THE EFFECTS OF PARTNERED RELATIONS ON PREVENTABLE HEALTH BEHAVIOR AND HEALTH OUTCOMES IN RETIRED AND SEMI-RETIRED ADULTS FROM THE HEALTH AND RETIREMENT STUDY.

by
ZIRKA T. SMITH
(Under the Direction of Toni Miles)

ABSTRACT

Introduction: There are a number of challenges associated with marital status in older adults. Fewer studies have been conducted to investigate the association between social relationships that include partner status and health behaviors among older adults. This study is designed to define and assess the association of health behavior and outcomes of adult relationships. With an expanded definition of adult pairs, we test its potential for promoting health. We define health in two ways. Health is measured by the absence of chronic disease. Prevention is another measure of health in our study operationalized as being physically active, being a non-smoker, and partaking in yearly health exams. Methods: This research consists of a secondary analysis of cross-sectional data from the Health and Retirement Study (HRS) from the 2014 wave of the survey. For analysis purposes, we focused on those individuals who were self-respondents of the study, did not live in a nursing home or assisted living facility, and did not have missing answers for the relationship status questions and variables included in each outcome. Of the possible 18,748 survey responses, for the first analysis 4,163 participants were included in the first analysis and 16,622 in the second analysis. Results: The results of this study found the magnitude of the association between partnership and marriage with preventable health behavior remained different. Partnered women have a 56% lower odds of adopting moderate

preventable health behavior compared to their married counterpart (OR=0.44; 95% CI 0.24, 0.81). Additionally partnered men and women are 23% and 39% times less likely to adopt best preventable health behavior respectively (OR 0.39; 95% CI 0.19, 0.82 and OR=0.23; 95% CI 0.10, 0.50) compared to their married counterpart. Among women, those living with a partner were 1.73 (95% CI 1.01, 2.96) times more likely to have four or more chronic conditions compared to their married counterpart. Conclusion: The role of an individual's marital status on their health is important to understand, as one's partner is able to be vital in decision-making and care coordination. Care decisions support patients through innovative approaches that take a deeper dive in to patient care.

Keywords: Partnership, Preventative Health Behavior, Chronic Conditions, Older Age, Marital Status

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by

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A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PUBLIC HEALTH

ATHENS, GEORGIA
2018

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DEDICATION

This work is dedicated to my wife, Kaitlyn, and my daughter, Campbell.

You are my inspirations.

ACKNOWLEGEMENTS

I would first like to thank my committee members: Drs. Toni Miles, Andrea Swartzendruber, Joel Lee, and Molly Perkins. In particular, I would like to express my appreciation for my major professor, Dr. Miles, who devoted a great amount of time to guiding me through the dissertation process. Dr. Lee has also been vital through my entire doctoral career, providing mentorship throughout my time at the University of Georgia in the College of Public Health. Without the support of these mentors I would not have been able to accomplish my educational goals.

I greatly appreciate my classmates and other professors at UGA. Without the additional support of students in my cohort, classes, and prior graduates, I would not be where I am today. My cohort specifically is a group of strong, smart, and inspiring individuals. Our conversations challenged one another and required critical thinking. We also just truly enjoyed each other's company that was nice for needed breaks from classes and work. The professors in the College of Public Health are all so supportive. I have to specifically thank Dr. Donald Lloyd for his leadership inside and outside the classroom. Because of his experiences, stories, and teaching, my career aspirations pivoted after one lecture that opened my eyes to a different side of public health. I am so thankful for these wonderful people and friends in my life.

Lastly, I would like to thank my family and friends. I am about to have a lot more free time again. The selflessness and understanding of all those who are close to me has been a driver towards the completion of my degree and the goals I have for myself upon graduation. This has truly been a rewarding and motivating experience that has provided many lifelong benefits already.

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CHAPTER ONE: INTRODUCTION

Background

The number and proportions of older adults in the United States is growing rapidly. With the continuing aging of the U.S population and evolving health behavior patterns, identifying factors associated with adverse health outcomes in this group is increasingly important. By 2050, it is anticipated that Americans aged 65 or older will number nearly 90 million people[1]. The rapid aging in the U.S population is being driven by the reality that Americans are living longer lives; one out of every four 65 year olds today will live past the page of 90[2]. As more and more Americans approach retirement, society is increasingly challenged to help them grow older with dignity and comfort. Meeting and understanding these challenges are key to public health professionals and healthcare providers to target the care of aging adults.

There are a number of challenges associated with marital status in older adults. More older adults are divorced compared with previous generations[3]. The proportion of divorced women ages 65 and older increased from three percent in 1980 to 13 percent in 2015, and for men four percent to 11 percent during the same time period[3]. More than one-fourth of women 65 to 74 live alone and this proportion jumps to 42 percent among women ages 75 to 84, and 56 percent among women ages 85 and older[3]. As the number of individuals living alone increases with age, the means by which marital status and partnered relationships serve to promote healthy behavior and increase health outcomes in this population needs to be better understood.

The quality of individuals' social relationships has a strong influence on patterns of behaviors and health outcomes[4]. Many studies focused on adults provide evidence that social relationships influence health behavior[5]. Being married, having a family, and involvement in

religious organizations have all been associated with health promoting activities[5]. Those with poor social relationships are more likely to smoke and engage in low levels of physical activity[5]. Relatively less research has been conducted to investigate the association between social relationships that include partner status and health behaviors among older adults[4,5]. Partnered relationships in this study are defined as individuals who answered the Health Retirement Survey's (HRS) questionnaire about living arrangements as not married but partnered. Knowing more about this relationship status may determine if it is more similar to being married or not. Some US studies have shown that older adults with some social relationship status have better nutrition, increased use of mammography, and more frequent visits to the health care providers[4,6,7]. Patterns of behavior and the nature of partnered relations are dynamic and may contribute a better yield of knowledge of one's health status as one ages.

Health behaviors are a key determinant of population health and well-being. Preventable health behaviors are any activities undertaken by a person who believes himself to be healthy for the purpose of preventing disease or detecting disease in an asymptomatic stage[8]. Health damaging behaviors such as smoking, physical inactivity, and neglecting regular health screenings have been associated with increased risk or disability and death in older adults[9–11]. Habits of maintaining good health help promote successful aging. The role of unhealthy behavior in acquiring non-communicable diseases has been documented, and evidence supports a high worldwide prevalence of unhealthy behaviors[12,13]. This evidence has contributed to interventions to implement lifestyle changes and has led to a better understanding of factors that determine an individual's choices of unhealthy behaviors and their decisions to change those behaviors. Here lies an opportunity for public health policy improvements in this targeted demographic.

Improving preventable health behavior in older adults may ultimately improve productivity, reduce health care services, and better individual's quality of life.

Preventable health behavior in this study is operationalized as modifiable risk behavior and includes smoking, physical activity and having a blood pressure screening. These risk behaviors are commonly associated with poor health outcomes[4,14-16]. It is notable that many of these prior studies have generally focused on a younger cohort of individuals. The HRS provides large cohort data of aging adults to assess the protective benefits of relationships in older age and association of preventable health behavior.

In addition to preventable health behaviors being important in one's health, chronic conditions post a significant risk in older adults. The prevalence of multiple chronic conditions (MCC) among individuals increases with age and is substantial among older adults, where one fifth of adults aged 45 to 64 and up to nearly 80 percent of adults aged 65 and older report two or more chronic conditions[17,18]. Chronic illnesses are conditions that last a year or more and require ongoing medical attention and / or limit activities of daily living[19]. Twenty eight percent of Americans have multiple (two or more) concurrent chronic conditions (MCC), which contribute to frailty and disability[20,21].

As the number of chronic conditions in an individual increases, the risks of the following outcomes increases: mortality, poor functional status, unnecessary hospitalizations, greater healthcare utilization and costs, and elevated mortality rates[19,20,22,23]. Twenty seven percent of people with 5 or more MCCs are hospitalized compared to four percent of those with zero MCCs[20]. On average, over the year, people with two MCCs fill 16.1 prescriptions averaging of $1,152 annually compared to people with zero MCCs who fill an average of 1.4 prescriptions for an average of $70 annually[20]. Resource implications for addressing MCC are significant; 66

percent of total healthcare spending is directed toward care for approximately a quarter of Americans with MCC[20]. The combined effects of increasing life expectancy and the challenges of changes to marital status will dramatically increase the demand of managing multiple chronic conditions among the growing population of older individuals. More attention is needed to understand this vulnerable population living with chronic conditions and suggest support required to meet long-term needs to provide a positive quality of life.

Purpose of this Study

This study is designed to define and assess the association of health behavior and outcomes of adult relationships. Partnerships created by two consenting adults are our focus. With an expanded definition of adult pairs, we test its potential for promoting health. We define health in two ways. Health is measured by the absence of chronic disease. Prevention is another measure of health in our study operationalized as being physically active, being a non-smoker, and partaking in yearly health exams.

Based on previous studies, clinicians working with older people living alone should anticipate higher levels of disease and disability[24]. The rationale for this study is that the results will provide new knowledge that can facilitate targeted intervention activities of older individuals based on their relationship status. Target population screening based on one's relationship may be useful in identifying older individuals who are at risk for poor health behavior choices or multiple chronic conditions.

More individuals are wanting to age in place. Having a spouse or partner through this process offers an unpaid effort that affects the wellbeing of the individual being cared for. With a shrinking pool of those who are married later in life, these responsibilities begin to fall on other family members or result in hospital stays or other hands on care such as nursing home and

assisted living facilities[25]. Solid scientific evidence shows that social relationships affect a range of health outcomes, including physical health, health habits, and mortality risk[5]. Married adults are half as likely to enter long-term care facilities as unmarried adults[25]. Alternatively, lacking close kin is more prevalent in never-married and those living alone[26].

The risks associated with increased morbidity and mortality in older age are plentiful; finding opportunities to increase preventable health behavior and reduce MCC's are two factors that may decrease negative outcomes. With desires to age in place and avoid institutional care, knowing more about demographic and societal changes will be important for these aging cohorts. This study aims to better understand the implications of relationship status trends, moving beyond binary comparisons of married and unmarried adults to provide an examination how preventable health behavior and multiple chronic condition risk varies among married, partnered, divorced/ separated/ widowed, and never married relationship status categories. Having more clarity around influential relationships will facilitate options in decision-making and merits expanded attention to policy to meet the growing needs of an aging population.

Specific Aims

Specific Aim 1: Is being in a partnered relationship associated with increased likelihood of participating in preventable health behavior among adults aged 50 years and older?

Hypothesis 1: Being in a partnered relationship will be associated with an increased likelihood of having better preventable health behavior in older aged adults, similar to the beneficial factors of marriage.

Specific Aim 2: Is being in a partnered relationship associated with a decreased likelihood of having multiple chronic conditions, after adjusting for established risk factors and preventable health behavior, among adults aged 50 years and older?

Hypothesis 2: Being in a partnered relationship will be associated with a decreased likelihood of having multiple chronic conditions in older adults.

Innovation

Population aging presents one of the most profound social challenges of our time, especially considering the context of other social trends such as partnership. These trends have crucial implications to police and practice, as well as for the intergenerational relationships and the well-being of aging adults themselves. There are limitations to data currently presented on various types of living arrangements and their effects on health in older age. Data and research currently do not consistently differentiate between marriage and partnership. This study, using the HRS data set, aims to be more comprehensive by presenting research evidence on both marital status and partnership later in life and their relation to health. Understanding the benefits of these types of social support are important to comprehensively understand in this growing aging population.

Studies show that married individuals live longer and enjoy better physical health compared to those who are not married[27,28]. What is less studied are the benefits of more diverse relationships on health behaviors and outcomes. Living alone and living with a partner have become more widespread options of living arrangements, even in older ages, which necessitates a need for a closer examination of these relationships and their impacts on health behavior and health outcomes. Compared to married individuals, the association of partnered relationships in older adults and health –related behavior and outcomes is not as well documented, which is the gap this study aims to fill.

CHAPTER TWO: LITERATURE REVIEW

Preventable Health Behavior

Promoting successful aging and maintenance of good quality of life among older adults are central concerns to gerontologists. Health behavior explains about 40 percent of premature mortality as well as substantial morbidity and disability in the United States[5]. Most studies that examine preventable health behavior focus on young or middle-aged adults due to assumptions that illnesses are inevitable in old age and older individuals are not as likely to benefit from preventable health behavior[29]. Research has demonstrated, however, that engaging in preventable health behavior can help decrease morbidity in older adults and show that they are not resistant to trying interventions[30].

Despite benefits of preventable health behaviors, many older adults do not adopt them[29,31]. Compared to their younger counterparts, older adults tend to receive less preventive care, such as health screenings, and offered fewer nutritional and physical activity interventions[31]. Community – dwelling individuals over the age of 65 are less likely to maintain a balanced diet or consume nutritional supplements[32]. Additionally, increased age is associated with decreased physical activity [33]. In a study by Goodwin, participants, aged 75 years and older, considered arthritis, difficulty sleeping, and heart disease to be aspects of normal aging and were less likely to see a physician regularly and to seek preventive care, such as blood –pressure screening or flu vaccines, in the previous year[34].

Investigating the factors associated with healthy behavior ultimately are of interest if these behaviors are associated with positive health outcomes in the elderly population. Evidence

suggests that correlation among health behaviors implies in order to undertake healthy behavior, one's attempt to improve health may be behavior – specific[35]. Based on these findings, this research focuses on a number of different health behaviors in the analysis. The behaviors included are (a) having blood pressure checked within the last years by a doctor or medical person; (b) performing physical activity (moderate or strenuous activity for at least 30 minutes, three or more times per week); and (c) not being a smoker.

Evidence regarding these behaviors is well established. Regular blood pressure screening for hypertension is associated with effective treatment for hypertensive related morbidity and mortality[36]. High blood pressure was the primary or contributing cause of death for more than 362,000 Americans in 2010[37]. It is primarily associated with diagnosed conditions such as heart failure, heart attack, stroke, and chronic kidney disease[37].The American College of Sports Medicine has a significant amount of new evidence that supports the benefits of regular exercise and physical activity in older adults[38]. Exercise and physical activity can influence the aging process through their impact on the development and progression of chronic disease and disabling conditions[38]. Lastly, according to the American Lung Association the current generation of older adults in the United States has the highest smoking rate of any generation. Smoking is the most preventable cause of disease and death in the U.S[39]. Long-term older adult smokers are at higher risks for many diseases such as dementia, heart disease, cancer, lung disease, osteoporosis, diabetes, and many more[39]. How the prevalence of these behaviors is associated with relationship status in older age requires more investigation.

Preventable Health Behavior and Marriage

Married people enjoy better physical activity and have longer life expectancies than single or divorced families[40]. Many studies suggest that the symbolic meaning of particular

social ties, like marriage, may foster a greater sense of responsibility to stay healthy, thus promoting healthier lifestyles[5]. There are several explanations for this link between marriage and health, including that healthy people are more likely to marry and less likely to divorce[40]. Healthy people also are more likely to possess certain characteristics, such as higher earnings, emotional health, and physical attractiveness, which may make them more desirable marriage partners than those in poor health[40]. Once married, those who are healthier may be better able to communicate, enjoying participating in activities and engage in the promotion of better health behavior[40]. Overall, marriage tends to reduce many health- related risky behaviors and improve health – promoting behaviors[41].

Among married couples, the role of health-related social control plays a promoting factor in health enhancing behavior. Health-related social control refers to interactions entailing influence and regulation of health practices. A spouse may monitor, inhibit, regulate, or facilitate health behaviors in ways that promote a partner's health[42]. In a sample of 109 couples, an analysis by Lewis et al. found that, maintaining a couple as the unit of analysis, spouses' reports of more frequent social control overall and the use of positive, bilateral, and direct social control tactics predicted their partners' reports of health-enhancing behavioral reactions[43]. Married people are also more likely to engage in positive healthy behaviors such as going to the doctor regularly[40]. Those who are married are more likely to be screened for cancer than those who are widowed or divorced[34,44]. Married men and women experience lower mortality at every age relative to those who remain unmarried or lose their spouse through widowhood or divorce through rigorous research[45–47]. Additional research supports findings that marriage increases longevity among adults 65 and older[27].

Preventable Health Behavior in Unmarried Individuals

Being divorced, separated, or widowed can be detrimental to one's health[48]. For example, there is evidence that married individuals are less likely to smoke and more likely to quit smoking in Sweden, Denmark, the United States, Finland, and Korea [49–51], compared with unmarried individuals. Some studies show that married men and women are more likely to exercise and eat healthier, less fatty foods compared to their unmarried counterparts[52–55]. Women who never marry have lower family incomes than those who do marry, and divorced women experience substantial decline in income[40]. High incomes are correlated with ability to purchase high quality health care, live in safe neighborhoods, which all promote health for adults[40].

Recent research, conducted by Kutob et al challenge previous studies showing that modifiable health behavior is more favorable in married couples[56]. This study found that women who were divorced or separated had a reduction in BMI and waist circumference, changes that were accompanied by improvement in diet quality ($\beta = 0.78$, 95% CI 0.10-1.47), and physical activity ($\beta = 0.98$, 95% CI 0.12-1.85), relative to women who remained married[56]. Contrary to earlier literature that suggested modifiable health outcomes and behaviors are more favorable to individuals who are married, some studies identify that unmarried individuals have improved health benefits later in life[57–60]. In a Canadian study conducted of 12,611 community- dwelling people aged 65 and older, being unmarried was associated with frequent physical activity in late life[45,61]. Additional studies found similar findings that report high physical activity among divorcees[62,63].

Many of the studies, noted previously, provide significant support on the impact of marital status on health behavior, although some of the findings are mixed. Most of these studies dichotomize marital status into married versus unmarried and do not consider other partnered relationships. Additional research that considers partnered relationships will lead to a better

understanding of the effects of partnership and marriage on health behavior and help reconcile contradictory research findings presented here.

Preventable Health Behavior and Partnerships

Partners often engage in similar health behaviors[64]. Most models of health behavior describe perceptions of one's own health risks as a major factor underlying motivation to change behavior[64]. Partnership consistently provide a source of engagement that influence healthy living across the life course[65]. Partnerships offer a type of accountability that may encourage individuals to improve health behaviors and also influence the types of activities in which individuals engage[66]. Furthermore, partnerships, across the life course, are likely to improve the general ability for individuals to successfully maintain health[66].

In addition to marriage having benefits on health outcomes, marriage and cohabitating also have a positive effect on prevention behavior. In a multivariate analysis, controlling for age and education level, married or cohabitating people have more positive intentions (OR: 1.26, 95% CI 1.14 – 1.38) and higher attendance rates at screenings (OR: 1.23, 95% CI 1.04 – 1.45) for colorectal cancer than non-married people[43]. Additionally, inviting partners together significantly increased screening intentions among women (OR: 1.17, 95% CI 1.04 – 1.31) but not men (OR: 0.97, 95% CI 0.85-1.10); co-invitation significantly increased attendance at screening for both genders (OR 1.34, 95% CI 1.14 – 1.58)[43].

Sexual minorities have received increasing attention in social science and public health as a result of increasing recognition of health disparities associated with sexual orientation[67]. Sexual orientation is not asked generally on large-scale surveys, but is mostly addressed in smaller studies conducted in single cities or states. Information on samples of gay men and women in same-sex cohabitating relationships are available in small samples so outcomes can be compared

with heterosexual men and women in cohabitating relationships. Because this data is limited, it remains unclear whether older adults in same-sex partnerships experience health benefits as their married counterparts do.

When looking specifically at older adults, researchers have found better health associated with having a partner in general. Married and cohabitating adults live longer than unmarried peers who live along[27],[68]. Research conducted using the Caring and Aging Pride Project of adults 50 years of age and older found that relationship statuses with greater social integration (partnered or married) were associated with better outcomes[69].

Theory and Preventable Health Behavior

Many studies provide evidence that social ties influence health behavior. Social ties influence health behavior because they may influence, or "control" our health habits[5]. The social cognitive theory supports a multifaceted causal structure in which self-efficacy beliefs operate together with goals and outcome expectations that facilitate regulation of human motivation, behavior, and well-being[70]. Human health is a social matter, not just an individual one which is why it is important to better understand social systems that effect human health[70]. Self-efficacy beliefs must also be considered in one's health behavior. Assessing personal efficacy often stem from pressures of social surroundings[70]. Regardless of age group, researchers are interested in identifying the facts that predict whether individuals will engage in preventive health behavior, as widely used in the Health Belief model and Transtheoretical model[71]. These models do not consider having a partnership as an influencer or the likelihood of engaging in preventive health behavior. However, since regulation of behavior is not solely a personal matter, this study will continue to exam relationship associations and health behavior.

Interdependence is a theoretical approach that refers to the ways in which interacting partners influence one another's outcomes[72] or structure influence in one's relationship. This refers to both negative and positive outcomes and consequences. Interdependence within couples can be characterized by several paths of influence[72]. Lewis et al. describes one path as each partner being responsible for his or her own health and behavior, with little influence from the spouse. Another path represents each member of a dyad having influence on his or her partner's outcomes, but not his or her own[72]. The third type of influence represents the possibility of joint influence, when a spouse's outcomes are determined by his or her own action and his or her partner's actions. The last possibility is that both partners experience mutually joint effects where each spouse's health and behavior is determined by their own actions and those of their partners[72].

Health-related social control refers to interactions entailing influence and regulation of health practices[72]. In married couples the role of health related social control plays a promoting factor in health enhancing behavior. In a sample of 109 couples, an analysis by Lewis et al. found that, maintaining a couple as the unit of analysis, spouses' reports of more frequent social control overall and the use of positive, bilateral, and direct social control tactics predicted their partners' reports of health-enhancing behavioral reactions[43].

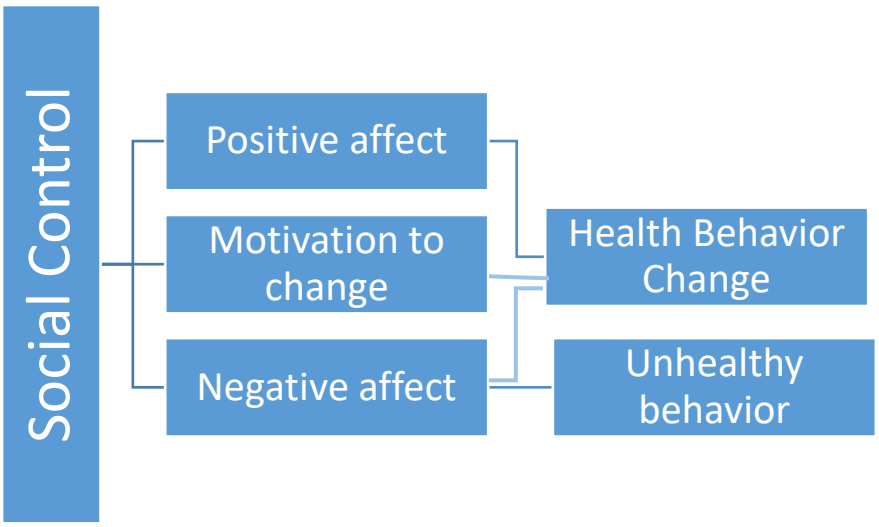

Figure 1 Social Control conceptualization of Health Behavior[71]

Multiple Chronic Conditions

More than one in four American have two or more concurrent chronic conditions, including arthritis, asthma, chronic respiratory conditions, diabetes, heart disease, human immunodeficiency virus infection, and hypertension[20]. Multiple chronic conditions can contribute to frailty and disability, most older persons who are frail or disabled have Multiple Chronic Conditions (MCC)[73]. As the number of chronic conditions in an individual increases, the risks of the following outcomes also increase: mortality, poor functional status, unnecessary hospitalizations, adverse drug events, duplicative tests, and conflicting medical advice[19,20,22,23,74]. The prevalence of MCC among individuals increases with age and is substantial among older adults, even though many Americans with MCC are under the age of 65 years[73].

Individuals with MCC suffer suboptimal health outcomes which can lead to rising health care expenses, which is why enhanced attention on this population is critical. Several conceptual models have been developed that attempt to transcend the focus on individual disease management and move toward broader approaches to managing chronic illness. One of the most influential is the Chronic Care Model, which highlights the elements required to improve chronic

illness care. Two of the requirements in the model are self-management support and decision support[73]. This model promotes more productive interactions between patient and care team but also addition innovative approaches to addressing MCC outside the clinician's office. Social support in older age has been one innovative approach to this model[5,73].

In addition, healthcare expenditures and hospitalizations are important considerations among elderly populations with multiple chronic conditions. In a study by Wolff et al. 82 percent of aged Medicare beneficiaries had one or more chronic conditions, and 65 percent had multiple chronic conditions[23]. Inpatients admissions for ambulatory care sensitive conditions and hospitalizations with preventable complications increased with number of conditions; Medicare beneficiaries with 4 or more chronic conditions were 99 times more likely than a beneficiary without any conditions to have an admission for an ambulatory care sensitive condition (95% CI 86 -113)[23]. Per capita, Medicare expenditures increased with the number of chronic conditions from $211 with those without a chronic condition to $13,973 among those with 4 or more MCC[23].

Overall the MCC population is characterized by tremendous heterogeneity and varies greatly in the number of chronic conditions, the severity of condition and functional limitations. Developing the means for determining homogeneity in subgroups among heterogeneous populations is an important step to improve the health status of the aging population. Identifying subgroups will help determining more effective targets for interventions and consider potential disparities that may present implications for those with MCC. The combined effects of increasing life expectancy in the aging population and increasingly diverse marital status present new challenges to managing MCC among the population of older individuals. Developing a better understanding how conditions in combination with partnership status will help identify

interventions for this escalating public health challenge. This information can be useful in helping clinicians develop prevention strategies tailor to population subgroups with greater prevalence of MCC, subsequently reducing health care costs among these groups.

Multiple Chronic Conditions and Marriage

Marriage is perhaps the most studied social tie to health outcomes including cardiovascular disease, chronic conditions, mobility limitations, self-rated health, and depressive symptoms[75,76]. A number of rigorous studies reveal that marriage can also lead to better general physical health and better outcomes for some specific health conditions such as arthritis, hypertension, and heart disease[76–78].

A study by Quinones et al. found that among married and unmarried individuals, the percent of deaths was higher in the unmarried population. This study showed marital status overall had a protective hazard ratio of 0.76 (CI 0.47,1.22) and a stratified analysis revealed a strong protective effect among men and women younger than 60 years who were diagnosed with hyperlipidemia[58]. Substitution of marital status with cohabitation status confirmed the strata-specific effect of a statistically significant hazard ratio of 0.52 (CI: 0.34-0.86)[58].

A meta-analysis reviewing 53 data sets, with more than 250,000 elderly subjects, assessed the strength and overall estimates of the excess mortality associated with being unmarried in aging adults. Marriage or support from the spouse was a significant protective factor for total mortality in 26 studies, and the overall risk ration for married individuals was 0.88 (95%CI: 0.85-0.91)[27]. Twelve of the datasets compared the risk of death of widowed verses married persons reported a significantly greater mortality risk for those who lost the spouse (RR: 1.11, 95% CI 1.08-1.14)[27]. Similarly, divorced / separated subjects were significantly more likely to die than married individuals with an overall RR of death of divorced / separated persons was

1.16 (95% CI 1.09 – 1.23). Lastly, there is significantly greater mortality for never married people compared to married people with a RR of 1.11 (95% CI 1.07-1.15)[27].

Multiple Chronic Conditions and Unmarried Individuals

Over the past several decades, a dramatic shift in marriage has taken place as we have witnessed declines in marriage, increases in divorce, and increased cohabitation[44]. Men and women are entering their retirement years will be increasingly heterogeneous in terms of marital status.

In the United States, mortality rates among unmarried women were 50 percent higher than those for married women, and the gaps was worse for men[79]. Unmarried men's mortality rates were approximately 250 percent higher than those for married men[76]. Much of the scientific literature has supported that disability and chronic disease prevalence rate are higher among unmarried groups, including divorced and widows[44].

Being widowed as opposed to married was associated with worse health outcomes in a cross-sectional study of adults aged 60 years or older from regions of India[44]. Widowhood in general was not associated with any outcomes for men except cognitive ability, though men who were widowed within 0– 4 years were at greater risk for diabetes compared to married men[44]. Recently widowed women and women who were widowed long-term were more likely to experience hypertension, even after adjusting for other explanatory variables[44].

Findings such as the ones published by Manzoli et al suggest that it is important to support health care providers in identifying individuals at risk for morbidity and mortality[27]. In their meta-analysis pooling from 53 independent studies of elderly subjects the overall relative risk (RR) for married versus non-married individuals (which included widowed, divorced, separated, and never married) was 0.88 (95% CI 0.85-0.91)[27]. This estimate did not vary by

gender, study quality, or geographically. Compared to married individuals, the widowed had a RR of death of 1.11 (1.08-1.14), divorced/ separated 1.16 (1.09-1.23), and never married 1.11 (1.07 -1.15). Although some evidence of publication bias was found in this study, overall the estimates of the effect of marriage was robust to several statistical approaches and sensitivity analyses. The marriage protective influence remained significant[27].

Multiple Chronic Conditions and Partnership

Marriage is a behavior pattern in society that plays a role in culture and customs that is an integral part of population health. Whether the observed health advantages of marriage grow or alter is unclear due to changing norms involving marriage, divorce, cohabitation, and partnership. Family forms are becoming more diverse and the boundaries between marital statuses have blurred, making a need to better understand the complexity of marital status on health. It is known that supportive social ties may trigger physiological sequelae (reduced blood pressure, heart rate, and stress hormones) that are beneficial to health and minimize unpleasant arousal that instigates risky behavior[80]. What continues to need more research is whether partnerships have the protective benefits like marriage on health outcomes.

In a study of patients with cancer in Sweden, a team of researchers examined health care use and health costs among partners of persons living with cancer. The results found that health care use for partners increased in terms of inpatient care after a cancer diagnosis[81]. A significant increase was seen the second year for partners of patients with specific cancers: colon (RR 1.55, 95% 1.28 – 1.87), and lung cancer (RR 1.50, 95% 1.26 -1.79)[81]. This study showed an overall increase in health care costs and psychiatric diagnoses after the cancer diagnosis among partners of cancer patients[81].

Although the HRS does not indicate whether those in partnered relationships are of heterosexual or homosexual, it is interesting to still understand the dynamic of these relationships as the prevalence is increasing of same sex relationships across demographics. In a recent study by Ward et al. research on chronic health conditions among lesbian, gay, and bisexual populations were studied to examine 10 diagnosed chronic conditions by sexual orientation among US adults[82]. After age adjustments and controlling for sociodemographic characteristics, only a few significant health disparities were found by sexual orientation, and none for MCC. However, for conditions where differences were found, magnitudes were relatively large[82]. Gay/ lesbian adults had moderately higher odds of arthritis compared with straight adults (AOR =1.52); the same was found for women (AOR = 2.14)[82]. Gay men had higher odds of cancer compared with straight men (AOR = 2.09). Higher odds of hepatitis were found for gay / lesbian adults (AOR = 2.16) compared with straight adults and for gay men compared with straight men (AOR = 2.86)[82]. Since June of 2015, the United States Supreme court ruled that state level bans on same sex marriage are unconstitutional. Since the HRS data set was collected prior to 2015, this demographic does not want to be ignored.

Additional Variables to Consider in the relationship between Martial Status and Health

Sex

The health experiences of women and men differ, as women are more likely to experience daily symptoms and have higher incidence of acute conditions as well and non-chronic disease than are men[24]. This may indicate a difference in patterns of preventable health behaviors. Women are also more likely than men to participate in a wide variety of health promoting activities including receiving preventable medical care, participate in physical

activity, and are less likely to smoke[24]. However, these differences may diminish with age, which is something this study would like to further explore.

Past research demonstrates that marital status provides benefits for both sexes but females are usually more successful in influencing their male partner's behavior[63]. Several speculations were proposed to explain this observation. Women generally possess more knowledge about health-related issues and monitor their own health status more closely than men. Traditional nurturing role of women encourage them not only to guard their own health but also to monitor their spouses' health and assume responsibility for their partners behavior[83]. Additionally, married men report to have their behavior monitored more often than married women and women display stronger tendency to avoid risky behaviors and some of the risk aversion might spill to their male counterparts[84]. However, these differences may diminish with age, which is something this study would like to further explore.

Education

Education is a robust determinant of health because it uniquely shapes an individual's life chances and fundamentally alters the way people view themselves and relation to the world around them[85]. As Ross et al. discussed in their review paper, a couple's key characteristic in affecting concordance of health related behavior is educational background[86]. Other studies suggest that an individual's education affects their own health through material circumstances, behavioral factors, and social factors[5,86]. Therefore, taking education into account may well explain the health of aging individuals.

Body Mass Index (BMI)

Obesity remains a domain in which married men and women display systematically worse results than their never married, divorced, and widowed counterpart. A study by Eng

studied the health behavior of men and found becoming divorced or widowed was associated with decrease in BMI[87]. A similar study found that marriage was associated with weight gain while divorced individuals were significantly more likely to lose weight[88]. These studies were not limited to elderly adults.

Because of multiple factors, older adults have an increased risk of under nutrition, which is associated with increased mortality and morbidity. Under nutrition often goes unrecognized because of BMI calculations to fit the WHOs definitions of a healthy range of 18.5 to 24.9[89,90]. In western countries it is estimated that two thirds of adults over the age of 65 have a BMI greater than 25. In a meta- analysis by Winter et al. weight gain or higher BMI is protective against increased risk of mortality in adults 65 years and older[90].

Retirement Status

Americans now spend more years in retirement than ever before. A major wave of retirement begins in 2011 when the first Baby Boomers began to turn 65[91]. The notion that retirement harms health has persisted for decades. However, limited evidence shows that retiring may benefit one's health. A study but Ekerdt et al found that physical health declined generally over time in retirees but showed no significant difference between eventual retirees and those who continued working[92]. In a European study, researchers found that significant evidence that retirement has a health –preserving effect on overall general health[93]. Retirement lead to 35 percent decrease in the probability of reporting to be in fair, bad, or very bad health, and an almost on standard deviation improvement in the health index[93].

In their paper, Moon and her colleagues describe retirement as "a life course transition involving environmental changes that reshape health behaviors, social interactions, and psychosocial stresses" that also brings shifts to identity and preferences[91]. Retirement is ranked

10th on the list of life's 43 most stressful events and some people transition to retirement more successfully than others. Understanding how retirement is linked to health status may vary depending on the outcome. In this study, considering retirement status is important to consider as larger cohorts begin to enter retirement than ever before.

Conclusion of Literature Review

Marital status and its known associated benefits on health behavior and health outcome have been widely studied. This study further explores other types of partnered relationships that are typically not captured in research investigating the association between marital status and health. Partnership is a self-reported status of individuals who participated in the Health Retirement survey that did not identify as married. These individuals are believed to be different than the single: never married, divorced, separated, or widowed cohort but are often left out in binary analysis. By including partnership in our analysis, we can better learn how this type of relationship associates with health in older aged Americans.

CHAPTER THREE: METHODOLOGY

Study design and Data sources

This research consists of a secondary analysis of cross-sectional data from the Health and Retirement Study (HRS). The HRS is a biennial longitudinal interview survey of U.S adults over the age of 50 sponsored by the National Institute on Aging and conducted by the Institute for Social Research at the University of Michigan[94]. Employing a multi-stage area probability sampling design, HRS researchers began collecting data on issues of aging, health, and retirement starting in 1992. Since then, core interviews have been repeated on the original sample, along with newly added cohorts, every two years. The HRS is a publicly available, de-identified representative sample of U.S. adults aged 50 years and older.

Study Population

For this study respondents who participated in the 2014 wave of the survey and who provided information on the primary exposure and outcome were included. For analysis purposes, we focused on those individuals who were self-respondents of the study, did not live in a nursing home or assisted living facility, and did not have missing answers for the relationship status questions and variables included in each outcome. Of the possible 18,748 survey responses, for the first analysis 4,163 participants were included in the first analysis and 16,622 in the second analysis.

Variables and Measurements

Exposure variable: Partnered status. Respondents' relationship status was determined by a survey question that asked, "Are you married"? If answer was no, "Are you living with a

partner as if married?" If respondent was neither married nor partnered, a follow up question asked: "Are you divorced, separated, widowed, never married, or other?" Respondents who reported they were married, re-married were categorized as Married. Individuals who responded yes to living with a partner as married were categorized as Partnered. Respondents answered divorced, separated, or widowed were categorized as such. Those who identified as never married remained separated from the other single. The married individuals were the reference group for both analyses.

Control Variables: Education level was categorized as less than high school, high school graduate, some college, college graduate, or post-college degree. Body Mass Index was calculated by self-reported height and weight and categories of underweight (BMI <25), normal weight (BMI 25-29), overweight (BMI 30-34), or obese (BMI ≥ 35). Retirement status was categorized as follows: completely retired, partially retired, and not retired-working. Age was dichotomized in to two groups of those 50-64 and those 65 and older, based on a univariate analysis of that collected variable. Additionally, this study stratifies by sex in both analyses due previous studies that suggest varying benefits to marriage between men and women[28,83].

Primary Outcome of Aim 1 Adoption of Preventable Health Behavior: We measured preventable health behavior using three variables: physical activity, smoking status, and controlled blood pressure. Scores from these variables were combined to create a composite measure of Preventable Health Behavior, with possible scores ranging from 0 to 6. A higher score is indicative of a poorer, not better, adoption of preventable health behavior. Physical Activity included indicators of moderate, mild, and vigorous levels of activity and frequency of these activities. These measures were collapsed into one composite measures scored as 3 or more times a week = 0 for good physical activity, one to three times a month = 1 for little physical

activity, and hardly any activity = 2. Smoking status was scored as never = 0, former = 1, and current = 2. Blood pressure was scored using two variables –current blood pressure check and blood pressure under control. If pressure was both under control and checked within the year it was scored as 0, if blood pressure was not checked in the last year and blood pressure was under control then blood pressure was scored as 1, if blood pressure was not under control and not checked within the last year it was scored as a 2 Based on these scores individuals were grouped in categories of preventable health behavior – least (reference), moderate, or best adoption. Respondents with a score of 0 have had their blood pressure under control and checked within the prior year, are physically active at least three times a week, and have never smoked. Individuals with a score of a 6 do not have their blood pressure under control, are not physically active, and currently smoke.

Prior to conducting multivariate analysis, we collapsed the categories based on a univariate analysis to adoption of good (score of 0), moderate (score of 1 or 2), and least preventable health behavior (score greater than 3). Exploratory analysis determined whether initial variables may be confounders. All the descriptive variables had a p-value <0.05 and initially remained in the multinomial logistic model. See Table 1 for descriptive characteristic breakdown, Table 3 for Unadjusted Odds Ratio, and Table 4 for Adjusted Odds Ratio.

Primary Outcome of Aim 2 Multiple Chronic Conditions: The chronic conditions selected for this study originally stemmed from the HHS Initiative on Multiple Chronic Conditions Strategy Framework[73]. This framework has four overarching goals, one is to "facilitate research to fill knowledge gaps about individuals with multiple chronic conditions[73]". All chronic conditions examined in this study were diagnosed conditions determined by survey questions asking questions to adults whether they had ever been told by a doctor or health care provider

that they had a specific condition. Indicator variables of 8 chronic conditions were the following: Hypertension, Diabetes, Stroke, Non-skin Cancers, Chronic Lung Disease, Heart Disease, Arthritis, and Dementia. These indicator variables were summed to create a categorical measure for number of conditions present: 0, 1, 2, 3 and 4 or more. Research on multiple chronic conditions suggests including 20 conditions[73] when measuring the number of chronic conditions, but the 8 included in the HRS data set are strong predictors or mortality and morbidity.

Statistical Analysis

To examine the associations between partner status and both outcomes, preventable health behavior and multiple chronic conditions, univariate and bivariate analyses were conducted. Chi-square tests were used for categorical outcomes. Multiple regression analyses were then conducted to evaluate the influence of partner relationship on preventable health behavior and multiple chronic conditions. To examine these associations, linear regressions and multinomial logistic regressions were done to examine relationships between these variables. Each multivariable analysis controlled for socio-demographic characteristics and retirement status because these variables have been previously identified as potential confounders. SAS programming 9.4 was used as the statistical tool for analysis.

Aim 1: To arrive at the final sample size of 4163, individuals with missing data for the exposure or outcome were excluded for analytical purposes. Additionally, subjects were excluded from analysis if a proxy answered the questions for them or the subject was living in nursing home. The sample additionally reduced with the variable regarding controlled blood pressure, which was not conducted on every survey participant.

Exploratory analysis was performed to determine the distribution of the preventable health behavior score in the sample population across demographic groups and covariates.

Before modeling, assessment among the widowed, divorced, and separated groups showed no differences and this group was collapsed. Additionally, the never married, married, and living with a partner remained as separate categories for analysis.

Aim 2: To arrive at the final sample size of 16,622, individuals with missing data for the exposure or outcome were excluded for analytical purposes. Additionally, subjects were ineligible if a proxy answered the questions for them or the subject was living in nursing home. Exploratory analysis was performed to determine the distribution of the multiple chronic conditions in the sample population across demographic groups and covariates. Before modeling, assessment among the widowed, divorced, and separated groups showed no differences and this group was collapsed. Additionally, the never married, married, and living with a partner remained as separate categories for analysis.

Crude estimates would show the actual burden of chronic conditions by relationship status among US aging adults, however, this study is interested in the association between relationship status and MCC. To control for any influence in age, estimates were adjusted by age. In addition to descriptive characteristics of those with MCC, multivariate logistic regression analysis was conducted. An indicator of each of each of the selected diagnosed chronic conditions was regressed on relationship status, (using Married as the reference category) and socio-demographic characteristics. See Table 5 for descriptive characteristics and Table 6 for the unadjusted odds ratio.

CHAPTER FOUR: MANUSCRIPT ONE

THE ASSOCIATION BETWEEN PARTNERSHIPS AND THE ADOPTION OF PREVENTABLE HEALTH BEHAVIOR

Introduction

The rapid aging in the U.S population is being driven by the reality that Americans are living longer lives; one out of every four 65 year olds today will live past the page of 90[2]. As more and more Americans approach retirement, society is increasingly challenged to help them grow older with dignity and comfort. Meeting and understanding these challenges are key to public health professionals and healthcare providers to target the care of aging adults. This study aims to better understand the implications of relationship status trends, moving beyond binary comparisons of married and unmarried adults, and the examination of preventable health behavior in older adults in the United States.

Many studies provide evidence that social ties influence health behavior. Social ties influence health behavior because they may influence, or "control" our health habits[5]. One example is the protective benefits of marriage on health that have been widely studied. A spouse may monitor, inhibit, regulate, or facilitate health behaviors in ways that promote a partners health[42]. In a sample of 109 couples, an analysis by Lewis et al. found that, maintaining a couple as the unit of analysis, spouses' reports of more frequent social control overall and the use of positive, bilateral, and direct social control tactics predicted their partners' reports of health-enhancing behavioral reactions[43]. Married people are also more likely to engage in positive healthy behaviors such as going to the doctor regularly[40]. Those who are married are

more likely to be screened for cancer than those who are widowed or divorced[34,44]. Married men and women experience lower mortality at every age relative to those who remain unmarried or lose their spouse through widowhood or divorce through rigorous research[45–47]. Additional research supports findings that marriage increases longevity among older adults[27].

Relatively less research has been conducted to focus on the association between social relationships that include partner status and health behaviors among older adults[4,5]. Partnered relationships in this study are defined as individuals who answered the Health Retirement Survey's (HRS) questionnaire about living arrangements as not married but partnered. Some US studies have shown that older adults with some social relationship status have better nutrition, increased use of mammography, and more frequent visits to the health care providers[4,6,7]. If well-being is related to living full time with a partner rather than to being married, those in alternative relationship arrangements, such as a partnership, should show levels of well-being comparable with those of married people.

In addition to one's social support, health behaviors are a key determinant of population health and well-being. Preventable health behaviors are any activities undertaken by a person who believes himself to be healthy for the purpose of preventing disease or detecting disease in an asymptomatic stage[8]. Health damaging behaviors such as smoking, physical inactivity, and neglecting regular health screenings have been associated with increased risk or disability and death in older adults[9–11]. Habits of maintaining good health help promote successful aging[1,95,96]. The role of unhealthy behavior in acquiring non-communicable diseases has been documented and evidence supports a high worldwide prevalence of unhealthy behaviors[12,13]. This evidence has contributed to interventions to implement lifestyle change and has led to a better

understanding of factors that determine an individual's choices of unhealthy behaviors and their decisions to change those behaviors.

Promoting functional wellness and maintenance of good quality of life among older adults are central concerns to gerontologists. Health behavior explains about 40 percent of premature mortality as well as substantial morbidity and disability in the United States[5]Most studies that examine preventable health behavior focus on young or middle-aged adults due to assumptions that illnesses are inevitable in old age and older individuals are not as likely to benefit from preventable health behavior[29]. Research has demonstrated, however, that engaging in preventable health behavior can help decrease morbidity in older adults and they are not resistant to trying interventions[30].

Despite benefits of preventable health behaviors, many older adults do not adopt them[29,31]. Compared to their younger counterparts, older adults tend to receive less preventive care, such as health screenings, and offered fewer nutritional and physical activity interventions[31]. Community – dwelling individuals over the age of 65 are less likely to maintain a balanced diet or consume nutritional supplements[32]. Additionally, increased age is associated with decreased physical activity [33]. In a study by Goodwin, participants, aged 75 years and older, considered arthritis, difficulty sleeping, and heart disease to be aspects of normal aging were less likely to see a physician regularly and to seek preventive care, such as blood –pressure screening or flu vaccines, in the previous year[34].

Investigating the factors associated with healthy behavior ultimately are of interest if these behaviors are associated with positive health outcomes in the elderly population. Evidence suggest that correlation among health behaviors implies in order to undertake healthy behavior, one's attempt to improve health may be behavior – specific[35]. As a result, this research focuses

on a number of different health behaviors in the analysis. The behaviors included are (a) having blood pressure checked within the last years by a doctor or medical person; (b) performing physical activity (moderate or strenuous activity for at least 30 minutes, three or more times per week); and (c) not being a smoker.

Evidence regarding these behaviors is well established. Regular blood pressure screening for hypertension is associated with effective treatment for hypertensive related morbidity and mortality[36]. High blood pressure was the primary or contributing cause of death for more than 362,000 Americans in 2010[37]. It is mostly associated with diagnosed conditions such as heart failure, heart attack, stroke, and chronic kidney disease[37].The American College of Sports Medicine has a significant amount of new evidence that supports the benefits of regular exercise and physical activity in older adults[38]. Exercise and physical activity can influence the aging process through its impact on the development and progression of chronic disease and disabling conditions[38]. Lastly, according to the American Lung Association the current generation of older adults in the United States has the highest smoking rate of any generation. Smoking is the most preventable cause of disease and death in the U.S[39]. Long-term older adult smokers are at higher risks for many diseases such as dementia, heart disease, cancer, lung disease, osteoporosis, diabetes, and many more[39].

Population aging presents one of the most profound social challenges of our time, especially considering the context of other social trends such as partnership. These trends have crucial implications on health practice, as well as for the intergenerational relationships and the well-being of aging adults themselves. This study is designed to define and assess the health effects of adult relationships. The rationale for this study is that the results will provide new knowledge that can facilitate targeted intervention activities of older individuals based on their

relationship status. Living alone and living with a partner have become more widespread options of living arrangements, even in older ages, which necessitates a need for a closer examination of these relationships and their impacts on health behavior.

Materials and Methods

This research presents findings using a secondary, cross – sectional data from the Health and Retirement Study (HRS). The HRS is a biennial longitudinal interview survey of U.S adults over the age of 50 sponsored by the National Institute on Aging and conducted by the Institute for Social Research at the University of Michigan[94]. Employing a multi-stage area probability sampling design, HRS researchers began collecting data on issues of aging, health, and retirement starting in 1992. Since then, core interviews have been repeated on the original sample, along with newly added cohorts, every two years. The HRS is a publicly available, de-identified representative sample of U.S. adults aged 50 years and older.

Study Population

For purposes of this study respondents who participated in the 2014 wave of the survey and who provided information on the primary exposure and outcome were included. For analysis purposes, we focused on those individuals who were self – respondents of the study, did not live in a nursing home or assisted living facility, and did not have missing answers for the relationship status questions and variables included in each outcome. Of the possible 18,748 survey responses, 4,163 participants were included in the analysis.

To arrive at the final sample size of 4163, individuals with missing data for the exposure or outcome were excluded for analytical purposes. Additionally, subjects were excluded from analysis if a proxy answered the questions for them or the subject was living in nursing home. Exploratory analysis was performed to determine the distribution of the preventable health

behavior score in the sample population across demographic groups and covariates. Before modeling, assessment among the widowed, divorced, and separated groups showed no differences and this group was collapsed. Additionally, the never married, married, and living with a partner remained as separate categories for analysis.

Variables and Measurements

Exposure Variable: Partnered status. Respondents' relationship status was determined by a survey question that asked, "Is [Name] married or living with a partner"? If other was selected a follow up question asked: "If unmarried, are you divorced, separated, widowed, never married?" Respondents who reported they were married, re-married were categorized as Married. Those that voluntarily indicated they were living with a partner or partnered were categorized as Partnered, this included those who initially answered as other or unmarried but then asked to elaborate on civil status. Respondents answered divorced, separated, or widowed were categorized as such. Those who identified as never married remained separated from the other single. Individuals who responded "yes" to married were the reference group.

Control Variables: Education level was categorized as less than high school, high school graduate, some college, college graduate, or post-college degree. Body Mass Index was calculated by self-reported height and weight and categories of underweight (BMI <25), normal weight (BMI 25-29), overweight (BMI 30-34), or obese (BMI $\geq$ 35). Retirement status was categorized as follows: completely retired, partially retired, and not retired-working. Age was dichotomized in to two groups of those 50-64 and those 65 and older, based on a univariate analysis of that collected variable. Additionally, this study stratifies by sex due to previous literature and research that suggest differing health behavior among married men versus women[83].

Outcome: Adoption of Preventable Health Behavior: We measured preventable health behavior using three variables: physical activity, smoking status, and controlled blood pressure. Scores from these variables were combined to create a composite measure of Preventable Health Behavior, with possible scores ranging from 0 to 6. A higher score is indicative of a poorer, not better, adoption of preventable health behavior. Physical Activity included indicators of moderate, mild, and vigorous levels of activity and frequency of these activities. These measures were collapsed into one composite measures scored as 3 or more times a week = 0 for good physical activity, one to three times a month = 1 for little physical activity, and hardly any activity = 2. Smoking status was scored as never = 0, former = 1, and current = 2. Blood pressure was scored using two variables –current blood pressure check and blood pressure under control. If pressure was both under control and checked within the year it was scored as 0, if blood pressure was not checked in the last year and blood pressure was under control then blood pressure was scored as 1, if blood pressure was not under control and not checked within the last year it was scored as a 2 Based on these scores individuals were grouped in categories of preventable health behavior – least (reference), moderate, or best adoption. Respondents with a score of 0 have had their blood pressure under control and checked within the prior year, are physically active at least three times a week, and have never smoked. Individuals with a score of a 6 do not have their blood pressure under control, are not physically active, and currently smoke.

Prior to conducting multivariate analysis, we collapsed the categories based on a univariate analysis to adoption of good (score of 0), moderate (score of 1 or 2), and least preventable health behavior (score greater than 3). Exploratory analysis determined whether initial variables may be confounders. All the descriptive variables had a p-value <0.05 and

initially remained in the multinomial logistic model. See Table 1 for descriptive characteristic breakdown, Table 3 for Unadjusted Odds Ratio, and Table 4 for Adjusted Odds Ratio.

Statistical Analysis

To examine the associations between partner status and preventable health behavior, univariate and bivariate analyses were conducted. Chi-square tests were used for categorical outcomes. Multiple regression analysis was then conducted to evaluate the influence of partner relationship on preventable health behavior. To examine these associations, linear regressions and multinomial logistic regressions were done to examine relationships between these variables. Each multivariable analysis controlled for socio-demographic characteristics and retirement status because these variables have been previously identified as potential confounders. SAS programming 9.4 was used as the statistical tool for analysis.

Results

Table 1 shows descriptive characteristics of health behavior among the sampled adults from the 2014 Health Retirement Survey. Overall, the majority of respondents were female (51%), married (55%), over the age of 65 (55%), overweight (36%), have less than High School education (32%), and be completely retired (54%). For the related health behavior outcomes, almost 75 percent were non- smokers, 63 percent reported moderate or more physical activity, and 35 percent had a blood pressure screening within a year. Table 2 reflects similar characteristics by marital status compared to preventable health behavior. About three –fourths (73%) of the sampled population adopted moderate preventable health behavior. More men responded to being married or partnered (59 and 56 percent respectively).The unadjusted relationship between marital status and preventable health behavior, where married individuals are the reference group shows, that partnered individuals have a 60% lower odds of adopting

moderate preventable health behavior (OR = 0.40; 95% CI 0.27, 0.61) and 3.8 times lower odds of adopting best preventable health behavior (OR = 0.26; 95% CI 0.16, 0.43) practice compared to those in the reference group (Table 3). Individuals living who are divorced, separated, or widowed and those who are never married saw similar disadvantages like the partnered group compared to individuals who were married.

After adjusting for age, education, BMI, and retirement status and stratifying by sex, the magnitude of the association between partnership and marriage with preventable health behavior remained different (Table 4). However, partnered men were not statistically different than married men who participate in moderate preventable health behavior (OR= 0.57; 95% CI 0.30, 1.07) and among both men and women who were never married there was not a statistically significant difference in the adoption of moderate and best preventable health behavior. Partnered women have a 56% lower odds of adopting moderate preventable health behavior compared to their married counterpart (OR=0.44; 95% CI 0.24, 0.81). Additionally partnered men and women are 23% and 39% times less likely to adopt best preventable health behavior respectively (OR 0.39; 95% CI 0.19, 0.82 and OR=0.23; 95% CI 0.10, 0.50) compared to their married counterpart.

Discussion

Implications

We used a large and generalizable national dataset to provide robust estimates of the impact of partnership status on preventable health behavior in late life. Using multinomial regression models, we found partnership status to not be a robust predictor of preventable health behavior. Specifically, after adjusting for sex, age, body mass index, educational level, and retirement status, those who were married remained a social marker for positive health behavior.

This study found that individuals who are in partnered relationships do not receive the same benefits as those who are married in terms of practicing moderate or best preventable health behavior as hypothesized. Previous studies have shown the relationship between marriage and its positive association toward better health outcomes[42,65,97]. Health behaviors of married partners converge over time and such that partners who have been married many years may have similar behaviors[97]. The uniqueness of this study is that it is not limited to just marriage as an indication for influential cohabitation. The findings support studies that focus on marriage as a marker for this population to have better health behavior. However, our results suggest that partnerships in late life are not similar to marriage in their influence on adoption of better health behaviors.

This study further supports the influence in close relationships being diverse. Much of the research has focused on social control regards to health. A meta-analysis by Craddock et al. suggests that social control is associated with improved health behavior. Their findings suggest that positive social control is related to positive effects on health behavior[98]. The limitations to this meta-analysis is that it does not break down social control in to various relationship types but it does indicate that a level of relationship, in the context of social control, has benefits to one's health behavior. Little research has investigated the attributes about diverse relationships and its effects on preventable health behavior.

Research shows that compared with younger adults, older adults over the age of 50 are less likely to engage in preventable health behaviors, even though these behaviors continue to benefit individuals throughout a life span[29]. Individuals who engage in preventable health behavior may be better protected from declines in function and are more likely to live longer, healthier lives[58]. Death and decline associated with the leading chronic diseases are often

preventable or can be delayed[1]. Identifying positive contributing attributes that lead to improved preventable health behavior in these cohorts will benefit the aging population.

More research on partnered adults is needed, especially as the baby boom generation matures into retirement. Various factors, such as increased life expectancy, changing attitudes towards living arrangements, the rise of internet dating, and retirement communities will change romantic options available to older adults. As we know how marriage impacts health behavior, these additional relationship statuses will continue to be areas needing more research.

Study Strengths and Limitations

Researchers representing various disciplines have taken up the study of partnering behavior, and their work has been published[99]. Data collection available from the HRS provided a basis for supplementing what we know about partnering and expanding our conceptual and theoretical scope from marital to non-marital relationships. Additionally, preventable health behavior is a leading opportunity for risk prevention of developing a chronic disease. Using the HRS questionnaire, we classified health behaviors were into categories to create a composite measure of preventable health behavior. This research contributes new findings to the literature regarding the association between partnership and preventable health behavior in older aged adults. Using the HRS data set provided a large, representative sample that allows results to be somewhat generalizable to the U.S population.

Despite its contribution to the literature, we acknowledge some limitations of the data and the analysis. The HRS survey is self-reported data. Asking the question about partnership may be a sensitive question,; these questions were asked at a time before same-sex marriage was legal in the United States. Therefore, the number of respondents may be an underrepresentation of a larger number. Furthermore, sexual orientation is not a question included in the survey, so

partnership in this study represents both heterosexual and homosexual couples. Further studies, depending on how the data is collected, may want to further stratify by types of partnerships to best understand how they differ from married individuals.

Conclusion

As people in the United States and across the globe live longer, there is increasing interest in understand and promoting health in later life. We know marriage plays a key role in preventable health behavior and there are opportunities to engage older adults who are not married. Incorporating relationship characteristics as a predictor for health behavior later in life is not something that has been widely considered. The knowledge of knowing one's social relationship can greatly impact clinical decision-making and opportunities for influencing behavior changes. As substantial changes to living arrangements continue to evolve, it's an exciting time to be a researcher studying these influences. The results of this study show there is opportunity in knowing more about the differences in partnerships in later life and has identified an area where public health practitioners can promote healthy aging.

Table 1: Descriptive Characteristic of Health Behavior among Adults from the Health Retirement Survey, 2014, N = 4,163

	Sample Size N = 4,163 (100%)	**Non – Smoker** n = 3119 74.92%	**Physically Active** n = 2642 63.46%	**Blood Pressure Controlled and Checked within year** n = 1479 35.53%
Characteristics				
Marital Status				
Married	2306 (55.39)	1880 (81.53)	1528 (66.26)	887 (38.46)
Living with Partner	277 (6.65)	155 (55.96)	179 (64.62)	89 (32.13)
Divorced / Separated / Widowed	1363 (32.74)	950 (69.70)	793 (58.18)	420 (30.81)
Never Married	217 (5.21)	134 (61.75)	142 (65.44)	83 (38.25)
p-value		*<0.0001*	*<0.0001*	*<0.0001*
Sex				
Female	2129 (51.14)	1565 (73.51)	1266 (59.46)	768 (36.07)
Male	2034 (48.86)	1554 (76.40)	1376 (67.65)	711 (34.96)
p-value		*0.03*	*<0.0001*	*0.45*
Age				
Age, Mean (Std)	67.68 (10.10)	69.25 (10.22)	66.80 (9.73)	65.58 (9.92)
50-64	1863 (44.75)	1180 (63.34)	1261 (67.69)	804 (43.16)
65+	2300 (55.25)	1939 (84.30)	1381 (60.04)	675 (29.5)
p-value		*<0.0001*	*<0.0001*	*<0.0001*
Education				
No Formal Education	872 (21.05)	583 (66.86)	454 (52.06)	225 (25.80)
Less than High School	1331 (32.13)	985 (74.00)	794 (59.65)	449 (33.73)
High School Graduate	1060 (25.59)	775 (73.11)	719 (67.83)	405 (38.21)
Some College	476 (11.49)	407 (85.50)	343 (72.06)	208 (43.70)
Post College	404 (9.75)	357 (88.37)	317 (78.47)	181 (44.80)
p-value		*<0.0001*	*<0.0001*	*<0.0001*
Body Mass Index				
BMI, Mean (Std)	29.85 (14.05)	30.40 (14.75)	29.12 (13.12)	28.57 (14.55)
Normal	1077 (26.08)	737 (68.43)	750 (69.64)	512 (47.54)
Underweight	66 (1.60)	35 (53.03)	33 (50.00)	31 (46.97)
Overweight	1487 (36.01)	1128 (75.86)	999 (67.18)	531 (35.71)
Obese	1499 (36.30)	1192 (79.52)	845 (56.37)	394 (26.28)
p-value		*<0.0001*	*<0.0001*	*<0.0001*
Retirement Status				
Completely Retired	2224 (54.47)	1747 (78.55)	1252 (56.29)	599 (26.93)
Partially Retired	613 (15.01)	448 (79.08)	436 (71.13)	239 (38.99)
Not Retired – Working	1246 (30.52)	870 (69.82)	913 (73.27)	612 (49.12)
p-value		*<0.0001*	*<0.0001*	*<0.0001*

p-value for chi-squared test

Table 2: Descriptive Characteristic of Health Behavior among Adults from the Health Retirement Survey, 2014, N=4,163

	Sample Size N=4,163 100%	**Married** n=2,306 55.39%	**Partnered** n=277 6.65%	**Divorced / Separated / Widowed** n=1363 32.74%	**Never Married** n=217 5.21%
Characteristics					
Adoption of Preventable Health Behavior					
Least	307 (7.37)	113 (4.9)	34 (12.27)	139 (10.2)	21 (9.68)
Moderate	3024 (72.64)	1654 (71.73)	201 (72.56)	1016 (74.5)	153 (70.51)
Best	832 (19.99)	539 (23.37)	42 (15.16)	208 (15.26)	43 (19.82)
Sex					
Female	2129 (51.14)	951 (41.24)	122 (44.04)	932 (68.38)	124 (57.14)
Male	2034 (48.86)	1355 (58.76)	155 (55.96)	431 (31.62)	93 (42.86)
Age					
50-64	1863 (44.75)	1032 (44.75)	175 (63.18)	498 (36.54)	158 (72.81)
65+	2300 (55.25)	1274 (55.25)	102 (36.82)	865 (63.46)	59 (27.19)
Education					
No Formal Education	872 (21.05)	411 (17.91)	72 (26.18)	334 (24.56)	55 (25.82)
Less then High School	1331 (32.13)	719 (31.33)	76 (27.64)	474 (34.85)	62 (29.11)
High School Graduate	1060 (25.59)	574 (25.01)	89 (32.36)	345 (25.37)	52 (24.41)
Some College	476 (11.49)	371 (13.81)	26 (9.45)	111 (23.32)	22 (10.33)
Post College	404 (9.75)	274 (11.94)	12 (4.36)	96 (7.06)	22 (10.33)
Body Mass Index					
Normal	1077 (26.08)	509 (22.27)	76 (27.74)	432 (31.91)	60 (27.91)
Underweight	66 (1.6)	25 (1.09)	3 (1.09)	34 (2.51)	4 (1.86)
Overweight	1487 (36.01)	883 (38.63)	90 (32.85)	450 (33.23)	64 (39.77)
Obese	1499 (36.3)	869 (38.01)	105 (38.32)	438 (32.35)	87 (40.47)
Retirement Status					
Completely Retired	2224 (54.47)	1164 (51.53)	110 (40.59)	856 (63.83)	94 (44.34)
Partially Retired	613 (15.01)	330 (14.61)	48 (17.71)	193 (14.39)	42 (19.81)
Not Retired- Still Working	1246 (30.52)	765 (33.86)	113 (9.07)	292 (21.77)	76 (35.85)

Table 3 Unadjusted Association between Preventable Health Behavior and Marital Status, N= 4,163		
	Moderate Preventable Health Behavior vs. Least	**Best Preventable Health Behavior vs. Least**
Characteristics		
Marital Status		
Married	1.00	1.00
Living with Partner	0.40 (0.27, 0.61)	0.26 (0.16, 0.43)
Divorced / Separated / Widowed	0.49 (0.39, 0.65)	0.31 (0.23, 0.42)
Never Married	0.49 (0.30, 0.82)	0.43 (0.25, 0.75)

Table 4: Adjusting Association of Preventable Health Behavior stratified by Females and Males, 2014. N=4,163				
	Moderate Preventable Health Behavior vs. Least		Best Preventable Health Behavior vs. Least	
Characteristics	Females	Males	Females	Males
Marital Status				
Married	1.00	1.00	1.00	1.00
Living with Partner	0.44 (0.24, 0.81)	0.57 (0.30, 1.07)	0.39 (0.19, 0.82)	0.23 (0.10, 0.50)
Divorced / Separated / Widowed	0.60 (0.41, 0.86)	0.61 (0.39, 0.96)	0.38 (0.25, 0.57)	0.47 (0.28, 0.79)
Never Married	0.68 (0.35, 1.33)	0.94 (0.40, 2.22)	0.58 (0.27, 1.27)	0.66 (0.25, 1.79)
Age				
50-64	1.00	1.00	1.00	1.00
65+	2.93 (1.99, 4.30)*	4.25 (2.73, 6.61)*	2.89 (1.83, 4.58)*	3.36 (2.04, 5.54)*
Education				
No Formal Education	1.00	1.00	1.00	1.00
Less than High School	1.48 (1.02,2.15)*	1.12 (0.69, 1.82)	2.44 (1.46, 4.09)*	2.09 (1.18, 3.71)*
High School Graduate	2.88 (1.83, 4.55)*	1.64 (0.95, 2.83)	5.72 (3.22, 10.13)*	2.99 (1.58, 5.63)*
Some College	3.2 (1.53, 6.71)*	2.14 (0.92 (4.99)	10.71 (4.72, 24.34)*	4.95 (1.99, 12.29)*
Post College	12.24 (2.93, 51.23)*	1.52 (0.65, 3.55)	37.19 (8.49, 162.78)*	4.95 (1.99, 12.28)*
Body Mass Index				
Normal	1.00	1.00	1.00	1.00
Underweight	0.63, 0.22, 1.79)	0.48 (0.14, 1.63)	0.74 (0.23, 2.46)	0.31 (0.06, 1.58)
Overweight	1.00 (0.65, 1.55)	1.52 (0.92, 2.50)	0.73 (0.45, 1.19)	1.22 (0.71, 2.09)
Obese	1.02 (0.68, 1.55)	1.41 (0.84, 2.35)	0.44 (0.28, 0.71)	0.72 (0.41, 1.28)
Retirement Status				
Completely Retired	1.00	1.00	1.00	1.00
Partially Retired	1.58 (0.92, 2.69)	2.02 (1.23, 3.60)*	2.92 (1.59, 5.36)*	3.07 (1.63, 5.77)*
Not Retired - Working	1.46 (0.96, 2.19)	3.82 (2.20, 6.62)*	3.64 (2.24, 5.93)*	6.57 (3.59, 12.01)*

CHAPTER FIVE: MANUSCRIPT TWO

THE ASSOCIATION BETWEEN PARTNERSHIPS AND CHRONIC CONDITIONS

Introduction

More than one in four American have two or more concurrent chronic conditions, including arthritis, asthma, chronic respiratory conditions, diabetes, heart disease, human immunodeficiency virus infection, and hypertension[20]. Multiple chronic conditions (MCC) can contribute to frailty and disability; most older persons who are frail or disabled have multiple chronic conditions[73]. As the number of chronic conditions in an individual increases, the risks of the following outcomes also increase: mortality, poor functional status, unnecessary hospitalizations, adverse drug events, duplicative tests, and conflicting medical advice[19,20,22,23,74]. The prevalence of MCC among individuals increases with age and is substantial among older adults, even though many Americans with MCC are under the age of 65 years[73].

People with MCC suffer suboptimal health outcomes and incur rising health care expenses therefore enhanced attention on this population is critical. Several conceptual models have been developed that attempt to transcend the focus on individual disease management and move toward broader approaches to managing chronic illness. One of the most influential is the Chronic Care Model, which highlights the elements required to improve chronic illness care. Two of the requirements in the model are self-management support and decision support[73]. This model promotes more productive interactions between patient and care team but also introduces innovative approaches to addressing MCC outside the clinician's office. Social support in older age has been one innovative approach to this model[5,73].

In a study by Wolff et al. 82 percent of aged Medicare beneficiaries had 1 or more chronic conditions, and 65 percent had multiple chronic conditions[23]. Inpatients admissions for ambulatory care sensitive conditions and hospitalizations with preventable complications increased with number of conditions; Medicare beneficiaries with 4 or more chronic conditions were 99 times more likely than a beneficiary without any conditions to have an admission for an ambulatory care sensitive condition (95% CI 86 -113)[23]. Per capita, Medicare expenditures increased with the number of chronic conditions from $211 with those without a chronic condition to $13,973 among those with 4 or more MCC[23].

Overall the MCC population is characterized by tremendous heterogeneity and varies greatly in the number of chronic conditions, the severity of condition and functional limitations. Developing the means for determining homogeneity in subgroups among heterogeneous populations is an important step to improve the health status of the aging population. Identifying subgroups will help determining more effective targets for interventions and consider potential disparities that may present implications for those with MCC. The combined effects of increasing life expectancy in the aging population and increasingly diverse marital status present new challenges to managing MCC among the population of older individuals. Developing a better understanding how conditions in combination with partnership status will help identify interventions for this escalating public health challenge. This information can be useful in helping clinicians develop prevention strategies tailor to population subgroups with greater prevalence of MCC, subsequently reducing health care costs among these groups.

Marriage is perhaps the most studied social tie linked to health outcomes, including cardiovascular disease, chronic conditions, mobility limitations, self-rated health, and

depressive symptoms[75,76]. A number of rigorous studies reveal that marriage can also lead to better general physical health and better outcomes for some specific health conditions such as arthritis, hypertension, and heart disease[76–78].

Over the past several decades, a dramatic shift in marriage has taken place as we have witnessed declines in marriage, increases in divorce, and increased cohabitation and partnerships[44]. Men and women are entering their retirement years will be increasingly heterogeneous in terms of marital status. In the United States, mortality rates among unmarried women were 50 percent higher than those for married women, and the gaps were worse for men. Unmarried men's mortality rates were approximately 250 percent higher than those for married men[76]. Much of the scientific literature shows that prevalence rates for disability and chronic disease are higher among unmarried groups, including those who are divorced and widowed[44].

Marriage plays a role in culture and customs that is an integral part of population health. Whether the observed health advantages of marriage grow or alter is unclear due to changing norms involving marriage, divorce, cohabitation, and partnership. Family forms are becoming more diverse and the boundaries between marital statuses have blurred, making a need to better understand the complexity of marital status on health. It is known that supportive social ties may trigger physiological sequelae (reduced blood pressure, heart rate, and stress hormones) that are beneficial to health and minimize unpleasant arousal that instigates risky behavior[80]. What continues to need more research is whether partnerships are more like general social support system or have the protective benefits like marriage on health outcomes.

Studies show that married individuals live longer and enjoy better health compared to those who are not married[27,28]. What is less studied are the benefits of more diverse relationships on health behaviors and outcomes. Living alone and living with a partner have become more

widespread options of living arrangements, even in older ages, which necessitates a need for a closer examination of these relationships and their impacts on health outcomes. Compared to married individuals, the association of partnered relationships in older adults and Multiple Chronic Conditions is not as well documented, which is the gap this study aims to fill.

Methods

This research comprised of a secondary analysis of cross-sectional data from the Health and Retirement Study (HRS) data set. The HRS is a biennial longitudinal interview survey of U.S adults over the age of 50 sponsored by the National Institute on Aging and conducted by the Institute for Social Research at the University of Michigan[94]. Employing a multi-stage area probability sampling design, HRS researchers began collecting data on issues of aging, health, and retirement starting in 1992. Since then, core interviews have been repeated on the original sample, along with newly added cohorts, every two years. The HRS is a publicly available, de-identified representative sample of U.S. adults aged 50 years and older.

Study Population For this study, respondents who participated in the 2014 wave of the survey and who provided information on the primary exposure and outcome were included. For analysis purposes, we focused on those individuals who were self – respondents of the study, did not live in a nursing home or assisted living facility, and did not have missing answers for the relationship status questions and variables included in each outcome. Of the possible 18,748 survey responses, 16,622 respondents were included in the analysis.

To arrive at the final sample size of 16,622, individuals with missing data for the exposure or outcome were excluded for analytical purposes. Additionally, subjects were ineligible if a proxy answered the questions for them or the subject was living in nursing home. Exploratory analysis was performed to determine the distribution of the multiple chronic

conditions in the sample population across demographic groups and covariates. Before modeling, assessment among the widowed, divorced, and separated groups showed no differences and this group was collapsed. Additionally, the never married, married, and living with a partner remained as separate categories for analysis.

Exposure Variable: Partnered status. Respondents' relationship status was determined by a survey question that asked, "Is [Name] married or living with a partner"? If other was selected a follow up question asked: "If unmarried, are you divorced, separated, widowed, and never married?" Respondents who reported they were married, re-married were categorized as Married. Those that voluntarily indicated they were living with a partner or partnered were categorized as Partnered, this included those who initially answered as other or unmarried but then asked to elaborate on civil status. Respondents answered divorced, separated, or widowed were categorized as such. Those who identified as never married remained separated from the other single. The divorced/ separated/ widowed variable was the reference group for all analyses with this variable.

Additional Control Variables: Education level was categorized as less than high school, high school graduate, some college, college graduate, or post-college degree. Body Mass Index was calculated by self-reported height and weight and categories of underweight (BMI <25), normal weight (BMI 25-29), overweight (BMI 30-34), or obese (BMI $\geq$ 35). Retirement status was categorized as follows: completely retired, partially retired, and not retired-working. Age was dichotomized in to two groups of those 50-64 and those 65 and older, based on a univariate analysis of that collected variable.

Outcome Multiple Chronic Conditions: The chronic conditions selected for this study originally stemmed from the HHS Initiative on Multiple Chronic Conditions Strategy

Framework[73]. This framework has four overarching goals, one is to "facilitate research to fill knowledge gaps about individuals with multiple chronic conditions[73]. All chronic conditions examined in this study were diagnosed conditions determined by survey questions asking questions to adults whether they had ever been told by a doctor or health care provider that they had a specific condition. Indicator variables of 8 chronic conditions were the following: Hypertension, Diabetes, Stroke, Non-skin Cancers, Chronic Lung Disease, Heart Disease, Arthritis, and Dementia. These indicator variables were summed to create a categorical measure for number of conditions present: 0, 1, 2, 3 and 4 or more. Research on multiple chronic conditions suggests including 20 conditions[73] when measuring the number of chronic conditions, but the 8 included in the HRS data set are strong predictors or mortality and morbidity.

Statistical Analysis

To examine the associations between partner status and multiple chronic conditions, univariate and bivariate analyses were conducted. Chi-square tests were used for categorical outcomes. To examine these associations, multinomial logistic regression was conducted to examine relationships between these variables. Each multivariable analysis controlled for socio-demographic characteristics and retirement status because these variables have been previously identified as potential confounders. SAS programming 9.4 was used as the statistical tool for analysis. Crude estimates would show the actual burden of chronic conditions by relationship status among US aging adults, however, this study is interested in the association between relationship status and MCC. To control for any influence in age, estimates were adjusted by age. In addition to descriptive characteristics of those with MCC, multivariate logistic regression analysis was conducted. An indicator of each of each of the selected diagnosed chronic

conditions was regressed on relationship status, (using Married as the reference category) and socio-demographic characteristics.

Results

The results from this study indicate some significant difference between the varying relationship statuses among older individuals. Table 6 provides a description of the chronic conditions included in the Multiple Chronic Condition category by relationship status. In the sample, 63 percent of those surveyed responded that they have hypertension, 60 percent have arthritis, 25 percent have diabetes, and 25 percent have heart disease. Table 6 lists the characteristics of the individuals sampled, 57 percent responded as being married, 5.5 percent living with a partner, 32.5 percent divorced, separated, or widowed, and five percent responded as never being married. The distribution of chronic conditions between zero and four or more was somewhat even, 13.6 percent of the sampled population reported zero chronic conditions, 24 percent reported one, 27 percent reported having two, 20 percent reported three, and 15 percent reported having four or more chronic conditions. Additionally, 59 percent of the respondents were female, the mean age was 68 (STD ±10.29), many of the respondents reported having less than a high school graduation (31%), and the mean BMI of respondents was 30 (STD ± 14.74), and a majority of respondents were completely retires, 52 percent. The demographics of the sampled population is similar of the U.S population when comparing the sample to the 2010 census.

The unadjusted association seen in Table 7 between marital status and multiple chronic conditions, where married individuals were the reference group, living with a partner was not statistically different from their married counterparts in having one or multiple chronic conditions compared to zero. Never married individuals were also not statistically different in

each of the chronic condition categories, but those who have been divorced, separated, or widowed were 1.35 (95% CI 1.19, 1.53) times more likely to have one chronic condition compared to their married counterpart and up to 2.44 (95% CI 2.14, 2.78) times more likely to have four or more chronic conditions compared to their married counterpart.

After adjusting for age, education, BMI, retirement status and stratifying by sex, the magnitude of the relationship between marital status and multiple chronic conditions remained significant. Table 8 describes the adjusted changes in the associations. However, among women, those living with a partner were 1.73 (95% CI 1.01, 2.96) times more likely to have four or more chronic conditions compared to their married counterpart. Divorced, separated, and widowed women had a dose response- like increased likelihood of having one or multiple chronic conditions compared to their married counterpart; where the odds of having one chronic condition represents an OR of 1.31 (95% CI 1.04, 1.65) and increased to 2.03 (95% CI 1.56, 2.65) with four or more chronic conditions. Additionally, among both men and women, increased age represents an increased likelihood of having one or more chronic conditions. Individuals with more education are less likely to have chronic conditions compared to individuals with no formal education. In both men and women, individuals who are overweight and obese are at an increased risk for one or multiple chronic conditions compared to those in a normal BMI range. Lastly, individuals who are still working have a protective benefit compared to individuals who are retired among both men and women in not having an increased risk for one or multiple chronic conditions.

Discussion

Implications

This study found that individuals who are living with a partner do not receive similar benefits as those who are married in terms of likelihood of having one or more chronic conditions. Previous studies have shown the relationship between marriage and its positive association toward better health outcomes[42,65,97]. However, the same does not appear to hold true for those living with a partner.

Furthermore, research has found that marital relationships are highly gendered with the association of multiple chronic conditions[5]. The results of this study did show some differences in marital status and chronic conditions among men and women but only significant difference among women who were divorced, separated, or widowed compared to their married counterpart. Previous studies show that even among married women or those living with a partner, women are less inclined to care for themselves when they are ill and receive less spousal support in managing health problems[100]. Compared to men, in our results women were inclined to have an increased risk of having one or more multiple chronic conditions across most categories, which supports this finding. The implications of this information suggests that women living with MCC's may experience more difficulties and fewer gains than their male counterparts.

The role of an individual's marital status on their health is important to understand as one's partner is able to be vital in decision-making and care coordination. Some evidence suggests that unlike younger adults who prefer decision making autonomy, older adults show a tendency towards delegation and making decisions based on the wishes of others[101]. In contrast, a study by Chi et. al. found that most older adults prefer to participate in making health care decisions[102]. These findings as well as our research point to the opportunity for physicians, especially those in innovative health care delivery models, be involved in shared decision –

making conversations. These new health care delivery models need to tie in one's marital status as potential risk factors for developing multiple chronic conditions. Considering integration of these models in to value based medicine models, financial incentives for providers should be tied to patient and family based health care decisions. For example, the Comprehensive Primary Care Plus model, engages individuals and families to actively participate in decision – making[102].

As the prevalence of MCC continues to increase among adults in older ages, identifying factors that can help reduce one's risk is important since MCCs are associated with increased health care costs and decreased life expectancy as age increases[103,104]. Multiple chronic conditions are preventable. Many chronic conditions share similar preventable risk behaviors such as tobacco use, physical inactivity, and caloric consumption[105]. Other risks are non-modifiable, like age or sex, that increase one's likelihood of a chronic condition. Marriage is a known benefit to protect an individual against modifiable risk factors associated with MCC's[45]. As relationship statuses continue to be dynamic in the United States, understanding the value of how one's marital status can be a risk for multiple chronic conditions in older age is important to note. If marriage is different than having a partner in later life, what are the reasons underlying these changes?

Study Strengths and Limitations

This study was innovative in its approach to analyzing the association between partner status and chronic conditions. Researchers representing various disciplines have taken up the study of partnering behavior, and their work has been published[99]. Data collection available from the HRS provided a basis for supplementing what we know about partnering and expanding our conceptual and theoretical scope from marital to non-marital relationships. Using this expanded scope provided insights into how multiple chronic conditions are similar and different among

these relationship types. This research identified new findings that have not yet been published in this cohort. Using the HRS data set provided a large, representative study sample that allowed results to be generalizable to the U.S population.

Limitations to this study include that our analysis was largely based on secondary data. Therefore, the validity partially depends on the structure of the survey questions and participant's interpretation of the questions. The question regarding partnership did not distinguish whether or not the individual was in a same-sex or heterosexual marriage or partnership. At the time of the survey, in 2014, same sex marriage was not legal across all fifty states and the perception of cohabiting with a same-sex or opposite sex individual may alter one's response to "Are you married?" or "If not, are you living with a partner?". Due to timing and perception of views, this question may have been answered different ways depending on the comfort level or location of the individual responding. Additionally, chronic conditions included for analysis were determined by a limited number of self- reported diagnoses asked about in the survey. Some additional conditions are included in various reports that were not available to us in this study, therefore findings showing regarding the association between marital status and MCC's must be interpreted with caution.

Conclusion

The MCC population is characterized by tremendous clinical heterogeneity and developing a means for determining homogeneity among subgroups is viewed as an important step in the effort to improve the health status of the population[73]. While chronic conditions can be difficult on an individual, there is increased risk to those who are not married which represents a large proportion of older adults in the United States. Furthermore, a growing social

science literature reveals the changing forms of partnering in American society. Continuing to understand the impact of one's relationship on health behavior and chronic health is key.

Using an individual's partner as part of the health decision making team is an integrative approach to patient care. Knowing who the key players are in the room or around the table dictate a patient's success outside the doctor's office. With studies such as these, we start to better understand how certain relationship structures are alike and different. This information is key for developing integrative health models as they incorporate more of a team based approach to patient care.

Table 5 Descriptive Characteristics of Chronic Conditions included in Multiple Chronic Conditions, N=16,622					
	Sample Size N= 16,622 100%	**Married** n=9447 56.83%	**Partner** n=926 5.57%	**Divorced / Separated / Widowed** n=5403 32.51%	**Never Married** n=846 5.09%
Chronic Condition					
Hypertension	10,407 (62.61)	5575 (59.01)	568 (61.34)	3730 (69.04)	534 (63.12)
Diabetes	4086 (24.58)	2245 (23.76)	218 (23.54)	1413 (26.15)	210 (24.82)
Stroke	1129 (6.79)	566 (5.99)	56 (6.05)	449 (8.31)	58 (6.86)
Cancer (non- skin)	2591 (15.59)	1459 (15.44)	109 (11.77)	923 (17.08)	100 (11.82)
Lung Disease	1748 (10.52)	798 (8.45)	113 (12.20)	749 (13.86)	88 (10.40)
Heart Disease	4076 (24.52)	2226 (23.56)	183 (19.76)	1508 (27.91)	159 (18.79)
Arthritis	9949 (59.85)	5357 (56.71)	498 (53.78)	3626 (67.11)	468 (55.32)
Dementia	284 (1.71)	139 (1.47)	10 (1.08)	118 (2.18)	17 (2.01)

Table 6: Descriptive Characteristic of Multiple Chronic Conditions among Adults from the Health Retirement Survey, 2014, N = 16,622							
	Sample Size N = 16,622 (100%)	**Zero Chronic Conditions** n = 2268 (13.64%)	**1 Chronic Condition** n = 3928 (23.63%)	**2 Chronic Conditions** n = 4513 (27.15%)	**3 Chronic Conditions** n = 3389 (20.39%)	**4 or more Chronic Conditions** n = 2524 (15.18%)	**p-value tests for Chi - Squared**
Characteristics							
Marital Status							
Married	9447 (56.83)	1476 (15.62)	2368 (25.07)	3656 (26.94)	1806 (19.12)	1252 (13.25)	<0.0001
Living with Partner	926 (5.57)	158 (17.06)	255 (27.54)	220 (23.76)	167 (18.03)	126 (13.61)	
Divorced / Separated / Widowed	5403 (32.51)	499 (9.24)	1082 (20.03)	1524 (33.77)	1266 (37.36)	1032 (40.89)	
Never Married	846 (5.09)	135 (15.96)	223 (26.36)	224 (26.48)	150 (17.73)	114 (13.48)	
Sex							
Female	9787 (58.88)	1255 (12.82)	2329 (23.80)	2741 (28.01)	2021 (20.65)	1441 (14.72)	<0.0002
Male	6835 (41.12)	1013 (14.82)	1599 (23.39)	1772 (25.93)	1368 (20.01)	1083 (15.84)	
Age							
Age, Mean (Std)	67.78 (10.29)	61.29 (7.88)	65.11 (9.58)	68.50 (10.02)	70.93 (10.211)	72.22 (9.81)	<0.0001
50-64	7490 (45.06)	1708 (22.80)	2220 (29.64)	1873 (25.01)	1054 (14.07)	635 (8.48)	
65+	9132 (54.94)	560 (6.13)	1708 (18.70)	2640 (28.91)	2335 (25.57)	1889 (20.69)	
Education							
No Formal Education	3236 (19.57)	302 (9.33)	619 (19.13)	873 (26.98)	748 (23.11)	694 (21.45)	<0.0001
Less than High School	5188 (31.37)	591 (11.93)	1132 (21.82)	1453 (28.01)	1143 (22.03)	869 (16.75)	
High School Graduate	4048 (24.48)	574 (14.18)	1017 (25.12)	1069 (26.41)	835 (20.63)	553 (13.66)	
Some College	2118 (12.81)	427 (20.16)	596 (28.14)	552 (26.06)	336 (15.86)	207 (9.77)	
Post College	1947 (11.77)	347 (17.82)	550 (28.25)	551 (28.30)	310 (15.92)	189 (9.71)	
Body Mass Index							
BMI, Mean (Std)	30.03 (14.74)	28.08 (14.85)	29.36 (15.96)	29.97 (13.75)	31.01 (14.57)	31.57 (14.35)	<0.0001
Normal	2200 (26.02)	443 (20.14)	614 (27.91)	554 (25.18)	334 (15.18)	255 (11.59)	
Underweight	130 (1.54)	18 (13.85)	36 (27.69)	38 (29.23)	23 (17.69)	15 (11.54)	
Overweight	3054 (36.12)	452 (14.80)	733 (24.00)	849 (27.80)	599 (19.61)	421 (13.79)	
Obese	3070 (36.31)	255 (8.31)	614 (20.00)	835 (27.20)	752 (24.50)	614 (20.00)	

Retirement Status							
Completely Retired	8362 (51.88)	456 (5.45)	1474 (17.63)	2312 (27.65)	2198 (26.29)	1922 (22.98)	<0.0001
Partially Retired	2221 (13.78)	288 (12.97)	557 (25.08)	674 (30.35)	456 (20.53)	246 (11.08)	
Not Retired - Working	5534 (34.34)	1468 (26.53)	1798 (32.49)	1386 (25.05)	602 (10.88)	280 (5.06)	

p-value for chi-squared test

Table 7 Un-adjusted Association of Multiple Chronic Conditions and Marital Status among Adults from the Health Retirement Survey, 2014, N = 16,622

	1 Chronic Condition vs. zero	**2 Chronic Conditions vs. zero**	**3 Chronic Conditions vs. zero**	**4 or more Chronic Conditions vs. zero**
Characteristics				
Marital Status	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Married	1.00	1.00	1.00	1.00
Living with Partner	1.01 (0.82, 1.24)	0.81 (0.65, 1.00)	0.86 (0.69, 1.08)	0.94 (0.74, 1.20)
Divorced / Separated / Widowed	1.35 (1.19, 1.53)*	1.77 (1.57, 1.99)*	2.07 (1.83, 2.35)*	2.44 (2.14, 2.78)*
Never Married	1.03 (0.82, 1.29)	0.96 (0.77, 1.20)	0.91 (0.71, 1.16)	0.99 (0.77, 1.29)

Table 8: Adjusted Association of Multiple Chronic Conditions and Marital Status among Adults from the Health Retirement Survey, 2014, N = 16,622

	1 Chronic Condition vs. none		**2 Chronic Conditions vs. none**		**3 Chronic Conditions vs. none**		**4 or more Chronic Conditions vs. none**	
Characteristics	Females	Males	Females	Males	Females	Males	Females	Males
Marital Status								
Married	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Living with Partner	0.97 (0.62, 1.52)	1.12 (0.75, 1.68)	1.09 (0.69, 1.73)	0.91 (0.58, 1.40)	1.18 (0.71, 1.96)	1.21 (0.76, 1.92)	1.73 (1.01, 2.96)*	1.07 (0.63, 1.82)
Divorced / Separated / Widowed	1.31 (1.04, 1.65)*	0.92 (0.67, 1.3)	1.67 (1.32, 2.09)*	1.04 (0.76, 1.41)	1.78 (1.39, 2.28)*	0.92 (0.66, 1.29)	2.03 (1.56, 2.65)*	0.96 (0.68, 1.36)
Never Married	1.10 (0.69, 1.75)	1.31 (0.78, 2.21)	1.22 (0.76, 1.95)	1.24 (0.72, 2.13)	1.44 (0.86, 2.39)	1.22 (0.66, 2.24)	1.44 (0.82, 2.53)	1.24 (0.64, 2.44)
Age								
50-64	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
65+	1.74 (1.33, 2.28)*	2.02 (1.51, 2.71)*	2.77 (2.11, 3.62)*	2.89 (2.16, 3.87)*	3.05 (2.28, 4.07)*	3.03 (2.21, 4.14)*	2.65 (1.95, 3.61)*	4.14 (2.94, 5.84)*
Education								
No Formal Education	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Less than High School	0.86 (0.60, 1.22)	1.19 (0.82, 1.72)	0.75 (0.53, 1.07)	0.80 (0.56, 1.14)	0.76 (0.53, 1.09)	0.77 (0.52, 1.13)	0.433 (0.29, 0.63)	0.76 (0.51, 1.13)
High School Graduate	0.85 (0.59, 1.22)	1.70 (1.16, 2.48)*	0.78 (0.55, 1.11)	0.94 (0.65, 1.37)	0.68 (0.47, 0.98)^	1.10 (0.74, 1.64)	0.38 (0.26, 0.55)^	0.81 (0.53, 1.23)
Some College	0.64 (0.44, 0.94)^	0.89 (0.59, 1.32)	0.49 (0.33, 0.72)^	0.51 (0.34, 0.76)^	0.30 (0.19, 0.46)^	0.53 (0.34, 0.81)^	0.19 (0.12, 0.29)^	0.42 (0.27, 0.68)^
Post College	07.21 (0.48, 1.07)	1.14 (0.75, 1.72)	0.60 (0.40, 0.89)^	0.64 (0.43, 0.97)^	0.33 (0.22, 0.52)^	0.67 (0.43, 1.04)	0.19 (0.12, 0.31)^	0.40 (0.25, 0.66)^
Body Mass Index								
Normal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Underweight	1.07 (0.54, 2.11)	1.65 (0.39, 6.95)	1.26 (0.63, 2.52)	1.65 (0.39, 6.95)	0.99 (0.44, 2.19)	3.09 (0.72, 13.23)	0.76 (0.31, 1.85)	2.44 (0.50, 11.84)
Overweight	1.15 (0.91, 1.47)	1.41 (1.08, 1.86)*	2.03 (1.58, 2.60)*	1.48 (1.09, 1.92)*	2.37 (1.79, 3.13)*	1.75 (1.27, 2.41)*	1.94 (1.43 (2.63)*	1.93 (1.36, 2.74)*
Obese	1.99 (1.54, 2.59)*	2.11 (1.54, 2.91)*	4.62 (3.54, 6.04)*	2.82 (2.04, 3.90)*	7.25 (5.41, 9.71)*	4.92 (3.45, 7.02)*	7.85 (5.75, 10.72)*	2.11 (1.54, 2.91)*

Retirement Status								
Completely Retired	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Partially Retired	0.71 (0.51, 1.01)	0.75 (0.52, 1.08)	0.59 (0.42, 0.83)	0.62 (0.44, 0.89)	0.48 (0.34, 0.69)	0.42 (0.29, 0.61)	0.32 (0.22, 0.48)	0.21 (0.14, 0.32)
Not Retired - Working	0.64 (0.49, 0.85)	0.51 (0.37, 0.71)	0.38 (0.28, 0.49)	0.28 (0.21, 0.39)	0.19 (0.14, 0.26)	0.12 (0.08, 0.16)	0.09 (0.06, 0.13)	0.06 (0.4, 0.09)

CHAPTER SIX: DISCUSSION

Overall, these finding show that living with a partner provides some protective benefits to health similar to married individuals. Specifically, older adults in partnered relationships are similar to married individuals when it comes to the likelihood of having one or more chronic conditions. However, our findings show that those who are partnered are not as likely to participate in preventable health behaviors as their married counterparts. These results support that the influence of relationships on one's health may be diverse.

Many studies provide evidence that social ties influence health behavior since social control plays a promoting factor in health enhancing behavior[5]. Married men and women experience lower mortality at every age relative to those who remain unmarried or lose their spouse through widowhood or divorce[4]. One can think of social control or that regular advice from your partner to "eat your vegetables" or "how many donuts have you had today" or "don't drive so fast". A meta-analysis by Craddock et al. suggests that social control is associated with improved health behavior. Their findings suggest that positive social control is related to positive effects on health behavior[98]. The limitations to this meta-analysis, however, is that it does not break down social control in to various relationship types but it does indicate that a level of relationship, in the context of social control, has benefits to one's health behavior. Fewer studies have investigated the attributes about diverse relationships and their effects on preventable health behavior and health outcomes as this study has done.

Implications of Partnership on Preventable Health Behavior

Previous studies have shown the relationship between marriage and its positive association toward better health outcomes[42,65,97]. Health behaviors of married partners converge over time and such that partners who have been married many years may have similar behaviors[97]. The uniqueness of this study is that it is not limited to just marriage as an indication for influential cohabitation. The findings support studies that focus on marriage as a marker for this population to have better health behavior. However, our results suggest that partnerships in late life are not similar to marriage in their influence on adoption of better health behaviors.

Research has found that older adults are an age group that is the least likely to engage in preventable health behaviors, even though these behaviors continue to benefit individuals throughout a life span[29]. Individuals who engage in preventable health behavior may be better protected from declines in function and are more likely to live longer, healthier lives[58]. Death and decline associated with the leading chronic diseases are often preventable or can be delayed[1]. Identifying positive contributing attributes that lead to improved preventable health behavior in these cohorts will benefit the aging population.

More research on partnering adults is needed, especially as the baby boom generation matures into retirement. Various factors, such as increased life expectancy, changing attitudes towards living arrangements, the rise of Internet dating, and retirement communities will change romantic options available to older adults. As we know how marriage impacts health behavior, these additional relationship statuses will continue to be areas needing more research.

As people in the United States and across the globe live longer, there is an increasing interest in understand and promoting health in later life. We know marriage plays a key role in preventable health behavior and there are intervention opportunities to engage older adults who are not married. Incorporating relationship characteristics as a predictor for health behavior later

in life is not something that has been widely considered. The knowledge of knowing one's social relationship can greatly impact clinical decision- making and opportunities for influencing behavior changes. As substantial changes to living arrangements continue to evolve, it's an exciting time to be a researcher studying these influences. The results of this study show there is opportunity in knowing more about the differences in partnerships in later life and has identified an area where public health practitioners can promote healthy aging.

Implications of Partnerships on Chronic Conditions

This study found that individuals who are living with a partner are not significantly different from those who are married in terms of likelihood of having one or more chronic conditions. Previous studies have shown the relationship between marriage and its positive association toward better health outcomes[42,65,97]. However, the same does not appear to hold true for those living with a partner.

Furthermore, research has found that marital relationships are highly gendered with the association of multiple chronic conditions[5]. The results of this study did show some differences in marital status and chronic conditions among men and women but only significant difference among women who were divorced, separated, or widowed compared to their married counterpart. Previous studies show that even among married women or those living with a partner, women are less inclined to care for themselves when they are ill and receive less spousal support in managing health problems[100]. Compared to men, in our results women were inclined to have an increased risk of having one or more multiple chronic conditions across most categories, which supports this finding. The implications of this information suggests that women living with MCC's may experience more difficulties and fewer gains than their male counterparts.

Additionally, the role of an individual's marital status on their health is important to understand as one's partner is able to be vital in decision – making and care coordination. Evidence suggests that unlike younger adults who prefer decision making autonomy, older adults show a tendency towards delegation and making decisions based on the wishes of others[101]. Furthermore, a study by Chi et. al. found that most older adults prefer to participate in making health care decisions[102]. These findings along with our research find promising opportunity for physicians, especially those in innovative health care delivery models, be involved in shared decision – making conversations. These new health care delivery models need to tie in one's marital status as potential risk factors for developing multiple chronic conditions. Considering integration of these models in to value based medicine models, financial incentives for providers should be tied to patient and family based health care decisions. For example, the Comprehensive Primary Care Plus model, engages individuals and families to actively participate in decision – making[102].

As the prevalence of MCC continues to increase among adults in older ages, identifying factors that can help reduce one's risk is important since MCCs are associated with increased health care costs and decreased life expectancy as age increases[103,104]. Multiple chronic conditions are preventable. Many chronic conditions share similar preventable risk behaviors such as tobacco use, physical inactivity, and caloric consumption[105]. Other risks are non-modifiable, like age or sex, that increase one's likelihood of a chronic condition. Marriage is a known benefit to protect an individual against modifiable risk factors associated with MCC's[45]. As relationship statuses continue to be dynamic in the United States, understanding the value of how one's marital status can be a risk for multiple chronic conditions in older age is important to

note when it comes to prevention and intervention. If marriage is different than having a partner in later life, what are the reasons underlying these changes?

The MCC population is characterized by tremendous clinical heterogeneity and developing a means for determining homogeneity among subgroups is viewed as an important step in the effort to improve the health status of the population[73]. While chronic conditions can be overwhelming on an individual, there is increased risk to those who are not married which represents a large proportion of older adults in the United States. Furthermore, a growing social science literature reveals the changing forms of partnering in American society. Continuing to understand the impact of one's relationship on health behavior and chronic health conditions is key.

Study Strengths and Limitations

Researchers representing various disciplines have taken up the study of partnering behavior, and their work has been published[99]. Data collection available from the HRS provided a basis for supplementing what we know about partnering and expanding our conceptual and theoretical scope from marital to non-marital relationships. Using this expanded scope provided important insights towards how multiple chronic conditions are similar and different among these relationship types. Additionally, preventable health behavior is a leading opportunity for risk prevention of developing these chronic diseases. Again using the HRS questionnaire, health behaviors were identified innovatively in to categories to determine preventable health behavior. This research uncovered new findings that have not yet been published. Using the HRS data set provided a large, representative sample that helps provide a better understanding of the associations between diverse relationships and health.

Additionally, the research had some limitations to the data and analysis. The HRS survey is self-reported data. Asking the question about partnership may be a sensitive question, which was asked at a time before same- sex marriage was legal in the United States. Therefore, the number of respondents may be an underrepresentation of a larger number. Furthermore, sexual orientation is not disclosed, so partnership in this study represents both heterosexual and homosexual couples. At the time of the survey, in 2014, same sex marriage was not legal across all fifty states and the perception of cohabiting with a same- sex or opposite sex individual may alter one's response to "Are you married?" or "If not, are you living with a partner?". Due to timing and perception of views, this question may have been answered different ways depending on the comfort level or location of the individual responding.

Chronic conditions included for analysis were determined by a limited number of self-reported diagnoses asked about in the survey. Some additional conditions are included in various reports that were not available to us in this study, therefore direct comparisons about marital status as a risk factor for MCC's cannot be made.

The length and quality of relationships were not examined. The HRS data provides responses on length of marriage and number of marriages but is not as detailed around partnered relationships. To better understand the quality of relationships on health, these data could provide more strength behind the findings of this study.

Future Studies

The current study points to additional opportunities to dive in to the differences among individuals who are partnered versus married. Future studies, depending on how the data is collected, may want to further stratify by types of partnerships to best understand how they differ from married individuals. Additionally, considering length and quality of one's relationship may

provide a better understanding of how one's relationship is associated or may affect health behavior and outcomes.

Conclusion

The role of an individual's marital status on their health is important to understand, as one's partner is able to be vital in decision-making and care coordination. Care decisions support patients through innovative approaches that take a deeper dive in to patient care. Making medical decisions, especially as one ages, can be a complicated and overwhelming process. Having a support person to help with decisions about care, from diagnostic tests and x-rays to surgical procedures, can ease the right approach for patient-centered care. This concept helps personalize medicine through education, conversation, and provides the most well-rounded treatment option for all individuals involved.

Growing social science literature continues to reveal changing forms of partnering in American Society. Knowing more about these opportunities for motivation and engagement in older adults to participate in preventable health behavior is important to determine. When one engages in preventable health behavior it is positively associated with reduced chronic conditions later in life[30]. Chronic conditions are equally challenging to the individual and the caretaker. This study and this information is key for integrative health models as they incorporate more of a team- based approach to patient care.

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