cons	.1695289	.4063234	-0.74	0.459	.0015456	18.59457

```
.
. **RQ4: only need based factors
. logit personal_care adl_bath adl_dress adl_toilet adl_transfer adl_eat adl_continence adl_ambulation iadl_routine_housetasks
>  iadl_money_mgmt iadl_transport iadl_homemaintenance, or

Iteration 0:   log likelihood = -195.46419
Iteration 1:   log likelihood = -181.03181
Iteration 2:   log likelihood =  -180.5258
Iteration 3:   log likelihood = -180.52389
Iteration 4:   log likelihood = -180.52389

Logistic regression                             Number of obs     =        340
                                                LR chi2(11)       =      29.88
                                                Prob > chi2       =     0.0017
Log likelihood = -180.52389                     Pseudo R2         =     0.0764
```

personal_care	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
adl_bath	.5704262	.2688399	-1.19	0.234	.2264806	1.436706
adl_dress	3.320542	1.304573	3.05	0.002	1.537408	7.171808
adl_toilet	2.354776	.991458	2.03	0.042	1.031713	5.374532
adl_transfer	.570621	.2104676	-1.52	0.128	.2769434	1.175722
adl_eat	1.267165	.4146404	0.72	0.469	.6672737	2.40637
adl_continence	1.009173	.3020301	0.03	0.976	.5613245	1.814334
adl_ambulation	1.004789	.4652239	0.01	0.992	.4054741	2.489928
iadl_routine_housetasks	1.927796	1.163064	1.09	0.277	.5909085	6.289296
iadl_money_mgmt	.9674355	.2964748	-0.11	0.914	.5306005	1.76391
iadl_transport	.8987951	.3844699	-0.25	0.803	.3886418	2.078605
iadl_homemaintenance	.7589825	.2913995	-0.72	0.473	.3576236	1.610784
_cons	.1738459	.0803848	-3.78	0.000	.0702387	.4302811

```
. logit chore_home adl_bath adl_dress adl_toilet adl_transfer adl_eat adl_continence adl_ambulation iadl_routine_housetasks ia
> dl_money_mgmt iadl_transport iadl_homemaintenance, or

Iteration 0:   log likelihood = -149.94683
Iteration 1:   log likelihood =  -147.9199
Iteration 2:   log likelihood = -147.88947
Iteration 3:   log likelihood = -147.88946
Iteration 4:   log likelihood = -147.88946

Logistic regression                             Number of obs     =        337
                                                LR chi2(11)       =       4.11
                                                Prob > chi2       =     0.9664
Log likelihood = -147.88946                     Pseudo R2         =     0.0137
```

chore_home	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
adl_bath	1.298888	.6225293	0.55	0.585	.5077023	3.323031
adl_dress	1.133609	.4795829	0.30	0.767	.4947149	2.597594
adl_toilet	.6357716	.2701462	-1.07	0.286	.2764499	1.462129
adl_transfer	1.268737	.5179955	0.58	0.560	.5699618	2.824211
adl_eat	1.004823	.4102484	0.01	0.991	.4514003	2.23675
adl_continence	1.160076	.400873	0.43	0.667	.5893147	2.283629
adl_ambulation	.5902685	.2904985	-1.07	0.284	.2249747	1.548693
iadl_routine_housetasks	1.577641	1.004542	0.72	0.474	.4529152	5.495405
iadl_money_mgmt	.8813228	.305106	-0.36	0.715	.4471536	1.737054
iadl_transport	1.216428	.6026264	0.40	0.692	.4606763	3.212012
iadl_homemaintenance	1.255088	.5592418	0.51	0.610	.5240784	3.005746
_cons	.122485	.0618822	-4.16	0.000	.0455026	.329708

```
. logit home_meals adl_bath adl_dress adl_toilet adl_transfer adl_eat adl_continence adl_ambulation iadl_routine_housetasks ia
> dl_money_mgmt iadl_transport iadl_homemaintenance, or

Iteration 0:   log likelihood =  -185.1046
Iteration 1:   log likelihood = -174.00543
Iteration 2:   log likelihood = -173.38428
Iteration 3:   log likelihood = -173.37932
Iteration 4:   log likelihood = -173.37932

Logistic regression                             Number of obs     =        343
                                                LR chi2(11)       =      23.45
                                                Prob > chi2       =     0.0153
Log likelihood = -173.37932                     Pseudo R2         =     0.0633
```

home_meals	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
adl_bath	1.07552	.4542243	0.17	0.863	.4700351	2.46097
adl_dress	1.2112	.4469909	0.52	0.604	.5875999	2.496607
adl_toilet	1.225957	.4683059	0.53	0.594	.57986	2.591955
adl_transfer	.7717417	.2720669	-0.73	0.462	.3867164	1.540109
adl_eat	.5296538	.209257	-1.61	0.108	.2441727	1.148913
adl_continence	.8540742	.2640113	-0.51	0.610	.4659855	1.565377
adl_ambulation	.3977385	.1647486	-2.23	0.026	.1766114	.8957291
iadl_routine_housetasks	7.553735	5.401239	2.83	0.005	1.860016	30.67657
iadl_money_mgmt	.7030217	.2116681	-1.17	0.242	.3896603	1.268386
iadl_transport	1.324542	.5740268	0.65	0.517	.5664665	3.097116
iadl_homemaintenance	1.295254	.4996645	0.67	0.502	.6081215	2.758794
_cons	.0822482	.0504915	-4.07	0.000	.0246934	.2739504


```
. logit home_meals adl_bath adl_dress adl_toilet adl_transfer adl_eat adl_continence adl_ambulation iadl_routine_housetasks ia
> dl_money_mgmt iadl_transport iadl_homemaintenance, or

Iteration 0:   log likelihood =  -185.1046
Iteration 1:   log likelihood = -174.00543
Iteration 2:   log likelihood = -173.38428
Iteration 3:   log likelihood = -173.37932
Iteration 4:   log likelihood = -173.37932

Logistic regression                             Number of obs     =        343
                                                LR chi2(11)       =      23.45
                                                Prob > chi2       =     0.0153
Log likelihood = -173.37932                     Pseudo R2         =     0.0633
```

home_meals	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
adl_bath	1.07552	.4542243	0.17	0.863	.4700351	2.46097
adl_dress	1.2112	.4469909	0.52	0.604	.5875999	2.496607
adl_toilet	1.225957	.4683059	0.53	0.594	.57986	2.591955
adl_transfer	.7717417	.2720669	-0.73	0.462	.3867164	1.540109
adl_eat	.5296538	.209257	-1.61	0.108	.2441727	1.148913
adl_continence	.8540742	.2640113	-0.51	0.610	.4659855	1.565377
adl_ambulation	.3977385	.1647486	-2.23	0.026	.1766114	.8957291
iadl_routine_housetasks	7.553735	5.401239	2.83	0.005	1.860016	30.67657
iadl_money_mgmt	.7030217	.2116681	-1.17	0.242	.3896603	1.268386
iadl_transport	1.324542	.5740268	0.65	0.517	.5664665	3.097116
iadl_homemaintenance	1.295254	.4996645	0.67	0.502	.6081215	2.758794
_cons	.0822482	.0504915	-4.07	0.000	.0246934	.2739504

```
. logit transport adl_bath adl_dress adl_toilet adl_transfer adl_eat adl_continence adl_ambulation iadl_routine_housetasks iad
> l_money_mgmt iadl_transport iadl_homemaintenance, or

Iteration 0:   log likelihood = -186.40008
Iteration 1:   log likelihood = -177.62496
Iteration 2:   log likelihood = -177.38882
Iteration 3:   log likelihood = -177.38848
Iteration 4:   log likelihood = -177.38848

Logistic regression                             Number of obs     =        339
                                                LR chi2(11)       =      18.02
                                                Prob > chi2       =     0.0810
Log likelihood = -177.38848                     Pseudo R2         =     0.0483
```

transport	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
adl_bath	1.20927	.5485185	0.42	0.675	.4970757	2.941872
adl_dress	.9486676	.356117	-0.14	0.888	.454553	1.979902
adl_toilet	2.138795	.8941377	1.82	0.069	.9425807	4.853105
adl_transfer	1.06279	.3937739	0.16	0.869	.5141255	2.196978
adl_eat	.712132	.2732178	-0.88	0.376	.3357276	1.510546
adl_continence	.8835428	.2750113	-0.40	0.691	.480046	1.626194
adl_ambulation	.8477082	.3949367	-0.35	0.723	.3401592	2.112567
iadl_routine_housetasks	.2048693	.1076845	-3.02	0.003	.0731247	.5739709
iadl_money_mgmt	.7166894	.2237915	-1.07	0.286	.3886307	1.321676
iadl_transport	2.195531	1.054233	1.64	0.101	.8566748	5.62682
iadl_homemaintenance	1.085706	.424804	0.21	0.834	.5042699	2.337555
_cons	.5187964	.1777065	-1.92	0.055	.2651121	1.01523

```
. logit housing adl_bath adl_dress adl_toilet adl_transfer adl_eat adl_continence adl_ambulation iadl_routine_housetasks iadl_
> money_mgmt iadl_transport iadl_homemaintenance, or

Iteration 0:   log likelihood = -169.23832
Iteration 1:   log likelihood = -162.16733
Iteration 2:   log likelihood = -161.99144
Iteration 3:   log likelihood = -161.99129
Iteration 4:   log likelihood = -161.99129

Logistic regression                             Number of obs     =        336
                                                LR chi2(11)       =      14.49
                                                Prob > chi2       =     0.2069
Log likelihood = -161.99129                     Pseudo R2         =     0.0428
```

housing	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
adl_bath	1.150565	.4916195	0.33	0.743	.4979722	2.65838
adl_dress	.5430299	.2205974	-1.50	0.133	.2449269	1.203957
adl_toilet	1.117104	.4653667	0.27	0.790	.4937392	2.527492
adl_transfer	1.111776	.4140304	0.28	0.776	.5358289	2.306793
adl_eat	1.03546	.4466231	0.08	0.936	.4446168	2.411463
adl_continence	.6594194	.2205443	-1.25	0.213	.342354	1.270129
adl_ambulation	1.211695	.5629106	0.41	0.679	.4874786	3.011837
iadl_routine_housetasks	.5006051	.2609469	-1.33	0.184	.1802168	1.390577
iadl_money_mgmt	.7241778	.2407894	-0.97	0.332	.377416	1.389537
iadl_transport	2.252194	1.065462	1.72	0.086	.8910903	5.692329
iadl_homemaintenance	.6724326	.2533796	-1.05	0.292	.3212973	1.407312
_cons	.3769254	.1399475	-2.63	0.009	.1820603	.7803609

```
. logit homehealth adl_bath adl_dress adl_toilet adl_transfer adl_eat adl_continence adl_ambulation iadl_routine_housetasks ia
> dl_money_mgmt iadl_transport iadl_homemaintenance, or

Iteration 0:   log likelihood = -173.27067
Iteration 1:   log likelihood = -155.47818
Iteration 2:   log likelihood = -153.77474
Iteration 3:   log likelihood = -153.73318
Iteration 4:   log likelihood = -153.73304
Iteration 5:   log likelihood = -153.73304

Logistic regression                             Number of obs     =        336
                                                LR chi2(11)       =      39.08
                                                Prob > chi2       =     0.0001
Log likelihood = -153.73304                     Pseudo R2         =     0.1128
```

homehealth	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
adl_bath	1.741278	.9164515	1.05	0.292	.6206871	4.884991
adl_dress	1.821114	.6967388	1.57	0.117	.8603529	3.854764
adl_toilet	1.087318	.4391869	0.21	0.836	.4926528	2.399782
adl_transfer	1.137112	.4419142	0.33	0.741	.5308867	2.435592
adl_eat	1.861933	.6297102	1.84	0.066	.9595901	3.612788
adl_continence	.8603557	.2694692	-0.48	0.631	.4656676	1.589571
adl_ambulation	1.413876	.9221929	0.53	0.595	.393749	5.076951
iadl_routine_housetasks	2.793037	2.362042	1.21	0.225	.5323836	14.65308
iadl_money_mgmt	.6866229	.2239609	-1.15	0.249	.362306	1.301251
iadl_transport	.5000756	.2320336	-1.49	0.135	.2014098	1.241626
iadl_homemaintenance	2.502469	1.231089	1.86	0.062	.9541582	6.563221
_cons	.0290252	.0236295	-4.35	0.000	.0058859	.1431332

```
.
end of do-file
```

RQ5:

```
. do "C:\Users\wangzhe\AppData\Local\Temp\STD00000000.tmp"

. zip hospitalization_count age i.race sex rural source_DMAS, inflate(i.eligibility_typeDMAS accessDARS) vuong

Fitting constant-only model:

Iteration 0:   log likelihood = -351.11647  (not concave)
Iteration 1:   log likelihood = -283.25384
Iteration 2:   log likelihood = -248.67901
Iteration 3:   log likelihood = -246.23949
Iteration 4:   log likelihood = -246.21957
Iteration 5:   log likelihood = -246.21957

Fitting full model:

Iteration 0:   log likelihood = -246.21957
Iteration 1:   log likelihood = -240.24261
Iteration 2:   log likelihood =  -239.3332
Iteration 3:   log likelihood = -239.32984
Iteration 4:   log likelihood = -239.32984

Zero-inflated Poisson regression               Number of obs     =      1,008
                                               Nonzero obs       =         44
                                               Zero obs          =        964

Inflation model = logit                        LR chi2(8)        =      13.78
Log likelihood  = -239.3298                    Prob > chi2       =     0.0877
```

hospitalization_count	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
hospitalization_count						
age	-.0377829	.0144075	-2.62	0.009	-.0660211	-.0095448
race						
Black/African American	-.2264959	.2935889	-0.77	0.440	-.8019195	.3489277
Asian	.4652058	.5500072	0.85	0.398	-.6127885	1.5432
Hispanic/Latino	.9712266	.5707882	1.70	0.089	-.1474977	2.089951
Other	-.273205	1.343039	-0.20	0.839	-2.905514	2.359104
sex	.1233099	.319175	0.39	0.699	-.5022616	.7488815
rural	.5330925	.3062212	1.74	0.082	-.0670899	1.133275
source_DMAS	-1.090092	.3630277	-3.00	0.003	-1.801613	-.3785705
_cons	4.005921	1.201785	3.33	0.001	1.650465	6.361377
inflate						
eligibility_typeDMAS						
not eligible, received other services	.4627955	.4251534	1.09	0.276	-.3704898	1.296081
eligible, received services	1.040726	.3840313	2.71	0.007	.288039	1.793414
accessDARS	.3131984	.3202375	0.98	0.328	-.3144555	.9408523
_cons	1.907767	.3440085	5.55	0.000	1.233523	2.582011

```
Vuong test of zip vs. standard Poisson:           z =     3.49  Pr>z = 0.0002

.
end of do-file
```

```
. do "C:\Users\wangzhe\AppData\Local\Temp\STD00000000.tmp"

. ***H8
. logit hospitalization_simple c.age##i.race, or

Iteration 0:   log likelihood = -180.81288
Iteration 1:   log likelihood =  -177.2733
Iteration 2:   log likelihood =  -175.3412
Iteration 3:   log likelihood = -174.77897
Iteration 4:   log likelihood =  -174.4925
Iteration 5:   log likelihood = -174.41113
Iteration 6:   log likelihood = -174.38821
Iteration 7:   log likelihood = -174.38301
Iteration 8:   log likelihood = -174.38189
Iteration 9:   log likelihood =  -174.3817
Iteration 10:  log likelihood = -174.38166
Iteration 11:  log likelihood = -174.38165

Logistic regression                             Number of obs     =      1,008
                                                LR chi2(9)        =      12.86
                                                Prob > chi2       =     0.1689
Log likelihood = -174.38165                     Pseudo R2         =     0.0356
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	.9904641	.0252305	-0.38	0.707	.9422274	1.04117
race						
Black/African American	5.869821	16.07341	0.65	0.518	.0274011	1257.422
Asian	5.443558	29.53483	0.31	0.755	.0001311	226049.2
Hispanic/Latino	9.606834	57.03285	0.38	0.703	.000085	1086188
Other	6.2e-201	1.4e-196	-0.02	0.984	0	.
race#c.age						
Black/African American	.9765812	.0343361	-0.67	0.500	.9115501	1.046252
Asian	.985372	.0630419	-0.23	0.818	.8692451	1.117013
Hispanic/Latino	.9828558	.0718281	-0.24	0.813	.8516931	1.134218
Other	95.16625	21117.81	0.02	0.984	1.2e-187	7.3e+190
_cons	.0944483	.1900514	-1.17	0.241	.0018297	4.875333

```
Note: 29 failures and 0 successes completely determined.
```

```
. logit hospitalization_simple c.age##source_DMAS, or

Iteration 0:   log likelihood = -180.81288
Iteration 1:   log likelihood = -177.78534
Iteration 2:   log likelihood = -177.57053
Iteration 3:   log likelihood = -177.57002
Iteration 4:   log likelihood = -177.57002

Logistic regression                             Number of obs     =      1,008
                                                LR chi2(3)        =       6.49
                                                Prob > chi2       =     0.0902
Log likelihood = -177.57002                     Pseudo R2         =     0.0179
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	1.067689	.0402229	1.74	0.082	.9916932	1.149508
source_DMAS						
Community-based team/PSLH	2044.548	7038.883	2.21	0.027	2.399475	1742121
source_DMAS#c.age						
Community-based team/PSLH	.908248	.0376723	-2.32	0.020	.8373333	.9851687
_cons	.0002485	.0007861	-2.62	0.009	5.04e-07	.1224539

```
. logit hospitalization_simple c.age##i.eligibility_typeDMAS, or

Iteration 0:   log likelihood = -180.81288
Iteration 1:   log likelihood = -175.80563
Iteration 2:   log likelihood =  -172.1211
Iteration 3:   log likelihood = -172.10188
Iteration 4:   log likelihood = -172.10186

Logistic regression                             Number of obs     =      1,008
                                                LR chi2(5)        =      17.42
                                                Prob > chi2       =     0.0038
Log likelihood = -172.10186                     Pseudo R2         =     0.0482
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	1.048768	.032602	1.53	0.126	.9867771	1.114653
eligibility_typeDMAS						
not eligible, received other services	13610.37	51236.39	2.53	0.011	8.501823	2.18e+07
eligible, received services	19.38791	62.13174	0.93	0.355	.036284	10359.68
eligibility_typeDMAS#c.age						
not eligible, received other services	.8776242	.0433109	-2.65	0.008	.7967126	.9667529
eligible, received services	.9506813	.0368998	-1.30	0.193	.8810415	1.025826
_cons	.0019972	.0051566	-2.41	0.016	.0000127	.3148645

```
. logit hospitalization_simple rural##eligibility_typeDMAS, or

Iteration 0:   log likelihood = -180.81288
Iteration 1:   log likelihood = -176.22323
Iteration 2:   log likelihood = -174.41892
Iteration 3:   log likelihood = -174.40746
Iteration 4:   log likelihood = -174.40746

Logistic regression                             Number of obs     =      1,008
                                                LR chi2(5)        =      12.81
                                                Prob > chi2       =     0.0252
Log likelihood = -174.40746                     Pseudo R2         =     0.0354
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
rural						
Yes	1.836421	1.070504	1.04	0.297	.5858435	5.756557
eligibility_typeDMAS						
not eligible, received other services	1.133333	.6065519	0.23	0.815	.3970093	3.235301
eligible, received services	.4201977	.2109286	-1.73	0.084	.1570985	1.12392
rural#eligibility_typeDMAS						
Yes#not eligible, received other services	.1791242	.1755933	-1.75	0.079	.026226	1.223424
Yes#eligible, received services	.6039043	.4754891	-0.64	0.522	.1290528	2.825978
_cons	.0705882	.0298173	-6.28	0.000	.0308443	.1615435

```
. logit hospitalization_simple source_DMAS##i.eligibility_typeDMAS, or

Iteration 0:   log likelihood = -180.81288
Iteration 1:   log likelihood = -176.07575
Iteration 2:   log likelihood = -174.42959
Iteration 3:   log likelihood = -174.41751
Iteration 4:   log likelihood = -174.41751

Logistic regression                             Number of obs     =      1,008
                                                LR chi2(5)        =      12.79
                                                Prob > chi2       =     0.0254
Log likelihood = -174.41751                     Pseudo R2         =     0.0354
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
source_DMAS						
Community-based team/PSLH	.5803914	.3491192	-0.90	0.366	.1785267	1.886856
eligibility_typeDMAS						
not eligible, received other services	.1321427	.1474374	-1.81	0.070	.0148361	1.176971
eligible, received services	.2522724	.1907493	-1.82	0.069	.0573133	1.110411
source_DMAS#eligibility_typeDMAS						
Community-based team/PSLH #						
not eligible, received other services	7.319674	8.897224	1.64	0.102	.6758302	79.27675
Community-based team/PSLH#eligible, received services	1.508675	1.324624	0.47	0.640	.2699207	8.432476
_cons	.1351353	.0643884	-4.20	0.000	.0531122	.3438299

```
. logit hospitalization_simple source_DMAS##accessDARS, or

Iteration 0:   log likelihood = -180.81288
Iteration 1:   log likelihood = -180.58075
Iteration 2:   log likelihood = -180.58014
Iteration 3:   log likelihood = -180.58014

Logistic regression                             Number of obs     =      1,008
                                                LR chi2(3)        =       0.47
                                                Prob > chi2       =     0.9264
Log likelihood = -180.58014                     Pseudo R2         =     0.0013
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
source_DMAS						
Community-based team/PSLH	.9822454	.5059694	-0.03	0.972	.357893	2.695794
accessDARS						
yes	.9658537	.6637714	-0.05	0.960	.25115	3.714406
source_DMAS#accessDARS						
Community-based team/PSLH#yes	.8348219	.642617	-0.23	0.815	.1846581	3.774151
_cons	.0505051	.0231499	-6.51	0.000	.020567	.1240218

```
. logit hospitalization_simple i.eligibility_typeDMAS##accessDARS, or

Iteration 0:   log likelihood = -180.81288
Iteration 1:   log likelihood = -176.15167
Iteration 2:   log likelihood = -175.44548
Iteration 3:   log likelihood = -175.44525
Iteration 4:   log likelihood = -175.44525

Logistic regression                             Number of obs     =      1,008
                                                LR chi2(5)        =      10.74
                                                Prob > chi2       =     0.0569
Log likelihood = -175.44525                     Pseudo R2         =     0.0297
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
eligibility_typeDMAS						
not eligible, received other services	.6354167	.3996362	-0.72	0.471	.1852284	2.179765
eligible, received services	.3875855	.1987357	-1.85	0.065	.1418768	1.058824
accessDARS						
yes	.9123932	.5310236	-0.16	0.875	.29159	2.854903
eligibility_typeDMAS#accessDARS						
not eligible, received other services#yes	1.014497	.8502181	0.02	0.986	.1962841	5.243438
eligible, received services#yes	.6095282	.4677086	-0.65	0.519	.1354697	2.742492
_cons	.0983607	.0420841	-5.42	0.000	.0425236	.2275163

```
.
end of do-file
```

```
. do "C:\Users\wangzhe\AppData\Local\Temp\STD01000000.tmp"

. ***H9
. logit died age i.race sex rural source_DMAS i.eligibility_typeDMAS accessDARS, or

Iteration 0:   log likelihood = -586.76776
Iteration 1:   log likelihood = -552.05313
Iteration 2:   log likelihood = -551.36735
Iteration 3:   log likelihood =  -551.3666
Iteration 4:   log likelihood =  -551.3666

Logistic regression                             Number of obs     =      1,008
                                                LR chi2(11)       =      70.80
                                                Prob > chi2       =     0.0000
Log likelihood =  -551.3666                     Pseudo R2         =     0.0603
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	1.046515	.0083477	5.70	0.000	1.030281	1.063004
race						
Black/African American	.6677451	.1076157	-2.51	0.012	.4868876	.9157833
Asian	.6210466	.179457	-1.65	0.099	.3525022	1.094174
Hispanic/Latino	.5480629	.2944818	-1.12	0.263	.1911912	1.57106
Other	.3169503	.1639975	-2.22	0.026	.1149634	.8738218
sex	.6686268	.1130206	-2.38	0.017	.4800671	.9312487
rural	1.045849	.1791904	0.26	0.794	.7475301	1.46322
source_DMAS	.8431668	.1604162	-0.90	0.370	.5807225	1.224217
eligibility_typeDMAS						
not eligible, received other services	.3897157	.0949884	-3.87	0.000	.2417007	.6283735
eligible, received services	.4760667	.0951508	-3.71	0.000	.3217655	.7043626
accessDARS	.771573	.1185086	-1.69	0.091	.5710024	1.042596
_cons	.0400487	.0265775	-4.85	0.000	.010907	.1470519

```
.
end of do-file

. do "C:\Users\wangzhe\AppData\Local\Temp\STD01000000.tmp"

. ***H10
. logit died c.age##i.race, or

Iteration 0:   log likelihood = -586.76776
Iteration 1:   log likelihood = -561.99279
Iteration 2:   log likelihood = -559.76684
Iteration 3:   log likelihood = -559.58891
Iteration 4:   log likelihood =   -559.587
Iteration 5:   log likelihood =   -559.587

Logistic regression                             Number of obs     =      1,008
                                                LR chi2(9)        =      54.36
                                                Prob > chi2       =     0.0000
Log likelihood =   -559.587                     Pseudo R2         =     0.0463
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	1.049973	.0120676	4.24	0.000	1.026585	1.073893
race						
Black/African American	4.639466	5.98115	1.19	0.234	.3707728	58.05344
Asian	.0272145	.094009	-1.04	0.297	.0000312	23.72304
Hispanic/Latino	.0001254	.0010129	-1.11	0.266	1.67e-11	940.2287
Other	5.00e-11	6.38e-10	-1.86	0.063	6.71e-22	3.720166
race#c.age						
Black/African American	.9756597	.0154944	-1.55	0.121	.945759	1.006506
Asian	1.035519	.0404999	0.89	0.372	.9591065	1.118019
Hispanic/Latino	1.098766	.099149	1.04	0.297	.9206519	1.311338
Other	1.279396	.1771323	1.78	0.075	.97534	1.678238
_cons	.0094944	.0088809	-4.98	0.000	.001518	.0593836

```
. logit died c.age##source_DMAS, or

Iteration 0:   log likelihood = -586.76776
Iteration 1:   log likelihood = -571.98515
Iteration 2:   log likelihood = -571.84309
Iteration 3:   log likelihood = -571.84306

Logistic regression                             Number of obs     =      1,008
                                                LR chi2(3)        =      29.85
                                                Prob > chi2       =     0.0000
Log likelihood = -571.84306                     Pseudo R2         =     0.0254
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	1.035565	.017659	2.05	0.040	1.001526	1.070761
source_DMAS						
Community-based team/PSLH	.5140211	.7845826	-0.44	0.663	.0258071	10.23819
source_DMAS#c.age						
Community-based team/PSLH	1.005123	.0190321	0.27	0.787	.9685048	1.043127
_cons	.0265444	.0362336	-2.66	0.008	.0018284	.3853704

```
. logit died c.age##i.eligibility_typeDMAS, or

Iteration 0:   log likelihood = -586.76776
Iteration 1:   log likelihood = -561.00996
Iteration 2:   log likelihood = -560.47074
Iteration 3:   log likelihood = -560.47051
Iteration 4:   log likelihood = -560.47051

Logistic regression                             Number of obs     =      1,008
                                                LR chi2(5)        =      52.59
                                                Prob > chi2       =     0.0000
Log likelihood = -560.47051                     Pseudo R2         =     0.0448
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	1.039955	.0186281	2.19	0.029	1.004078	1.077114
eligibility_typeDMAS						
not eligible, received other services	3.035156	6.00613	0.56	0.575	.0627737	146.7521
eligible, received services	.202533	.3344373	-0.97	0.334	.0079603	5.153019
eligibility_typeDMAS#c.age						
not eligible, received other services	.9736722	.024312	-1.07	0.285	.9271687	1.022508
eligible, received services	1.009167	.0205643	0.45	0.654	.9696565	1.050288
_cons	.0316883	.0454621	-2.41	0.016	.0019042	.5273368

```
. logit died rural##eligibility_typeDMAS, or

Iteration 0:   log likelihood = -586.76776
Iteration 1:   log likelihood = -575.23864
Iteration 2:   log likelihood = -574.98045
Iteration 3:   log likelihood = -574.98044

Logistic regression                             Number of obs     =      1,008
                                                LR chi2(5)        =      23.57
                                                Prob > chi2       =     0.0003
Log likelihood = -574.98044                     Pseudo R2         =     0.0201
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
rural						
Yes	1.70088	.5721022	1.58	0.114	.8797642	3.288372
eligibility_typeDMAS						
not eligible, received other services	.4808462	.1454201	-2.42	0.015	.2658161	.8698236
eligible, received services	.6020425	.1454545	-2.10	0.036	.3749518	.9666714
rural#eligibility_typeDMAS						
Yes#not eligible, received other services	.4700917	.2322586	-1.53	0.127	.1784961	1.238045
Yes#eligible, received services	.6066513	.2403547	-1.26	0.207	.2790576	1.318817
_cons	.5689655	.1240611	-2.59	0.010	.3710942	.8723439

```
. logit died source_DMAS##i.eligibility_typeDMAS, or

Iteration 0:   log likelihood = -586.76776
Iteration 1:   log likelihood = -574.00269
Iteration 2:   log likelihood =  -573.7629
Iteration 3:   log likelihood = -573.76283
Iteration 4:   log likelihood = -573.76283

Logistic regression                             Number of obs     =      1,008
                                                LR chi2(5)        =      26.01
                                                Prob > chi2       =     0.0001
Log likelihood = -573.76283                     Pseudo R2         =     0.0222
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
source_DMAS						
Community-based team/PSLH	.8070175	.2954044	-0.59	0.558	.3938268	1.653715
eligibility_typeDMAS						
not eligible, received other services	.5144737	.2182323	-1.57	0.117	.2240246	1.181491
eligible, received services	.3409933	.1364801	-2.69	0.007	.1556175	.7471937
source_DMAS#eligibility_typeDMAS						
Community-based team/PSLH # not eligible, received other services	.58312	.2995932	-1.05	0.294	.2130251	1.596192
Community-based team/PSLH#eligible, received services	1.56718	.7137585	0.99	0.324	.6418695	3.826408
_cons	.826087	.2561001	-0.62	0.538	.4499246	1.516742

```
. logit died source_DMAS##accessDARS, or

Iteration 0:   log likelihood = -586.76776
Iteration 1:   log likelihood = -584.66034
Iteration 2:   log likelihood = -584.65728
Iteration 3:   log likelihood = -584.65728

Logistic regression                             Number of obs     =      1,008
                                                LR chi2(3)        =       4.22
                                                Prob > chi2       =     0.2386
Log likelihood = -584.65728                     Pseudo R2         =     0.0036
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
source_DMAS						
Community-based team/PSLH	.9236842	.2209028	-0.33	0.740	.5780364	1.476019
accessDARS						
yes	.8709677	.2794362	-0.43	0.667	.4644163	1.633415
source_DMAS#accessDARS						
Community-based team/PSLH#yes	.861898	.3087702	-0.41	0.678	.4270883	1.739379
_cons	.4444444	.0944263	-3.82	0.000	.2930704	.6740049

```
. logit died i.eligibility_typeDMAS##accessDARS, or

Iteration 0:   log likelihood = -586.76776
Iteration 1:   log likelihood = -573.91978
Iteration 2:   log likelihood = -573.74152
Iteration 3:   log likelihood =  -573.7415

Logistic regression                             Number of obs     =      1,008
                                                LR chi2(5)        =      26.05
                                                Prob > chi2       =     0.0001
Log likelihood =  -573.7415                     Pseudo R2         =     0.0222
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
eligibility_typeDMAS						
not eligible, received other services	.4264871	.1536657	-2.37	0.018	.2104811	.8641688
eligible, received services	.6079386	.167299	-1.81	0.071	.3545007	1.042563
accessDARS						
yes	1.088435	.3613589	0.26	0.799	.5678126	2.086413
eligibility_typeDMAS#accessDARS						
not eligible, received other services#yes	.736488	.3526602	-0.64	0.523	.2881217	1.882588
eligible, received services#yes	.6115045	.232412	-1.29	0.196	.2903267	1.28799
_cons	.675	.1681238	-1.58	0.115	.4142791	1.099802

RQ6:

```
. do "C:\Users\wangzhe\AppData\Local\Temp\STD00000000.tmp"

. zip hospitalization_count personal_care chore_home home_meals transport housing homehealth, inflate(i.eligibi
> lity_typeDMAS) vuong

Fitting constant-only model:

Iteration 0:   log likelihood = -81.349968
Iteration 1:   log likelihood = -72.055275
Iteration 2:   log likelihood = -64.891086
Iteration 3:   log likelihood = -64.012856
Iteration 4:   log likelihood = -63.968974
Iteration 5:   log likelihood = -63.968869
Iteration 6:   log likelihood = -63.968869

Fitting full model:

Iteration 0:   log likelihood = -63.968869
Iteration 1:   log likelihood = -61.208469  (not concave)
Iteration 2:   log likelihood = -59.601517  (not concave)
Iteration 3:   log likelihood = -58.892975
Iteration 4:   log likelihood = -58.272301
Iteration 5:   log likelihood = -58.152535
Iteration 6:   log likelihood = -58.152394
Iteration 7:   log likelihood = -58.152394

Zero-inflated Poisson regression               Number of obs     =        325
                                               Nonzero obs       =         12
                                               Zero obs          =        313

Inflation model = logit                        LR chi2(6)        =      11.63
Log likelihood  = -58.15239                    Prob > chi2       =     0.0707
```

hospitalization_count	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
hospitalization_count						
personal_care	.9947858	.8855185	1.12	0.261	-.7407987	2.73037
chore_home	.8393746	1.233583	0.68	0.496	-1.578404	3.257153
home_meals	-.0202653	.6380573	-0.03	0.975	-1.270835	1.230304
transport	-.1432189	.6490631	-0.22	0.825	-1.415359	1.128921
housing	2.648992	1.101627	2.40	0.016	.4898436	4.80814
homehealth	2.126392	.8363776	2.54	0.011	.4871222	3.765662
_cons	-2.219082	.8675473	-2.56	0.011	-3.919443	-.5187204
inflate						
eligibility_typeDMAS						
not eligible, received other services	-.3951685	.9112819	-0.43	0.665	-2.181248	1.390911
eligible, received services	.5186196	.8939237	0.58	0.562	-1.233439	2.270678
_cons	2.154833	.7879522	2.73	0.006	.6104747	3.69919

```
Vuong test of zip vs. standard Poisson:            z =     1.86  Pr>z = 0.0314


. ***H12
. logit died personal_care chore_home home_meals transport housing homehealth, or

Iteration 0:   log likelihood = -176.76168
Iteration 1:   log likelihood = -171.78458
Iteration 2:   log likelihood = -171.70318
Iteration 3:   log likelihood = -171.70316

Logistic regression                            Number of obs     =        325
                                               LR chi2(6)        =      10.12
                                               Prob > chi2       =     0.1198
Log likelihood = -171.70316                    Pseudo R2         =     0.0286
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
personal_care	1.592766	.4975869	1.49	0.136	.863442	2.93813
chore_home	1.025333	.3913377	0.07	0.948	.4852749	2.166417
home_meals	.672371	.2452209	-1.09	0.276	.3289779	1.374204
transport	1.55621	.5034203	1.37	0.172	.8254906	2.93376
housing	.8350847	.3104506	-0.48	0.628	.4029845	1.730504
homehealth	1.940529	.6023821	2.14	0.033	1.056061	3.565755
_cons	.2314814	.0494475	-6.85	0.000	.1522959	.3518389

```
. do "C:\Users\wangzhe\AppData\Local\Temp\STD00000000.tmp"

. ***H13
. logit hospitalization_simple personal_care##c.age, or

Iteration 0:   log likelihood = -58.366161
Iteration 1:   log likelihood = -56.846088
Iteration 2:   log likelihood = -56.765009
Iteration 3:   log likelihood = -56.764706
Iteration 4:   log likelihood = -56.764706

Logistic regression                             Number of obs     =        340
                                                LR chi2(3)        =       3.20
                                                Prob > chi2       =     0.3614
Log likelihood = -56.764706                     Pseudo R2         =     0.0274

------------------------------------------------------------------------------
hospitalization_simple | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------------+------------------------------------------------------
        personal_care  |
                  Yes  |   .1889336   .9391428    -0.34   0.737     .0000111    3216.802
                  age  |   .9425343   .0353787    -1.58   0.115     .8756825     1.01449
                       |
  personal_care#c.age  |
                  Yes  |   1.022898   .0668441     0.35   0.729     .8999289     1.16267
                       |
                _cons  |   4.157993   11.89045     0.50   0.618     .0153016    1129.877
------------------------------------------------------------------------------

. logit hospitalization_simple personal_care##sex, or

Iteration 0:   log likelihood = -58.366161
Iteration 1:   log likelihood = -58.285009
Iteration 2:   log likelihood = -58.280158
Iteration 3:   log likelihood =  -58.28015
Iteration 4:   log likelihood =  -58.28015

Logistic regression                             Number of obs     =        340
                                                LR chi2(3)        =       0.17
                                                Prob > chi2       =     0.9820
Log likelihood =  -58.28015                     Pseudo R2         =     0.0015

------------------------------------------------------------------------------
hospitalization_simple | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------------+------------------------------------------------------
        personal_care  |
                  Yes  |   1.633333    2.05766     0.39   0.697     .1382733    19.29352
                       |
                   sex |
                female |   1.020833   .8234124     0.03   0.980     .2100723    4.960676
                       |
    personal_care#sex  |
         Yes#female    |   .6297376   .9049183    -0.32   0.748     .0376706    10.52729
                       |
                _cons  |   .0408163   .0294446    -4.43   0.000     .0099262    .1678359
------------------------------------------------------------------------------

. logit hospitalization_simple personal_care##rural, or

Iteration 0:   log likelihood = -58.366161
Iteration 1:   log likelihood = -57.810038
Iteration 2:   log likelihood = -57.764243
Iteration 3:   log likelihood = -57.764119
Iteration 4:   log likelihood = -57.764119

Logistic regression                             Number of obs     =        340
                                                LR chi2(3)        =       1.20
                                                Prob > chi2       =     0.7520
Log likelihood = -57.764119                     Pseudo R2         =     0.0103

------------------------------------------------------------------------------
hospitalization_simple | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------------+------------------------------------------------------
        personal_care  |
                  Yes  |   .5681818   .6213895    -0.52   0.605     .0666154    4.846186
                       |
                 rural |
                  Yes  |   1.098901   .7242103     0.14   0.886     .3019883    3.998776
                       |
  personal_care#rural  |
              Yes#Yes  |   2.929756   3.946778     0.80   0.425     .2090008    41.06908
                       |
                _cons  |        .04   .0166533    -7.73   0.000     .0176879    .0904573
------------------------------------------------------------------------------
```

```
. logit hospitalization_simple personal_care##source_DMAS, or

note: 1.personal_care#0.source_DMAS != 0 predicts failure perfectly
      1.personal_care#0.source_DMAS dropped and 17 obs not used

note: 1.personal_care#1.source_DMAS omitted because of collinearity
Iteration 0:   log likelihood = -57.632443
Iteration 1:   log likelihood = -57.372796
Iteration 2:   log likelihood =  -57.36959
Iteration 3:   log likelihood =  -57.36959

Logistic regression                             Number of obs     =        323
                                                LR chi2(2)        =       0.53
                                                Prob > chi2       =     0.7689
Log likelihood =  -57.36959                     Pseudo R2         =     0.0046
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
personal_care						
Yes	1.514706	.9514479	0.66	0.509	.4422363	5.188028
source_DMAS						
Community-based team/PSLH	.6796116	.5514602	-0.48	0.634	.1385373	3.333919
personal_care#source_DMAS						
Yes#Acute Care Hospital/PSAC	1	(empty)				
Yes#Community-based team/PSLH	1	(omitted)				
_cons	.0571429	.0415445	-3.94	0.000	.013744	.2375802

```
.
. logit hospitalization_simple chore_home##c.age, or

Iteration 0:   log likelihood = -51.805883
Iteration 1:   log likelihood = -47.209936
Iteration 2:   log likelihood = -46.149387
Iteration 3:   log likelihood = -46.133323
Iteration 4:   log likelihood = -46.133284
Iteration 5:   log likelihood = -46.133284

Logistic regression                             Number of obs     =        337
                                                LR chi2(3)        =      11.35
                                                Prob > chi2       =     0.0100
Log likelihood = -46.133284                     Pseudo R2         =     0.1095
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
chore_home						
Yes	6.98e-09	5.99e-08	-2.19	0.029	3.48e-16	.1397679
age	.8853568	.0402974	-2.68	0.007	.8097957	.9679684
chore_home#c.age						
Yes	1.264629	.1257382	2.36	0.018	1.040712	1.536722
_cons	335.0398	1089.796	1.79	0.074	.5706403	196711.8

```
. logit hospitalization_simple chore_home##sex, or

note: 1.chore_home#0.sex != 0 predicts failure perfectly
      1.chore_home#0.sex dropped and 8 obs not used

note: 1.chore_home#1.sex omitted because of collinearity
Iteration 0:   log likelihood = -51.512258
Iteration 1:   log likelihood = -51.214138
Iteration 2:   log likelihood = -51.205083
Iteration 3:   log likelihood = -51.205074
Iteration 4:   log likelihood = -51.205074

Logistic regression                             Number of obs     =        329
                                                LR chi2(2)        =       0.61
                                                Prob > chi2       =     0.7355
Log likelihood = -51.205074                     Pseudo R2         =     0.0060
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
chore_home						
Yes	1.384127	1.132675	0.40	0.691	.2783626	6.882417
sex						
female	.5779817	.408407	-0.78	0.438	.144693	2.30877
chore_home#sex						
Yes#male	1	(empty)				
Yes#female	1	(omitted)				
_cons	.0555556	.0329539	-4.87	0.000	.0173708	.1776788

```
. logit hospitalization_simple chore_home##rural, or

note: 1.chore_home#0.rural != 0 predicts failure perfectly
      1.chore_home#0.rural dropped and 32 obs not used

note: 1.chore_home#1.rural omitted because of collinearity
Iteration 0:   log likelihood = -50.585638
Iteration 1:   log likelihood =  -50.18146
Iteration 2:   log likelihood = -50.004365
Iteration 3:   log likelihood = -50.004129
Iteration 4:   log likelihood = -50.004129

Logistic regression                             Number of obs     =        305
                                                LR chi2(2)        =       1.16
                                                Prob > chi2       =     0.5591
Log likelihood = -50.004129                     Pseudo R2         =     0.0115
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
chore_home						
Yes	2.690476	2.416144	1.10	0.270	.4628279	15.64007
rural						
Yes	.9380531	.6164126	-0.10	0.922	.2587537	3.400699
chore_home#rural						
Yes#No	1	(empty)				
Yes#Yes	1	(omitted)				
_cons	.0377358	.0156936	-7.88	0.000	.0167015	.0852612

```
. logit hospitalization_simple chore_home##source_DMAS, or

note: 1.chore_home#0.source_DMAS != 0 predicts failure perfectly
      1.chore_home#0.source_DMAS dropped and 9 obs not used

note: 1.chore_home#1.source_DMAS omitted because of collinearity
Iteration 0:   log likelihood = -51.475044
Iteration 1:   log likelihood = -51.392211
Iteration 2:   log likelihood = -51.391702
Iteration 3:   log likelihood = -51.391702

Logistic regression                             Number of obs     =        328
                                                LR chi2(2)        =       0.17
                                                Prob > chi2       =     0.9200
Log likelihood = -51.391702                     Pseudo R2         =     0.0016
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
chore_home						
Yes	1.295455	1.046125	0.32	0.749	.2661012	6.306632
source_DMAS						
Community-based team/PSLH	.7719298	.6233606	-0.32	0.749	.1585632	3.757968
chore_home#source_DMAS						
Yes#Acute Care Hospital/PSAC	1	(empty)				
Yes#Community-based team/PSLH	1	(omitted)				
_cons	.0454545	.0328636	-4.28	0.000	.0110194	.1874973

```
.
. logit hospitalization_simple home_meals##c.age, or

Iteration 0:   log likelihood = -61.612327
Iteration 1:   log likelihood = -58.287536
Iteration 2:   log likelihood = -57.861315
Iteration 3:   log likelihood = -57.858018
Iteration 4:   log likelihood = -57.858017

Logistic regression                             Number of obs     =        343
                                                LR chi2(3)        =       7.51
                                                Prob > chi2       =     0.0573
Log likelihood = -57.858017                     Pseudo R2         =     0.0609
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
home_meals						
Yes	.0005455	.0025336	-1.62	0.106	6.07e-08	4.900688
age	.9075613	.0372029	-2.37	0.018	.8374972	.9834869
home_meals#c.age						
Yes	1.110788	.0668896	1.74	0.081	.987128	1.24994
_cons	65.46487	197.5762	1.39	0.166	.17662	24264.8

```
. logit hospitalization_simple home_meals##sex,or

Iteration 0:   log likelihood = -61.612327
Iteration 1:   log likelihood = -59.979737
Iteration 2:   log likelihood = -59.764847
Iteration 3:   log likelihood = -59.764337
Iteration 4:   log likelihood = -59.764337

Logistic regression                             Number of obs     =        343
                                                LR chi2(3)        =       3.70
                                                Prob > chi2       =     0.2962
Log likelihood = -59.764337                     Pseudo R2         =     0.0300
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
home_meals						
Yes	10.8	13.73987	1.87	0.061	.8923116	130.7166
sex						
female	2.43	2.588411	0.83	0.405	.3012416	19.60187
home_meals#sex						
Yes#female	.0964506	.139223	-1.62	0.105	.0056967	1.632991
_cons	.0185185	.0186892	-3.95	0.000	.0025619	.1338607

```
. logit hospitalization_simple home_meals##rural,or

Iteration 0:   log likelihood = -61.612327
Iteration 1:   log likelihood = -60.658876
Iteration 2:   log likelihood = -60.334288
Iteration 3:   log likelihood = -60.334015
Iteration 4:   log likelihood = -60.334015

Logistic regression                             Number of obs     =        343
                                                LR chi2(3)        =       2.56
                                                Prob > chi2       =     0.4651
Log likelihood = -60.334015                     Pseudo R2         =     0.0207
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
home_meals						
Yes	.7361111	.8066158	-0.28	0.780	.0859436	6.304824
rural						
Yes	1.115789	.7346288	0.17	0.868	.3070128	4.05516
home_meals#rural						
Yes#Yes	3.396226	4.476809	0.93	0.354	.256429	44.9807
_cons	.0377358	.0156936	-7.88	0.000	.0167015	.0852612

```
. logit hospitalization_simple home_meals##source_DMAS, or

note: 1.home_meals#0.source_DMAS != 0 predicts failure perfectly
      1.home_meals#0.source_DMAS dropped and 17 obs not used

note: 1.home_meals#1.source_DMAS omitted because of collinearity
Iteration 0:   log likelihood = -60.832198
Iteration 1:   log likelihood = -59.875757
Iteration 2:   log likelihood = -59.783313
Iteration 3:   log likelihood = -59.783119
Iteration 4:   log likelihood = -59.783119

Logistic regression                             Number of obs     =        326
                                                LR chi2(2)        =       2.10
                                                Prob > chi2       =     0.3503
Log likelihood = -59.783119                     Pseudo R2         =     0.0172
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
home_meals						
Yes	2.401316	1.41476	1.49	0.137	.7567544	7.6198
source_DMAS						
Community-based team/PSLH	.6392694	.5186117	-0.55	0.581	.130359	3.134924
home_meals#source_DMAS						
Yes#Acute Care Hospital/PSAC	1	(empty)				
Yes#Community-based team/PSLH	1	(omitted)				
_cons	.0571429	.0415445	-3.94	0.000	.013744	.2375802

```
.
. logit hospitalization_simple homehealth##c.age, or

Iteration 0:   log likelihood = -61.295996
Iteration 1:   log likelihood = -60.649843
Iteration 2:   log likelihood = -56.851293
Iteration 3:   log likelihood = -56.817787
Iteration 4:   log likelihood = -56.817719
Iteration 5:   log likelihood = -56.817719

Logistic regression                             Number of obs     =        336
                                                LR chi2(3)        =       8.96
                                                Prob > chi2       =     0.0299
Log likelihood = -56.817719                     Pseudo R2         =     0.0731
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
homehealth						
Yes	23589.85	140042	1.70	0.090	.2087062	2.67e+09
age	.980971	.03554	-0.53	0.596	.9137294	1.053161
homehealth#c.age						
Yes	.881503	.0725126	-1.53	0.125	.7502462	1.035723
_cons	.1623247	.4668884	-0.63	0.527	.0005782	45.56836

```
. logit hospitalization_simple homehealth##sex, or

Iteration 0:   log likelihood = -61.295996
Iteration 1:   log likelihood = -60.136803
Iteration 2:   log likelihood =  -59.44968
Iteration 3:   log likelihood = -59.444176
Iteration 4:   log likelihood = -59.444172

Logistic regression                             Number of obs     =        336
                                                LR chi2(3)        =       3.70
                                                Prob > chi2       =     0.2953
Log likelihood = -59.444172                     Pseudo R2         =     0.0302
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
homehealth						
Yes	7.000012	8.831774	1.54	0.123	.5904118	82.99322
sex						
female	1.89372	2.030999	0.60	0.552	.2314243	15.49611
homehealth#sex						
Yes#female	.2899155	.409107	-0.88	0.380	.018244	4.607055
_cons	.0204082	.0206154	-3.85	0.000	.0028181	.1477908

```
. logit hospitalization_simple homehealth##rural, or

Iteration 0:   log likelihood = -61.295996
Iteration 1:   log likelihood = -60.643399
Iteration 2:   log likelihood = -58.405108
Iteration 3:   log likelihood = -58.391486
Iteration 4:   log likelihood = -58.391475
Iteration 5:   log likelihood = -58.391475

Logistic regression                             Number of obs     =        336
                                                LR chi2(3)        =       5.81
                                                Prob > chi2       =     0.1213
Log likelihood = -58.391475                     Pseudo R2         =     0.0474
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
homehealth						
Yes	.7878788	.8642926	-0.22	0.828	.0917704	6.764197
rural						
Yes	.78	.5605212	-0.35	0.730	.1907246	3.189939
homehealth#rural						
Yes#Yes	6.610577	8.814562	1.42	0.157	.4844453	90.2057
_cons	.0384615	.016001	-7.83	0.000	.0170179	.0869256

```
. logit hospitalization_simple homehealth##source_DMAS, or

Iteration 0:   log likelihood = -61.295996
Iteration 1:   log likelihood = -59.985795
Iteration 2:   log likelihood = -59.749769
Iteration 3:   log likelihood = -59.749517
Iteration 4:   log likelihood = -59.749517

Logistic regression                             Number of obs     =        336
                                                LR chi2(3)        =       3.09
                                                Prob > chi2       =     0.3775
Log likelihood = -59.749517                     Pseudo R2         =     0.0252
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
homehealth						
Yes	4.555556	6.657195	1.04	0.299	.2598067	79.87895
source_DMAS						
Community-based team/PSLH	1.525581	1.638876	0.39	0.694	.1857894	12.52708
homehealth#source_DMAS						
Yes#Community-based team/PSLH	.5267313	.8300004	-0.41	0.684	.024005	11.55782
_cons	.0243902	.0246859	-3.67	0.000	.003355	.177311

```
.
. logit hospitalization_simple transport##c.age, or

Iteration 0:   log likelihood =  -58.32405
Iteration 1:   log likelihood =  -57.17671
Iteration 2:   log likelihood = -56.812384
Iteration 3:   log likelihood = -56.811774
Iteration 4:   log likelihood = -56.811774

Logistic regression                             Number of obs     =        339
                                                LR chi2(3)        =       3.02
                                                Prob > chi2       =     0.3879
Log likelihood = -56.811774                     Pseudo R2         =     0.0259
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
transport						
Yes	21.80034	111.5508	0.60	0.547	.0009614	494311.4
age	.9712242	.0346981	-0.82	0.414	.9055436	1.041669
transport#c.age						
Yes	.9665489	.0655215	-0.50	0.616	.8462948	1.103891
_cons	.3642543	1.020906	-0.36	0.719	.0014987	88.5301

```
. logit hospitalization_simple transport##sex, or

Iteration 0:   log likelihood =  -58.32405
Iteration 1:   log likelihood = -57.811641
Iteration 2:   log likelihood = -57.718313
Iteration 3:   log likelihood = -57.718146
Iteration 4:   log likelihood = -57.718146

Logistic regression                             Number of obs     =        339
                                                LR chi2(3)        =       1.21
                                                Prob > chi2       =     0.7502
Log likelihood = -57.718146                     Pseudo R2         =     0.0104
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
transport						
Yes	2.55	3.245227	0.74	0.462	.210508	30.88956
sex						
female	.9015152	.7365525	-0.13	0.899	.1817722	4.471142
transport#sex						
Yes#female	.6722689	.9584647	-0.28	0.781	.0411122	10.99297
_cons	.0392157	.0282682	-4.49	0.000	.0095473	.1610788

```
. logit hospitalization_simple transport##rural, or

Iteration 0:   log likelihood =  -58.32405
Iteration 1:   log likelihood = -57.630671
Iteration 2:   log likelihood = -57.327143
Iteration 3:   log likelihood = -57.325904
Iteration 4:   log likelihood = -57.325904

Logistic regression                             Number of obs     =        339
                                                LR chi2(3)        =       2.00
                                                Prob > chi2       =     0.5732
Log likelihood = -57.325904                     Pseudo R2         =     0.0171
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
transport						
Yes	1.758621	1.371192	0.72	0.469	.3814984	8.10684
rural						
Yes	1.504425	1.027207	0.60	0.550	.3946194	5.735385
transport#rural						
Yes#Yes	1.427887	1.672721	0.30	0.761	.1437276	14.18559
_cons	.0294118	.0149206	-6.95	0.000	.010882	.0794942

```
. logit hospitalization_simple housing##source_DMAS, or

note: 1.housing#0.source_DMAS != 0 predicts failure perfectly
      1.housing#0.source_DMAS dropped and 9 obs not used

note: 1.housing#1.source_DMAS omitted because of collinearity
Iteration 0:   log likelihood = -57.808575
Iteration 1:   log likelihood = -56.645706
Iteration 2:   log likelihood =  -56.42216
Iteration 3:   log likelihood = -56.422092
Iteration 4:   log likelihood = -56.422092

Logistic regression                             Number of obs     =        327
                                                LR chi2(2)        =       2.77
                                                Prob > chi2       =     0.2500
Log likelihood = -56.422092                     Pseudo R2         =     0.0240
```

hospitalization_simple	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
housing						
Yes	2.857143	1.728525	1.74	0.083	.8729088	9.351796
source_DMAS						
Community-based team/PSLH	.6967593	.570638	-0.44	0.659	.1399453	3.469024
housing#source_DMAS						
Yes#Acute Care Hospital/PSAC	1	(empty)				
Yes#Community-based team/PSLH	1	(omitted)				
_cons	.0465116	.0336448	-4.24	0.000	.0112676	.1919952

```
. do "C:\Users\wangzhe\AppData\Local\Temp\STD00000000.tmp"

. ***H14
. logit died personal_care##c.age, or

Iteration 0:   log likelihood = -185.50216
Iteration 1:   log likelihood = -181.50946
Iteration 2:   log likelihood = -181.40775
Iteration 3:   log likelihood = -181.40775

Logistic regression                             Number of obs     =        340
                                                LR chi2(3)        =       8.19
                                                Prob > chi2       =     0.0423
Log likelihood = -181.40775                     Pseudo R2         =     0.0221
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
personal_care						
Yes	.2529301	.5897946	-0.59	0.556	.002619	24.42717
age	1.023718	.0171999	1.40	0.163	.9905559	1.05799
personal_care#c.age						
Yes	1.022907	.0292835	0.79	0.429	.9670932	1.081943
_cons	.0413655	.0568175	-2.32	0.020	.002802	.610668

```
. logit died personal_care##sex, or

Iteration 0:   log likelihood = -185.50216
Iteration 1:   log likelihood = -183.49831
Iteration 2:   log likelihood = -183.45968
Iteration 3:   log likelihood = -183.45967

Logistic regression                             Number of obs     =        340
                                                LR chi2(3)        =       4.08
                                                Prob > chi2       =     0.2524
Log likelihood = -183.45967                     Pseudo R2         =     0.0110
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
personal_care						
Yes	3.224998	2.077365	1.82	0.069	.9124992	11.39794
sex						
female	1.605518	.6744865	1.13	0.260	.7047272	3.657711
personal_care#sex						
Yes#female	.3917306	.2803059	-1.31	0.190	.0963615	1.592471
_cons	.1860467	.0716354	-4.37	0.000	.0874733	.3957022

```
. logit died personal_care##rural, or

Iteration 0:   log likelihood = -185.50216
Iteration 1:   log likelihood = -184.21634
Iteration 2:   log likelihood = -184.20573
Iteration 3:   log likelihood = -184.20573

Logistic regression                             Number of obs     =        340
                                                LR chi2(3)        =       2.59
                                                Prob > chi2       =     0.4587
Log likelihood = -184.20573                     Pseudo R2         =     0.0070
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
personal_care						
Yes	1.257143	.4876552	0.59	0.555	.5877561	2.688884
rural						
Yes	.8642857	.2768756	-0.46	0.649	.4612892	1.619353
personal_care#rural						
Yes#Yes	1.484849	.8412995	0.70	0.485	.489103	4.507793
_cons	.2892562	.055516	-6.46	0.000	.1985703	.4213578

```
. logit died personal_care##source_DMAS, or

Iteration 0:   log likelihood = -185.50216
Iteration 1:   log likelihood =  -183.3648
Iteration 2:   log likelihood = -183.34569
Iteration 3:   log likelihood = -183.34569

Logistic regression                             Number of obs     =        340
                                                LR chi2(3)        =       4.31
                                                Prob > chi2       =     0.2296
Log likelihood = -183.34569                     Pseudo R2         =     0.0116
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
personal_care						
Yes	.5785715	.425869	-0.74	0.457	.1367141	2.448504
source_DMAS						
Community-based team/PSLH	.6988235	.2844192	-0.88	0.379	.3147248	1.551687
personal_care#source_DMAS						
Yes#Community-based team/PSLH	3.13452	2.496414	1.43	0.151	.658039	14.93105
_cons	.3703704	.1371056	-2.68	0.007	.1792809	.7651356

```
. logit died chore_home##c.age, or

Iteration 0:   log likelihood = -183.51799
Iteration 1:   log likelihood =   -181.535
Iteration 2:   log likelihood = -181.52461
Iteration 3:   log likelihood = -181.52461

Logistic regression                             Number of obs     =        337
                                                LR chi2(3)        =       3.99
                                                Prob > chi2       =     0.2629
Log likelihood = -181.52461                     Pseudo R2         =     0.0109
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
chore_home						
Yes	4.779618	14.7613	0.51	0.612	.0112345	2033.438
age	1.028952	.0152726	1.92	0.055	.9994491	1.059325
chore_home#c.age						
Yes	.9820798	.0368122	-0.48	0.630	.9125158	1.056947
_cons	.0303497	.0367051	-2.89	0.004	.002836	.3247904

```
. logit died chore_home##sex, or

Iteration 0:   log likelihood = -183.51799
Iteration 1:   log likelihood = -183.15335
Iteration 2:   log likelihood = -183.15211
Iteration 3:   log likelihood = -183.15211

Logistic regression                             Number of obs     =        337
                                                LR chi2(3)        =       0.73
                                                Prob > chi2       =     0.8657
Log likelihood = -183.15211                     Pseudo R2         =     0.0020
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
chore_home						
Yes	1.393939	1.230553	0.38	0.707	.2470662	7.864561
sex						
female	1.320574	.4888171	0.75	0.453	.6392729	2.727968
chore_home#sex						
Yes#female	.778882	.7452831	-0.26	0.794	.1193957	5.081063
_cons	.2391304	.0802596	-4.26	0.000	.123864	.4616624

```
. logit died chore_home##rural, or

Iteration 0:   log likelihood = -183.51799
Iteration 1:   log likelihood = -182.71065
Iteration 2:   log likelihood = -182.70277
Iteration 3:   log likelihood = -182.70277

Logistic regression                             Number of obs     =        337
                                                LR chi2(3)        =       1.63
                                                Prob > chi2       =     0.6525
Log likelihood = -182.70277                     Pseudo R2         =     0.0044
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
chore_home						
Yes	1.572482	.6676922	1.07	0.286	.6841581	3.614221
rural						
Yes	1.088369	.3112618	0.30	0.767	.621358	1.906385
chore_home#rural						
Yes#Yes	.4255522	.3097704	-1.17	0.241	.1021742	1.772411
_cons	.2890625	.0539545	-6.65	0.000	.2004989	.4167461

```
. logit died chore_home##source_DMAS, or

Iteration 0:   log likelihood = -183.51799
Iteration 1:   log likelihood = -183.26925
Iteration 2:   log likelihood = -183.26553
Iteration 3:   log likelihood = -183.26553

Logistic regression                             Number of obs     =        337
                                                LR chi2(3)        =       0.50
                                                Prob > chi2       =     0.9178
Log likelihood = -183.26553                     Pseudo R2         =     0.0014
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
chore_home						
Yes	1.590909	1.252158	0.59	0.555	.3401649	7.440486
source_DMAS						
Community-based team/PSLH	.9440559	.3576135	-0.15	0.879	.4493223	1.983524
chore_home#source_DMAS						
Yes#Community-based team/PSLH	.6658201	.5815831	-0.47	0.641	.1201838	3.688652
_cons	.3142857	.1086359	-3.35	0.001	.1596242	.6188004

```
. logit died home_meals##c.age, or

Iteration 0:   log likelihood = -188.65074
Iteration 1:   log likelihood = -186.56328
Iteration 2:   log likelihood =   -186.553
Iteration 3:   log likelihood =   -186.553

Logistic regression                             Number of obs     =        343
                                                LR chi2(3)        =       4.20
                                                Prob > chi2       =     0.2411
Log likelihood =   -186.553                     Pseudo R2         =     0.0111
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
home_meals						
Yes	.6265222	1.53158	-0.19	0.848	.0052013	75.46783
age	1.025857	.0160942	1.63	0.104	.9947924	1.057891
home_meals#c.age						
Yes	1.00527	.0302626	0.17	0.861	.9476721	1.066368
_cons	.0408045	.0523365	-2.49	0.013	.0033033	.5040483

```
. logit died home_meals##sex,or

Iteration 0:   log likelihood = -188.65074
Iteration 1:   log likelihood = -188.24489
Iteration 2:   log likelihood = -188.24398
Iteration 3:   log likelihood = -188.24398

Logistic regression                             Number of obs     =        343
                                                LR chi2(3)        =       0.81
                                                Prob > chi2       =     0.8462
Log likelihood = -188.24398                     Pseudo R2         =     0.0022
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
home_meals						
Yes	1.333333	.9960641	0.39	0.700	.3083545	5.76537
sex						
female	1.358974	.5065066	0.82	0.411	.6545727	2.8214
home_meals#sex						
Yes#female	.6367925	.5209478	-0.55	0.581	.1281286	3.164825
_cons	.25	.084275	-4.11	0.000	.1291219	.4840386

```
. logit died home_meals##rural,or

Iteration 0:   log likelihood = -188.65074
Iteration 1:   log likelihood = -188.31852
Iteration 2:   log likelihood = -188.31692
Iteration 3:   log likelihood = -188.31692

Logistic regression                             Number of obs     =        343
                                                LR chi2(3)        =       0.67
                                                Prob > chi2       =     0.8808
Log likelihood = -188.31692                     Pseudo R2         =     0.0018
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
home_meals						
Yes	.7291667	.3335015	-0.69	0.490	.2975157	1.787079
rural						
Yes	1	.2966479	-0.00	1.000	.5591043	1.788575
home_meals#rural						
Yes#Yes	1.520737	.9464774	0.67	0.501	.4490378	5.150217
_cons	.32	.0581309	-6.27	0.000	.2241411	.456855

```
. logit died home_meals##source_DMAS, or

Iteration 0:   log likelihood = -188.65074
Iteration 1:   log likelihood = -188.35687
Iteration 2:   log likelihood = -188.35585
Iteration 3:   log likelihood = -188.35585

Logistic regression                             Number of obs     =        343
                                                LR chi2(3)        =       0.59
                                                Prob > chi2       =     0.8988
Log likelihood = -188.35585                     Pseudo R2         =     0.0016
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
home_meals						
Yes	1.296296	.8501952	0.40	0.692	.3584521	4.687891
source_DMAS						
Community-based team/PSLH	.994832	.4111692	-0.01	0.990	.4425311	2.236432
home_meals#source_DMAS						
Yes#Community-based team/PSLH	.6400424	.4753088	-0.60	0.548	.1493099	2.74365
_cons	.3214286	.1231644	-2.96	0.003	.1516781	.6811554

```
. logit died homehealth##c.age, or

Iteration 0:   log likelihood = -182.06249
Iteration 1:   log likelihood = -172.28417
Iteration 2:   log likelihood = -171.93062
Iteration 3:   log likelihood = -171.92965
Iteration 4:   log likelihood = -171.92965

Logistic regression                             Number of obs     =        336
                                                LR chi2(3)        =      20.27
                                                Prob > chi2       =     0.0001
Log likelihood = -171.92965                     Pseudo R2         =     0.0557
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
homehealth						
Yes	3483.887	9023.953	3.15	0.002	21.74124	558269.2
age	1.064458	.0187588	3.54	0.000	1.028319	1.101867
homehealth#c.age						
Yes	.9112975	.0298272	-2.84	0.005	.854673	.9716735
_cons	.0015253	.0022571	-4.38	0.000	.0000839	.0277273

```
. logit died homehealth##sex, or

Iteration 0:   log likelihood = -182.06249
Iteration 1:   log likelihood = -178.61619
Iteration 2:   log likelihood = -178.54219
Iteration 3:   log likelihood = -178.54215
Iteration 4:   log likelihood = -178.54215

Logistic regression                             Number of obs     =        336
                                                LR chi2(3)        =       7.04
                                                Prob > chi2       =     0.0706
Log likelihood = -178.54215                     Pseudo R2         =     0.0193
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
homehealth						
Yes	2.792208	1.887628	1.52	0.129	.7421753	10.50483
sex						
female	1.718537	.7556523	1.23	0.218	.7259054	4.068534
homehealth#sex						
Yes#female	.6756391	.5077015	-0.52	0.602	.1549134	2.946733
_cons	.1627907	.0663485	-4.45	0.000	.0732328	.3618707

```
. logit died homehealth##rural, or

Iteration 0:   log likelihood = -182.06249
Iteration 1:   log likelihood =  -178.5331
Iteration 2:   log likelihood = -178.41543
Iteration 3:   log likelihood = -178.41542

Logistic regression                             Number of obs     =        336
                                                LR chi2(3)        =       7.29
                                                Prob > chi2       =     0.0631
Log likelihood = -178.41542                     Pseudo R2         =     0.0200
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
homehealth						
Yes	1.306286	.5657236	0.62	0.537	.5589868	3.052635
rural						
Yes	.8207483	.2608144	-0.62	0.534	.4402692	1.530036
homehealth#rural						
Yes#Yes	2.307577	1.392626	1.39	0.166	.7070576	7.531087
_cons	.2755906	.0526121	-6.75	0.000	.1895676	.4006495

```
. logit died homehealth##source_DMAS, or

Iteration 0:   log likelihood = -182.06249
Iteration 1:   log likelihood = -177.29521
Iteration 2:   log likelihood = -177.15691
Iteration 3:   log likelihood = -177.15663
Iteration 4:   log likelihood = -177.15663

Logistic regression                             Number of obs     =        336
                                                LR chi2(3)        =       9.81
                                                Prob > chi2       =     0.0202
Log likelihood = -177.15663                     Pseudo R2         =     0.0269
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
homehealth						
Yes	.3131313	.3478829	-1.05	0.296	.0354861	2.76309
source_DMAS						
Community-based team/PSLH	.6732323	.2624557	-1.01	0.310	.313566	1.445443
homehealth#source_DMAS						
Yes#Community-based team/PSLH	8.091365	9.341528	1.81	0.070	.8419856	77.75689
_cons	.3548387	.1245313	-2.95	0.003	.1783612	.7059301

```
. logit died transport##c.age, or

Iteration 0:   log likelihood = -184.05043
Iteration 1:   log likelihood = -180.26178
Iteration 2:   log likelihood = -180.21689
Iteration 3:   log likelihood = -180.21687

Logistic regression                             Number of obs     =        339
                                                LR chi2(3)        =       7.67
                                                Prob > chi2       =     0.0534
Log likelihood = -180.21687                     Pseudo R2         =     0.0208
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
transport						
Yes	3.729062	9.772364	0.50	0.616	.0219252	634.2418
age	1.038768	.0164403	2.40	0.016	1.007041	1.071496
transport#c.age						
Yes	.9882452	.0323084	-0.36	0.718	.9269081	1.053641
_cons	.0128258	.0168327	-3.32	0.001	.0009794	.1679601

```
. logit died transport##sex, or

Iteration 0:   log likelihood = -184.05043
Iteration 1:   log likelihood =  -182.3771
Iteration 2:   log likelihood = -182.34406
Iteration 3:   log likelihood = -182.34404

Logistic regression                             Number of obs     =        339
                                                LR chi2(3)        =       3.41
                                                Prob > chi2       =     0.3323
Log likelihood = -182.34404                     Pseudo R2         =     0.0093
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
transport						
Yes	3.214282	2.362178	1.59	0.112	.7612639	13.57165
sex						
female	1.766825	.7370867	1.36	0.172	.7799877	4.002202
transport#sex						
Yes#female	.3428575	.2746466	-1.34	0.181	.0713275	1.648049
_cons	.177778	.0682126	-4.50	0.000	.0838062	.3771205

```
. logit died transport##rural, or

Iteration 0:   log likelihood = -184.05043
Iteration 1:   log likelihood = -183.23467
Iteration 2:   log likelihood = -183.21913
Iteration 3:   log likelihood = -183.21912

Logistic regression                             Number of obs     =        339
                                                LR chi2(3)        =       1.66
                                                Prob > chi2       =     0.6453
Log likelihood = -183.21912                     Pseudo R2         =     0.0045
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
transport						
Yes	1.146564	.4131421	0.38	0.704	.5658277	2.323337
rural						
Yes	.9936886	.2993684	-0.02	0.983	.5505655	1.79346
transport#rural						
Yes#Yes	1.66177	1.049615	0.80	0.421	.4818715	5.73074
_cons	.2844037	.0578902	-6.18	0.000	.1908418	.423835

```
. logit died transport##source_DMAS, or

Iteration 0:   log likelihood = -184.05043
Iteration 1:   log likelihood = -183.47265
Iteration 2:   log likelihood = -183.46702
Iteration 3:   log likelihood = -183.46701

Logistic regression                             Number of obs     =        339
                                                LR chi2(3)        =       1.17
                                                Prob > chi2       =     0.7610
Log likelihood = -183.46701                     Pseudo R2         =     0.0032
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
transport						
Yes	1.65	1.172897	0.70	0.481	.4096474	6.645961
source_DMAS						
Community-based team/PSLH	.9232143	.3664265	-0.20	0.840	.42409	2.009773
transport#source_DMAS						
Yes#Community-based team/PSLH	.7645921	.5960364	-0.34	0.731	.1659118	3.523566
_cons	.3030303	.1093864	-3.31	0.001	.1493563	.6148209

```
. logit died housing##c.age, or

Iteration 0:   log likelihood = -182.06249
Iteration 1:   log likelihood = -179.09744
Iteration 2:   log likelihood = -179.05807
Iteration 3:   log likelihood = -179.05803
Iteration 4:   log likelihood = -179.05803

Logistic regression                             Number of obs     =        336
                                                LR chi2(3)        =       6.01
                                                Prob > chi2       =     0.1112
Log likelihood = -179.05803                     Pseudo R2         =     0.0165
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
housing						
Yes	.1506828	.4507298	-0.63	0.527	.0004285	52.99313
age	1.028013	.0155405	1.83	0.068	.9980012	1.058928
housing#c.age						
Yes	1.021887	.0374399	0.59	0.555	.9510787	1.097966
_cons	.0336723	.0417313	-2.74	0.006	.0029672	.382118

```
. logit died housing##sex, or

Iteration 0:   log likelihood = -182.06249
Iteration 1:   log likelihood = -181.30352
Iteration 2:   log likelihood = -181.29707
Iteration 3:   log likelihood = -181.29707

Logistic regression                             Number of obs     =        336
                                                LR chi2(3)        =       1.53
                                                Prob > chi2       =     0.6752
Log likelihood = -181.29707                     Pseudo R2         =     0.0042
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
housing						
Yes	.6153848	.5155746	-0.58	0.562	.119125	3.179
sex						
female	1.317073	.509447	0.71	0.476	.6171108	2.810973
housing#sex						
Yes#female	1.444444	1.319326	0.40	0.687	.2411184	8.653085
_cons	.25	.0883883	-3.92	0.000	.1250244	.4999024

```
. logit died housing##rural, or

note: 1.housing#1.rural != 0 predicts failure perfectly
      1.housing#1.rural dropped and 9 obs not used

Iteration 0:   log likelihood = -179.64792
Iteration 1:   log likelihood = -179.49065
Iteration 2:   log likelihood = -179.49058
Iteration 3:   log likelihood = -179.49058

Logistic regression                             Number of obs     =        327
                                                LR chi2(2)        =       0.31
                                                Prob > chi2       =     0.8544
Log likelihood = -179.49058                     Pseudo R2         =     0.0009
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
housing						
Yes	1.073835	.3949242	0.19	0.846	.5222655	2.207923
rural						
Yes	1.17426	.3366998	0.56	0.575	.6694162	2.059835
housing#rural						
Yes#Yes	1	(empty)				
_cons	.2897196	.0590942	-6.07	0.000	.1942487	.4321134

```
. logit died housing##source_DMAS, or

Iteration 0:   log likelihood = -182.06249
Iteration 1:   log likelihood = -181.47037
Iteration 2:   log likelihood = -181.45871
Iteration 3:   log likelihood =  -181.4587

Logistic regression                             Number of obs     =        336
                                                LR chi2(3)        =       1.21
                                                Prob > chi2       =     0.7512
Log likelihood =  -181.4587                     Pseudo R2         =     0.0033
```

died	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
housing						
Yes	.3437537	.3825759	-0.96	0.337	.0388074	3.044951
source_DMAS						
Community-based team/PSLH	.8362573	.3114596	-0.48	0.631	.4030087	1.735264
housing#source_DMAS						
Yes#Community-based team/PSLH	2.703528	3.155572	0.85	0.394	.2744126	26.63531
_cons	.3636364	.1225818	-3.00	0.003	.1878137	.7040561

```
.
end of do-file

.
```

Appendix B

Script for Consent

Hello, my name is Raven Weaver. I am a student at Virginia Tech working on a research project about older adults' service needs. I sent you a letter about a week ago inviting you to participate in a research project that I am working on with the Department of Medical Assistance Services. Did you receive the letter?

If no, describe study.

If yes proceed . . .

We received your contact information from the Department of Medical Assistance Services. I understand that you applied for services and supports through the Medicaid Elderly and Disabled Consumer-Direction waiver program but were not considered eligible. I am calling about 20 individuals like you that were ineligible to receive services through the waiver program to talk about your experiences managing everyday activities.

I am interested in how you are taking care of yourself without those services. My questions will take about 30 minutes, depending on how much you want to tell me. Would you be willing to be interviewed about your care needs?

Is now a good time to talk or would you like to schedule this interview for another time?

To determine your eligibility for the study, may I ask you two brief questions?

If no, thank them for their time and end the call.

If yes proceed, ask:

1. *In the past two years, have you applied for assistance through the Department of Medical Assistance Services?*
2. *Do you currently live in <rural county>?*

<Go over procedures (ask/provide time for them to find their copy to simultaneously review), obtain consent, ask about recording interview>

To summarize, we are asking you to spend about 30 minutes answering questions about your experience of managing your needs after being ineligible for formal assistance through Medicaid EDCD waiver program and how it affects your health, well-being, and quality of life. Do you have any questions?

Script for Interviews

1. *How are you doing today?*

2. *Why did you initially apply for help?*
    a. If someone other than the participant initiated seeking help (e.g., daughter, spouse)
        i. *Did you think you needed help?*
        ii. *Why would your daughter want to get you help?*

3. *Next, let's talk about common daily activities we all do. Do you have difficulty with . . . [ask about highlighted tasks below]. Are there other activities that you have trouble with or need help to do?*

	Trouble			**What makes it difficult?**	**How do you get these things done (i.e., manage [task] by yourself)?**	**Receive Help?**		**Who provides help?**	**How do they help?**	**How long have they been helping?**	**Is help adequate/ sufficient ?**	
	None	Some	A lot	If some/a lot:	*What are you currently doing to get these things done?* *Have you changed your daily routine to make things easier for you?* *Have you made any changes around your home to help make things easier for you?* *Are you using mobility aids, personal alarms, assistance from others, etc.?*	Yes	No	*spouse, adult child, friend, neighbor, other relative* *Do you have other family living nearby?*	*What do they do to help? Do they arrange for others to help you? Pay for someone to help you?*	*weeks, months, years*	Yes	No
Bathing												
Getting dressed												
Using the bathroom												
Getting in /out of the bed or a chair												
Bathroom accidents												
Eating by yourself												
Mobility												

	Trouble			**What makes it difficult?**	**Well, how do you manage it by yourself? What types of changes have you made?**	**Receive Help?**		**Who provides help?**	**How do they help?**	**How long have they been helping?**	**Is help adequate/ sufficient?**	
	None	Some	A lot	If some/a lot:	*What are you currently doing to get these things done?* *Have you changed your daily routine to make things easier for you?* *Have you made any changes around your home to help make things easier for you?* *Are you using mobility aids, personal alarms, assistance from others, etc.?*	Yes	No	*spouse, adult child, friend, neighbor, other relative* *Do you have other family living nearby?*	*What do they do to help? Do they arrange for others to help you? Pay for someone to help you?*	*weeks, months, years*	Yes	No
Making something to eat												
Using the phone												
Going shopping												
Doing laundry												
Cleaning the house												
Driving (or, going places)												
Taking your medications												
Paying your bills												
Home maintenance												

4. *Of all the problems you are having, if you could get help with one of them, what would it be?*
    a. *What would be different if you had help with* _ [response] __?

    b. *Can you tell me how you decided that this specific problem was most important?*

    c. *What is the most you would be able to pay each month out of your own pocket for this help?*

5. *What could happen that would make you have to move from your home?*
    a. *Where would you go?*
        i. Would these arrangements work?

    b. *Have you made any specific plans or decisions about what you would do?*
        i. Have you talked to [caregiver] *about these plans?*

6. *What advice would you give others to help them manage their everyday lives if they do not have help from services in the community? What would you tell them NOT to do?*

7. [Multidimensional scale of perceived social support]
I'm going to read a few statements regarding your interactions with others. Tell me if you strongly agree, agree, disagree, or strongly disagree with the statement.

There is a special person around when I am in need.	Strongly agree	Agree	Disagree	Strongly disagree
My family really tries to help me.	Strongly agree	Agree	Disagree	Strongly disagree
I get the emotional help and support I need from my family and friends.	Strongly agree	Agree	Disagree	Strongly disagree
My friends really try to help me.	Strongly agree	Agree	Disagree	Strongly disagree

8. *How would you rate your overall Quality of Life? Is it*
    Excellent *Good* *Fair* *Poor*

    If Fair/Poor ask: *What would have to happen for you to be able to rate your quality of life*

    Good or Excellent?

9. Loneliness
The next set of questions is about you. Remember, there are no right tor wrong answers. How often do you …Would you say [responses]

feel that you lack companionship	hardly ever/ never	some of the time	often
feel left out?	hardly ever/ never	some of the time	often
feel isolated from others	hardly ever/ never	some of the time	often

10. *Now I would like you to think about the past week. Tell me how often you . . . [first question]. Would you say rarely, sometimes, occasionally, or all the time?*

		Rarely or None of the Time (< 1 day) (0)	Some or a little of the Time (1-2 days) (1)	Occasional or a moderate amount of time (3-4 days) (2)	All of t time (5-7 day (3)
1	How often were you bothered by things that don't usually bother you? Was it…	0	1	2	3
2	How often did you have trouble keeping your mind on what you were doing? Would you say…	0	1	2	3
3	How often did you feel depressed? Would you say…	0	1	2	3
4	How often did you feel that everything you did took effort? Was it…	0	1	2	3
5	How often did you feel hopeful about the future? Would you say…	0	1	2	3
6	How often did you felt fearful? Would you say …	0	1	2	3
7	How often was your sleep restless?	0	1	2	3
8	How often were you happy?	0	1	2	3
9	How often did you feel lonely?	0	1	2	3
10	How often did you feel like you could not "get going"? Would you say…	0	1	2	3

11. *We're almost done. I just want to make sure I have the right information.*
    a. *I have that you are___<years>__ years old. Is that correct? _____*

    b. *Are you married?*
       Married Widowed Divorced Never married

    c. *Do you live with anyone?*
       With Spouse Alone With Spouse + Other Other

    d. *Race*
       White Black/African-American Asian Hispanic Other

Is there anything else you think I should know to help me understand how you manage to take care of yourself?

Thank you for talking with me. The information you shared will help us understand of how individuals take care of themselves without services.

Before you go, **<confirm mailing address so I can send gift card in appreciation>.**

Appendix C

Journal Guidelines

Submission guidelines for the *Journal of Aging and Health* (https://us.sagepub.com/en-us/nam/journal-of-aging-and-health/journal200849#submission-guidelines)

This journal is a member of the Committee on Publication Ethics (COPE).

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Government report:
3. National Center for Health Statistics. Health, United States, 1989. (DHHS Pub. no. [PHS] 90-1232.) Hyattsville, MD: U.S. Public Health Service, 1990.

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4. Hinman AR. Progress over the last decade. In: Proceedings of the 24th Immunization Conference, Orlando (FL), May 21-5, 1990:17-20. Atlanta: Centers for Disease Control, 1990.

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