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Correlates and Etiological Factors Associated with Hedonic Well-Being Among an Aging Population of US Men and Women: secondary data analysis of a national survey

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ABSTRACT

Objective. To understand the gender-specific factors that uniquely contribute to successful aging in a US population of men and women, 57-85 years of age. This was achieved through the examination of the correlates of subjective well-being defined by health-related quality of life (HRQoL), across several biological and psychosocial determinants of health.

Design. Cross sectional study

Setting. The NSHAP (National Social Life, Health and Ageing Project, 2010-11) a representative sample of the US population.

Participants. 3,377 adults aged 57 to 85 (1538 men, 1839 women) from the NSHAP.

Main outcome measures. The bio-psychosocial factors of Biological/Physiological Function, Symptom Status, Functional Status, General Health Perceptions and HRQoL-happiness.

Method. HRQoL was measured using the NSHAP Wave 2 multistage, stratified area probability sample of US households (N=3,377). Variable selection was guided by the Wilson's and Cleary's Model (WCM) that classifies health outcomes at five main levels and characteristics.

Results. Our findings indicate differences in bio-psychosocial factors comprised in the WCM and their relative importance and unique impact on HRQoL by gender. Women reported significantly lower HRQoL than men (t=3.5, df=3366). The most significant contributors to HRQoL in women were mental health (B=0.31; 0.22, 0.39), loneliness (B=-0.26; -0.35, -0.17), urinary incontinence (B= -0.22; -0.40, -0.05) and support from spouse/partner (B=0.27; 0.10, 0.43), and family B=0.12; 0.03, 0.20). Men indicated mental health (B=0.21; 0.14, 0.29), physical health (B=0.17; 0.10, 0.23), functional difficulties (B=0.38; 0.10, 0.65), loneliness (B=-0.20; -0.26, -0.12), depression (B= -0.36; -0.58, -0.15) and support from friends (B=0.06; 0.10, 0.11) as significant contributors. Those with greater social support had better HRQoL (F=4.22, df=4). Lack of companionship and reliance on spouse/partner were significant HRQoL contributors in both groups.

Conclusion. Our findings offer insight into aging, gender and subjective well-being. The results provided an opportunity to identify bio-psychosocial factors to inform interventions to support successful aging.

Strengths and limitations of this study

- A variety of bio-psychosocial factors that contribute to well-being by gender were compared, where prior studies have not used gender as an independent variable.
- Effect sizes were used to summarize our regression analyses for a manageable and clinically interpretable picture of the unique contribution of gender across the comprehensive Wilson Cleary Model's (WCM), linking bio-psychosocial factors to overall well-being defined as Health Related Quality of Life - happiness.
- We were unable to establishing a cause-effect relationship or to determine changes in perceptions over time based on our cross-sectional analysis.
- We were limited to define the WCM levels based on variables in the NSHAP; yet with the variety of indicators captured in the NSHAP, this was a minor limitation.
- Beyond identified limitations, results mirrored prior research and contributed to the understanding of HRQoL gender-based differences, while controlling for potential confounders including age, race/ethnicity and socioeconomic status.

INTRODUCTION

Successful aging was traditionally defined as the absence of disease and associated functional limitations.[1] However, the definition has shifted to a multidimensional view that accounts for psychosocial and cultural aspects of health and health related quality of life (HRQoL).[1,2] This shift in definition is driven by patient center care, patient empowerment and shared decision making with providers in the healthcare setting.[2] In fact, HRQoL is now viewed as an important complement to biomedical measures of health.[3] An important indicator of successful aging is subjective well-being, an aspect of HRQoL. Subjective well-being, is a direct predictor of health outcomes affecting biological, physical, and psychosocial changes in older adults.[4,5] Improvements in population-level well-being is an aspiration of society, sparking policy and economic debates.[6] Studies of life satisfaction have shown that subjective well-being is affected by a multitude of additional factors, including social and familial relationships. These additional factors may be protective, potentially decreasing or eliminating the chronic disease and symptom burden.[6]

Three approaches exist to capture subjective well-being; these are life evaluation (e.g., life satisfaction); hedonic well-being (e.g., experienced happiness, anger); and eudemonic well-being (e.g., life meaning and purpose.[6] Researchers suggest subjective well-being be a measure for healthcare resources allocation. Therefore, the need exists to further identify and understand the factors associated with successful aging.[2,7] It is also essential to compare these factors between men and women to determine the unique contribution of gender.[2] Evidence to date remains unclear as prior studies of gender differences have focused on specific chronic diseases or on socioeconomic and demographic factors, usually controlling for gender as a potential confounder and not as an independent variable.[8] Therefore, we sought to identify the correlates and etiological factors associated with hedonic well-being, specifically feelings of happiness, through a bio-psychosocial lens, accounting for gender variability, in an aging population of US adults. Happiness, served as a proxy for HRQoL. It is a measure of life satisfaction, the absence or presence of desirable or undesirable feelings or experiences. It is proven useful in the analysis of HRQoL.[9]

Guided by the Wilson's and Cleary's Conceptual Model (WCM), Figure 1 we analyzed the National Social Life, Health and Aging Project (NSHAP), second wave data. We examined whether objective (e.g., biological/physiological) and self-perceived measures (e.g., functional status) of health explain gender differences in HRQoL (i.e., happiness). Self-rated perceptions of health have been observed to correlate with other health indicators including morbidity.[10] We determined the best models predicting the HRQoL of male and female US adults ages 57 to 85.[11] We explored the extent to which the WCM levels interact to predict HRQoL and provide greater insight into aging. The bio-psychosocial WCM was selected for our analysis as it considers health outcomes on a continuum of increasing complexity and health trajectories associated with aging. It is also shown to enhance knowledge about HRQoL in diverse populations.[11] The model classifies health outcomes at five main levels.[11] The first level Biological/Physiological function, examines the individual as a whole. Symptoms (level 2), are the perceptions of physical, emotional, and cognitive states. Symptoms are considered significant determinants of Functional Status (level 3), with biological and symptom variables evidenced to be correlated with Functional Status. General Health Perceptions (level 4) are subjective appraisals of health and Overall Quality of Life (level 5) as a whole.[11] Variables that comprise each level interact in complex ways to determine HRQoL. Arrows linking the five main levels indicate dominant causal relationships. In addition, the five main levels are influenced by individual (e.g., age, education) and environmental characteristics (e.g., social support).[11] Studies of hedonic states, including happiness, have predicted morbidity and mortality. However, cofounding factors indicate that well-being is coupled with additional factors such as education.[10] The WCM controls for potential confounding. Additionally, different than prior studies that compared the quantified HRQoL scores across gender, we identified the hierarchical differences of each WCM level and their weighted contribution to HRQoL (happiness).

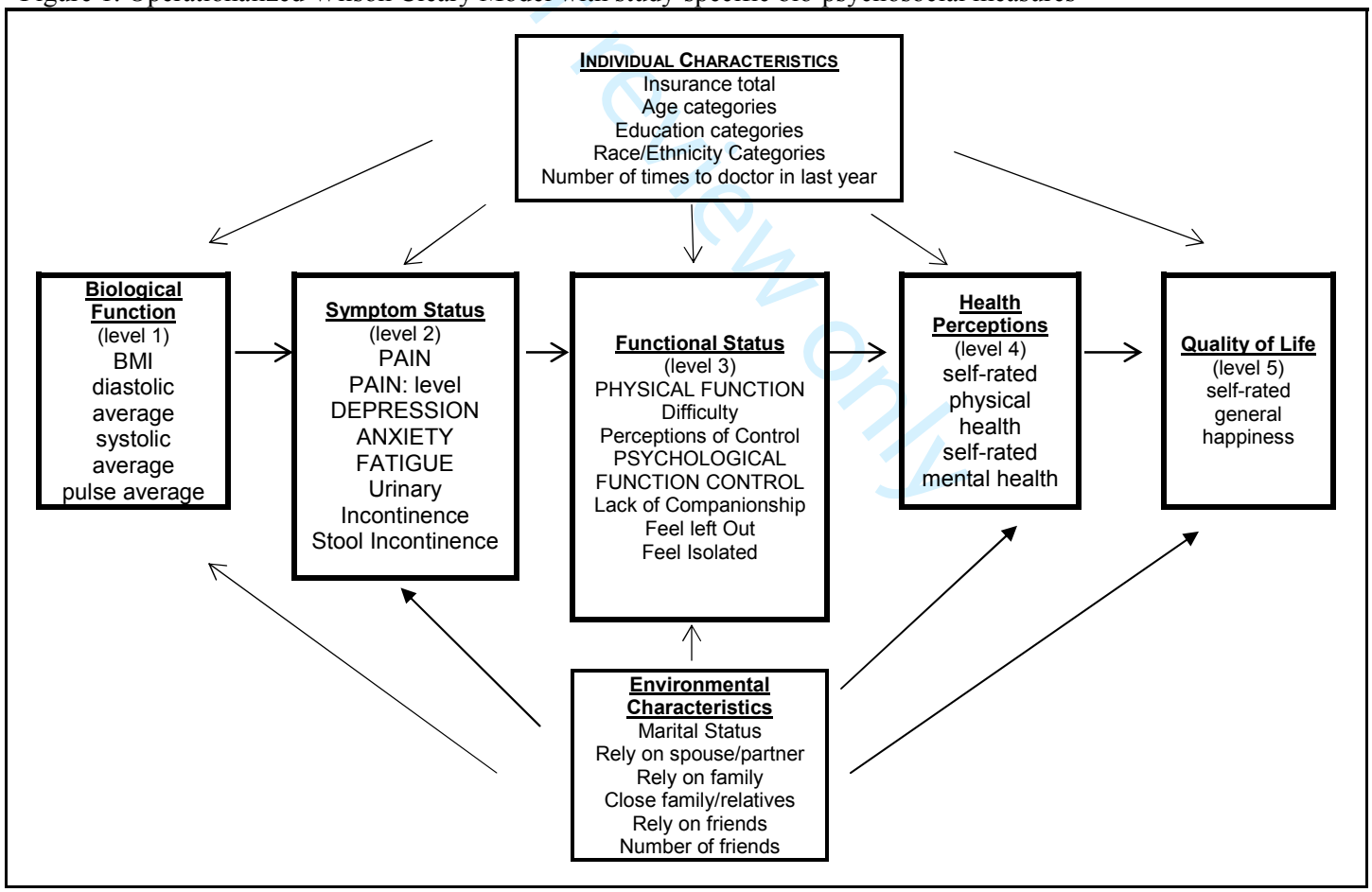
METHODS

Participants. The second wave of the NSHAP survey, a National sample of US adults ages 57 to 85, was utilized in our analysis, was conducted from 2010-2011.[12] The survey focused on exploring interpersonal connections and overall health outcomes as they relate to: culture, gender and socioeconomic status; health behaviors; health care

utilization, social support, and well-being.[12] Our current study utilized Wave 2 data to explore the relationship between the WCM constructs for both men and women. Wave 2, with its large sample size (N=3,377) and strong methodology, allowed us to systematically investigate important aspects of HRQoL and aging.

Measures. NSHAP variables used in our analysis were selected based on best fit with the WCM constructs. We categorized the five main levels and characteristics of the WCM under two overarching categories of Objective and Subjective health indicators, Figure 1. The Objective indicators of the first main level of Biological/Physiological Function were, Body Mass Index (BMI), average pulse rate, and average blood pressure (systolic and diastolic). The last four main levels of the WCM comprised Subjective health indicators. These included the assessment of participant perceptions of health outcomes on both individual and societal levels. Variables that comprised Symptom Status were pain, pain level, depression, anxiety, fatigue, urinary incontinence and stool incontinence. Variables that comprised Functional Status were physical function difficulty, perceptions of control, companionship and feeling left out or isolated. Variables that comprised General Health Perceptions were self-rated physical and mental health. Our outcome variable of interest for HRQoL in this study was defined by hedonic well-being: self-rated happiness, asking participants thoughts and feelings about their life overall. The WCM also accounts for important individual and environment influences directly impacting objective and subjective indicators. Variables that comprise Individual Characteristics were insurance coverage, age group, education, race/ethnicity, and provider visits. Variables that comprise Environmental Characteristics were marital status, reliance on spouse, partner, relatives and friends, and number of friends.

Figure 1. Operationalized Wilson Cleary Model with study-specific bio-psychosocial measures



Statistical analysis. The association between HRQoL (i.e., happiness) and the constructs of the WCM were examined in separate analyses for male and female participants. Descriptive statistics were conducted to characterize the sample and variable distributions. Participant characteristics were summarized with means and standard deviations for continuous variables and percentages and frequencies for categorical variables. Individual and environmental characteristics were also examined for potential confounding. Pearson Product Moment Correlations (PPMCs) were calculated to determine the relationship between the WCM construct and characteristic variables and reported HRQoL by participants. Chi square analyses were used to assess differences in categorical variables. Linear regression analyses were performed to assess the relevant importance of significantly correlated variables that potentially contribute to HRQoL. Variables with significant differences ($p<0.05$) were retained for additional analysis.

Two independent stepwise multiple regressions (i.e., men and women) were performed to identify variables as a group best associated with HRQOL. Retained variables were ranked by partial R^2 order to determine their relative contribution. Effect sizes were also estimated for each retained variable with t-values corresponding to the coefficient estimates divided by the associated standard errors. To identify constructs with the most consistent associations with HRQoL, effect sizes and R^2 rankings were averaged per WCM construct for men and women. Data analysis was conducted with use of SPSS 21.0. The stepwise approach allows for the prevention of bias in the selection of variables in the final model.[13 14]

Patient Involvement. As an analysis of secondary data, no participants were not involved in the development of our research questions or with the analysis of the outcome measures. Additionally, participants were not involved with the interpretation of data or the writing of our analytic findings. Dissemination of analytic findings to study participants or members of their associated communities will not be accomplished.

Table 1. Demographic Characteristics of Participants *(N=3,377)*

	N	*(%)*
Gender		
Male	1538	45.5
69 or Under	585	38.0
70-79	610	39.7
80 or older	343	22.3
Female	1839	54.5
69 or Under	812	44.2
70-79	633	34.4
80 or older	394	21.4
Race		
non-Black, non-Hispanic	2493	73.8
Black or African American	517	15.3
non-Black Hispanics	367	10.9
Education		
more than High School	1899	56.2
High School or less	1478	43.8
Insurance Coverage		
Medicaid-Medicare	2307	81.3
Private	411	14.5
None	121	4.3
Marital Status		
Married	2286	67.7
Not currently Married	32.3	1091
Partnership if non-Married		
No	890	88.5

RESULTS

A total of 3,377 participants were included in the analysis. The majority of participants (54.5%) were women. The largest percentage of men were in the 70-79 age group (39.7%) with the largest percentage of women in the 69 and under age group (44.2%). The sample was predominantly non-Black, non-Hispanic (73.8%, N=2493). Most participants had at least a high school education (56.2%, N=1899). More than two-thirds were married (67.7%, N=2286). Of those who indicated they were unmarried, 88.5% (N=890) were not in any romantic, intimate, or sexual partnerships. More than two-thirds had health care coverage in the form of Medicaid, Medicare, or a combination of both (81.3%, N=2307). Table 1 provides a breakdown of the demographic characteristics.

Table 2. Correlations: Variables Associated with Men and Women and HRQoL *(N=3,377)*

		HRQoL: self-rated general happiness	
		Men	**Women**
BIOLOGICAL/PHYSIOLOGICAL FUNCTION	BMI	.011	.005
	diastolic average	-.011	.020
	systolic average	-.004	.022
	pulse average	-.021	.011
SYMPTOM STATUS	PAIN	-.084**	-.099**
	PAIN: level	-.103**	-.088**
	DEPRESSION	-.308**	-.343**
	ANXIETY	-.172**	-.214**
	FATIGUE	.210**	.217**
	Urinary Incontinence	-.039	-.070*
	Stool Incontinence	-.024	-.073*
FUNCTIONAL STATUS	PHYSICAL FUNCTION Difficulty	-.136**	-.181**
	Perceptions of Control	-.096**	-.101**
	Psychological Function Control	.016	.024
	Lack of Companionship	-.365**	-.391**
	Feel left Out	-.332**	-.335**
	Feel Isolated	-.344**	-.361**
GENERAL HEALTH PERCEPTIONS	self-rated physical health	.312**	.277**
	self-rated mental health	.412**	.428**
INDIVIDUAL CHARACTERISTICS	Insurance total	.021	.002
	Age categories	-.026	-.086**
	Education categories	.059*	.089**
	Race/Ethnicity Categories	.045	.028
	Number of times to doctor in last year	-.061*	-.138**
ENVIRONMENTAL CHARACTERISTICS	Marital Status	-.168**	-.156**
	Rely on spouse/partner	.183**	.243**
	Rely on family	.114**	.126**
	Close family/relatives	.119**	.151**
	Rely on friends	.097**	.170**
	Number of friends	.178**	.149**

Bivariate correlation analyses were initially conducted to examine the associations between the outcome HRQoL variable and those that comprised the WCM constructs. For men, of the original 31 variables, bivariate correlation analysis led to the elimination of 6 variables, for women the elimination of seven variables, Table 2. All significantly correlated variables were then screened by simple linear regression. For men, regression analysis led to the elimination of 13 variables, for women the elimination of 17 variables. HRQoL happiness scores were compared by the total scores for men, women and participants combined across the categorized age groups (69 or younger, 70-79, 80 or older). Significant results were observed across age groups for combined participants (X^2=18.6, p=.017) and for women (X^2=20.1, p=.010), both having significantly lower HRQoL score with increasing age.

Table 3. WCM Constructs and HRQoL Outcomes *(N=3,377)*

MEN	**Partial R^2**	**Partial R^2 Rank**	**Effect Size (t-value)**	**Average R^2 Ranks**	**Average Effect Sizes (t-values)**
GENERAL HEALTH PERCEPTIONS	0.24, 1.8	1, 3	8.3, 5.9	2	7.1
FUNCTIONAL STATUS	0.21, .07	2, 6	7.2, 2.2	4	4.7
SYMPTOM STATUS	0.14	4	4.8	4	4.8
ENVIRONMENTAL CHARACTERISTICS	0.09	5	3.0	5	3.0
WOMEN	**Partial R^2**	**Partial R^2 Rank**	**Effect Size (t-value)**	**Average R^2 Ranks**	**Average Effect Sizes (t-values)**
GENERAL HEALTH PERCEPTIONS	0.39	1	9.4	1	9.4
FUNCTIONAL STATUS	0.33	2	7.9	2	7.9
SYMPTOM STATUS	0.03	5	0.68	5	0.68
ENVIRONMENTAL CHARACTERISTICS	0.16, 0.12	3, 4	3.6, 2.6	3.5	3.09

A second linear regression analysis was conducted. Partial R^2 were ranked from 1 (most important) -5 (least important) for men and women separately, with significant variables identified in the second linear regression analyses. Additionally, the last two columns on Table 3 contain the average of the R^2 ranking and the average effect sizes. The highest ranking variable for overall HRQoL happiness for men was General Health Perceptions (self-rated: mental health and physical health), Symptom Status (CESD- Depression score) and Functional Status (Lack companionship) both ranked second based on R^2 ranks, with Symptom Status having a greater average effect size. Physical Function Difficulty and Environmental Characteristics (Rely on spouse/partner) were last. Our regression analyses identified variables that, in the presence of all others, make a unique and direct contribution to HRQoL happiness.[10] The highest ranking variable for overall HRQoL for women was General Health Perceptions (mental health), followed by Functional Status (Lack of Companionship), Environmental Characteristics (Rely on spouse/partner and Number of close family members) and Symptom Status (urinary incontinence). The hierarch of contributing WCM constructs to overall HRQoL are ranked for men and women, Table 4.

Table 4. Hierarch of HRQoL Contributors based on Average Effect Sizes *(N=3,377)*		
Rank		Item Descriptions
MEN		
1st	GENERAL HEALTH PERCEPTIONS	Self-rated: mental health and physical health
2nd	SYMPTOM STATUS	Depression
3rd	FUNCTIONAL STATUS	Lack companionship, Physical Function Difficulty
4th	ENVIRONMENTAL CHARACTERISTICS	Number of close friends
WOMEN		
1st	GENERAL HEALTH PERCEPTIONS	Self-rated: mental health
2nd	FUNCTIONAL STATUS	Lack companionship
3rd	ENVIRONMENTAL CHARACTERISTICS	Rely on spouse/partner and Number of close family members
4th	SYMPTOM STATUS	Urinary Incontinence

DISCUSSION

Understanding subjective well-being and its association with health in older adults is still in its early stages. Consequently, the extent to which a variety of bio-psychosocial factors attribute to well-being and account for gender-related differences remain unclear. To explore this further, we utilized the WCM which offers the most comprehensive view of pathways linking the most relevant bio-psychosocial variables to overall well-being defined as HRQoL happiness.[2,11,15,16] Epidemiologic studies of happiness have predicted long term morbidity and mortality. Previous studies have shown that subjective well-being is not universal across populations, yet Individual Characteristics including, education and race/ethnicity, did not significantly contribute to HRQoL happiness in our population.[10] Our results did however, identify significant differences between men and women in the type and contribution of bio-psychosocial factors to HRQoL happiness. The overall models allowed for us to observe the interplay between various aspects of aging by gender.[11]

Mechanisms and Implications

Women reported significantly lower HRQoL than men. Our findings also indicated a significant decrease in HRQoL as age increased for the entire sample and for women. A decrease in HRQoL was also observed for men, but the results were not significant. Previous studies have identified lower HRQoL in populations of older women. It is hypothesized that gender-related differences in HRQoL of older adults may be in their perceptions of symptoms and illness progression, with men being less focused on symptom recognition until they are severe.[8] Interestingly, although there were no significant differences in perceptions of physical health between men and women in our analysis, it was the greatest contributor of HRQoL in men. Similarly, the third greatest contributor to HRQoL in men was the Functional Status level factor Physical Function Difficulty, also not observed in women. Prior studies have indicated that functional difficulty generally comprise the majority of an individual's functional health status, which in our study again was only associated with men. This is an interesting finding and may be attributed to the increased likelihood of men suffering from more severe and life threatening chronic conditions than women.[8] Instead, women are more likely to suffer from non-life threatening diseases including autoimmune disorders.[8] Social support significantly contributed to HRQoL in both men and women. The lack of companionship under the Functional Status level was significant in both groups. These findings align with the literature on loneliness in older ages and its adverse effects on HRQoL. [17,18] The reduction of inter-generational living and greater geographic expansion, has increased the report of loneliness in populations of older adults. Loneliness directly increases the likelihood of chronic diseases and all-cause mortality.[21] In our sample, the number of close family members was seen a significant contributor to HRQoL for women only. Having close family members may be more important to women, with 41 percent of the female sample reported being unmarried, only 21.9 percent of men. Additionally, HRQoL scores were significantly higher for married women. For those who reported being unmarried with a romantic, intimate, or sexual partner, men were significantly higher at 22.5 percent and women at 6.9 percent. Participants who reported greater social support from partners and relatives had higher HRQoL. Unhealthy familial relationships were predictors of loneliness in a prior study, particularly for the unmarried.[17,18] Their findings identify family ties as the most significant contributor to loneliness.[17,18] This aligns with our findings as women who reported a greater number of reliable family members had significantly higher HRQoL scores.

Therefore, the need exists for the consideration of social networks[19,20] and their impact on HRQoL in risk assessment and intervention development to improve aging-related outcomes. Previous studies have also shown that men and women who were satisfied with their family relationship had 1.8 and 3.0 times higher odds of good HRQoL, respectively. Frequent contacts and visits with friends or family motivate the participation in activities and increase HRQoL.[20,21]

The highest level significant contributor to HRQoL in both men and women was the General Health Perceptions level which both comprised of mental health. In fact, those who reported better mental health outcomes reported higher HRQoL. Men reported better mental health at a significantly higher level than women. Yet, depression was the only significant factor for the Symptom Status level in men alone and was the second highest contributor to their HRQoL. Other studies have shown that mental health concerns and symptoms of depression significantly impact HRQoL.[2,11,22] Our findings align with the literature on depression, with depression in women reported to be higher.[15,23,2,11,24-27] In fact, in our sample, depression scores for women were significantly higher than for men. Yet, depression was a major contributor to HRQoL only in men. Studies have shown that unmarried men have lower HRQoL compared to married men. Our findings show significantly higher depression scores for married men in our sample. Those who reported having demanding or critical spouses or did not spend much time with their spouses had significantly higher Depression scores. Though not significant in the hierarchical model, women with demanding and critical spouses also reported significantly higher depression scores. These results further reinforce our findings that relationship quality is a major contributor to HRQoL. Urinary incontinence was the only significant factor in the Symptom Status level for women. Those with urinary incontinence had significantly lower HRQoL scores. Our findings align with the literature, with recent studies indicating that women were more likely to report urinary incontinence and impaired HRQoL.[28,29] Studies have also shown that self-image is considered to be more important to women than men. In fact, in a study comparing HRQoL indicators between older men and women, a positive attitude about oneself was ranked in the top ten only for women.[30,31] Urinary incontinence may impact self-image, increasing the likelihood of depression and social isolation. Our findings indicate women who report urinary incontinence had significantly higher Depression scores; consistent with the higher likelihood of Depression and anxiety disorders in women compared to men. [8]

Strengths and limitations

Our analysis was based on a cross-sectional, single wave (Wave 2) of the NSHAP data and does not allow for establishing a cause-effect relationship or the determination of changes in perceptions over time. Our analysis is also limited to define the WCM levels based on variables included in the NSHAP, a limitation inherent to secondary data analysis. However, with the variety of indicators that comprise the NSHAP, this was a minor limitation. HRQoL was measured with one item of self-reported happiness in the NSHAP.

Variables that may potentially impact HRQoL are not identified, yet our analytic approach provides a minimum collection of variables necessary to begin the development of structural equation models to observe directional relationships. Our single item analysis may be considered less sensitive than the use of other HRQoL measures or validated tool. Yet, beyond the identified limitations, our study findings mirrored and reinforce prior research and further contributed to understanding HRQoL differences between older men and women while adjusting for confounders including age, race/ethnicity and socioeconomic status.

Conclusions and implications

The current analysis provides additional evidence to support insight into subjective well-being as it relates to successful aging. The findings of our analysis enhances our understanding of the bio-psychosocial factors that impact the HRQoL of older men and women. Our results add to the literature on successful aging in addition to the utility of the WCM in understanding the impact of HRQoL based on a variety of associated factors that comprise the models levels. We observed both similarities and differences between men and women based on the levels that best contribute to HRQoL. Further investigation is needed to determine the causal factors of the identified relationships between WCM levels and HRQoL. Other indicators of subjective well-being (e.g., life evaluations and eudemonic well-being) must also be assessed to inform collaborative care informed by mental and physical health.[10] In addition to informing the development of effective interventions to improve well-being independent of morbidity, income and other aging related factors that have adversely contributed to poor health outcomes.

Contributors:
The first author (MO) designed the work and analyzed the data. All authors assisted substantially in the data interpretation (MO, ND, OO, MP, RB), manuscript drafting (MO), revising for important intellectual content (MO, ND, OO, MP, RB, DB), final manuscript approval (MO, ND, OO, MP, RB, DB) and agreed accountability for all aspects of this work (MO, ND, OO, MP, RB, DB).

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Ethical approval: The NSHAP data analysis was carried out with de-identified, unrestricted Wave 2 Public Use File v1 designed for public dissemination. This dataset is appropriate for preliminary analyses and for the exploration of health and functioning of older American adults.

Data sharing: Wave 2 Public Use File v1 data for the National Social Life Health and Aging Project are available at http://www.icpsr.umich.edu/icpsrweb/NACDA/studies/34921.

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STROBE Statement—checklist of items that should be included in reports of observational studies

Correlates and Etiological Factors Associated with Hedonic Well-Being Among an Aging Population of US Men and Women: secondary data analysis of a national survey

Michelle Odlum, EdD, MPH[1], Nicole Davis, PhD, RN[2], Otis Owens, PhD, MPH, Michael Preston, PhD, MPH[4], Russell Brewer, DrPH, MPH[3], and Danielle Black, MS, MPH[5,1]

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract **pages 2, 9**
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found **page 2**
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported **pages 3, 4**
Objectives	3	State specific objectives, including any pre-specified hypotheses **page 2, 3**
Methods		
Study design	4	Present key elements of study design early in the paper **page 3, 4**
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection **page 3, 4**
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants **page 3, 4**
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable **page 4, 9**
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group **page 4**
Bias	9	Describe any efforts to address potential sources of bias **N/A**
Study size	10	Explain how the study size was arrived at **page 4**
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why **page 4, 5**
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding **page 5**
		(*b*) Describe any methods used to examine subgroups and interactions **page 5**
		(*c*) Explain how missing data were addressed **N/A**

(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed

Case-control study—If applicable, explain how matching of cases and controls was addressed

Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy **N/A**

(*e*) Describe any sensitivity analyses

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed **page 4**
		(b) Give reasons for non-participation at each stage **N/A**
		(c) Consider use of a flow diagram **N/A**
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders **page 4, 6**
		(b) Indicate number of participants with missing data for each variable of interest **N/A**
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		Cross-sectional study—Report numbers of outcome events or summary measures **page 6-8**
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included **page 5, 7**
		(*b*) Report category boundaries when continuous variables were categorized **N/A**
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses **page 5**
Discussion		
Key results	18	Summarise key results with reference to study objectives **page 6-8**
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias **page 9**
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence **page 8, 9**
Generalisability	21	Discuss the generalisability (external validity) of the study results **page 8, 9**
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based **page 10**

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Correlates and Etiological Factors Associated with Hedonic Well-Being Among an Aging Population of US Men and Women: secondary data analysis of a national survey

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ABSTRACT

Objective. To understand the gender-specific factors that uniquely contribute to successful aging in a US population of men and women, 57-85 years of age. This was achieved through the examination of the correlates of subjective well-being defined by health-related quality of life (HRQoL), across several biological and psychosocial determinants of health.

Design. Cross sectional study

Setting. The NSHAP (National Social Life, Health and Ageing Project, 2010-11) a representative sample of the US population.

Participants. 3,377 adults aged 57 to 85 (1538 men, 1839 women) from the NSHAP.

Main outcome measures. The bio-psychosocial factors of Biological/Physiological Function, Symptom Status, Functional Status, General Health Perceptions and HRQoL-happiness.

Method. HRQoL was measured using the NSHAP Wave 2 multistage, stratified area probability sample of US households (N=3,377). Variable selection was guided by the Wilson's and Cleary's Model (WCM) that classifies health outcomes at five main levels and characteristics.

Results. Our findings indicate differences in bio-psychosocial factors comprised in the WCM and their relative importance and unique impact on HRQoL by gender. Women reported significantly lower HRQoL than men (t=3.5, df=3366). The most significant contributors to HRQoL in women were mental health (B=0.31; 0.22, 0.39), loneliness (B=-0.26; -0.35, -0.17), urinary incontinence (B= -0.22; -0.40, -0.05) and support from spouse/partner (B=0.27; 0.10, 0.43), and family B=0.12; 0.03, 0.20). Men indicated mental health (B=0.21; 0.14, 0.29), physical health (B=0.17; 0.10, 0.23), functional difficulties (B=0.38; 0.10, 0.65), loneliness (B=-0.20; -0.26, -0.12), depression (B= -0.36; -0.58, -0.15) and support from friends (B=0.06; 0.10, 0.11) as significant contributors. Those with greater social support had better HRQoL (F=4.22, df=4). Lack of companionship and reliance on spouse/partner were significant HRQoL contributors in both groups.

Conclusion. Our findings offer insight into aging, gender and subjective well-being. The results provided an opportunity to identify bio-psychosocial factors to inform interventions to support successful aging.

Article Summary: Strengths and limitations of this study

- A variety of bio-psychosocial factors that contribute to well-being by gender were compared, where prior studies have not used gender as an independent variable.
- Effect sizes were used to summarize our regression analyses for a manageable and clinically interpretable picture of the unique contribution of gender across the comprehensive Wilson Cleary Model's (WCM), linking bio-psychosocial factors to overall well-being defined as Health Related Quality of Life - happiness.
- We were unable to establishing a cause-effect relationship or to determine changes in perceptions over time based on our cross-sectional analysis.
- We were limited to define the WCM levels based on variables in the NSHAP; yet with the variety of indicators captured in the NSHAP, this was a minor limitation.
- Beyond identified limitations, results mirrored prior research and contributed to the understanding of HRQoL gender-based differences, while controlling for potential confounders including age, race/ethnicity and socioeconomic status.

INTRODUCTION

Successful aging was traditionally defined as the absence of disease and associated functional limitations.[1] However, the definition has shifted to a multidimensional view that accounts for psychosocial and cultural aspects of health and health related quality of life (HRQoL).[1,2] This shift in definition is driven by patient center care, patient empowerment and shared decision making with providers in the healthcare setting.[2] In fact, HRQoL is now viewed as an important complement to biomedical measures of health.[3] An important indicator of successful aging is subjective well-being, an aspect of HRQoL. Subjective well-being, is a direct predictor of health outcomes affecting biological, physical, and psychosocial changes in older adults.[4,5] Improvements in population-level well-being is an aspiration of society, sparking policy and economic debates.[6] Studies of life satisfaction have shown that subjective well-being is affected by a multitude of additional factors, including social and familial relationships. These additional factors may be protective, potentially decreasing or eliminating the chronic disease and symptom burden.[6]

Three approaches exist to capture subjective well-being; these are life evaluation (e.g., life satisfaction); hedonic well-being (e.g., experienced happiness, anger); and eudemonic well-being (e.g., life meaning and purpose.[6] Researchers suggest subjective well-being as a measure for healthcare resources allocation. Therefore, the need exists to further identify and understand the factors associated with successful aging.[2,7] It is also essential to compare these factors between men and women to determine the unique contribution of gender.[2] Evidence to date remains unclear as prior studies of gender differences have focused on specific chronic diseases or on socioeconomic and demographic factors, usually controlling for gender as a potential confounder and not as an independent variable.[8] Therefore, we sought to identify the correlates and etiological factors associated with hedonic well-being, specifically feelings of happiness, through a bio-psychosocial lens, accounting for gender variability, in an aging population of US adults. Happiness, served as a proxy for HRQoL. It is a measure of life satisfaction, the absence or presence of desirable or undesirable feelings or experiences. It is proven useful in the analysis of HRQoL.[9]

Guided by the Wilson's and Cleary's Conceptual Model (WCM), Figure 1 we analyzed the National Social Life, Health and Aging Project (NSHAP), second wave data. We examined whether objective (e.g., biological/physiological) and self-perceived measures (e.g., functional status) of health explain gender differences in HRQoL (i.e., happiness). Self-rated perceptions of health have been observed to correlate with other health indicators including morbidity.[10] We determined the best models predicting the HRQoL of male and female US adults ages 57 to 85.[11] We explored the extent to which the WCM levels interact to predict HRQoL and provide greater insight into aging. The bio-psychosocial WCM was selected for our analysis as it considers health outcomes on a continuum of increasing complexity and health trajectories associated with aging. It is also shown to enhance knowledge about HRQoL in diverse populations.[11] The model classifies health outcomes at five main levels.[11] The first level Biological/Physiological function, examines the individual as a whole. Symptoms (level 2), are the perceptions of physical, emotional, and cognitive states. Symptoms are considered significant determinants of Functional Status (level 3), with biological and symptom variables evidenced to be correlated with Functional Status. General Health Perceptions (level 4) are subjective appraisals of health and Overall Quality of Life (level 5) as a whole.[11] Variables that comprise each level interact in complex ways to determine HRQoL. Arrows linking the five main levels indicate dominant causal relationships. In addition, the five main levels are influenced by individual (e.g., age, education) and environmental characteristics (e.g., social support).[11] Studies of hedonic states, including happiness, have predicted morbidity and mortality. However, cofounding factors indicate that well-being is coupled with additional factors such as education.[10] The WCM controls for potential confounding. Additionally, different than prior studies that compared the quantified HRQoL scores across gender, we identified the hierarchical differences of each WCM level and their weighted contribution to HRQoL (happiness).

METHODS

Participants. The second wave of the NSHAP survey, a National sample of US adults ages 57 to 85, was utilized in our analysis, was conducted from 2010-2011.[12] The survey focused on exploring interpersonal connections and overall health outcomes as they relate to: culture, gender and socioeconomic status; health behaviors; health care utilization, social support, and well-being.[12] Our current study utilized Wave 2 data to explore the relationship between the WCM constructs for both men and women. Wave 2, with its large sample size (N=3,377) and strong methodology, allowed us to systematically investigate important aspects of HRQoL and aging.

Measures. NSHAP variables used in our analysis were selected based on best fit with the WCM constructs. Thirty one variables were selected. We categorized the five main levels and characteristics of the WCM under two overarching categories of Objective and Subjective health indicators, Figure 1. The Objective indicators of the first main level of Biological/Physiological Function were, categorical: Body Mass Index (BMI), and continuous: average pulse rate, and average blood pressure (systolic and diastolic). The last four main levels of the WCM comprised Subjective health indicators. These included the assessment of participant perceptions of health outcomes on both individual and societal levels. Variables that comprised Symptom Status were categorical: pain, pain level, fatigue, urinary incontinence, stool incontinence and continuous: depression, anxiety. Variables that comprised Functional Status were categorical: physical function difficulty, companionship and feeling left out or isolated and continuous: perceptions of control. Variables that comprised General Health Perceptions were continuous self-rated physical and mental health. Our continuous outcome variable of interest for HRQoL in this study was defined by hedonic well-being: self-rated happiness, asked participants thoughts and feelings about their life overall. The WCM also accounts for important individual and environment influences directly impacting objective and subjective indicators. Variables that comprise Individual Characteristics were categorical: insurance coverage, age group, education, race/ethnicity, and provider visits. Variables that comprise Environmental Characteristics were categorical: marital status, reliance on spouse, partner, relatives and friends, and number of friends.

Statistical analysis. The association between HRQoL (i.e., happiness) and the constructs of the WCM were examined in separate analyses for male and female participants. Descriptive statistics were conducted to characterize the sample and variable distributions. Participant characteristics were summarized with means and standard deviations for continuous variables and percentages and frequencies for categorical variables. Individual and environmental characteristics were also examined for potential confounding. Correlations were calculated to determine the relationship between the WCM construct and characteristic variables and reported HRQoL by participants. Bivariate analysis was conducted. Chi square analyses were used to assess differences in categorical variables and T-tests in continuous variables, by gender. Linear regression analyses were performed to assess the relevant importance of significantly correlated variables that potentially contribute to HRQoL. Variables with significant differences ($p<0.05$) were retained for additional analysis.

Two independent stepwise multiple regressions (i.e., men and women) were performed to identify variables as a group best associated with HRQOL. Retained variables were ranked by partial R^2 order to determine their relative contribution. Effect sizes were also estimated for each retained variable with t-values corresponding to the coefficient estimates divided by the associated standard errors. To identify constructs with the most consistent associations with HRQoL, effect sizes and R^2 rankings were averaged per WCM construct for men and women. Data analysis was conducted with use of SPSS 21.0. The stepwise approach allows for the prevention of bias in the selection of variables in the final model.[13 14]

Patient Involvement. As an analysis of secondary data, no participants were not involved in the development of our research questions or with the analysis of the outcome measures. Additionally, participants were not involved with the interpretation of data or the writing of our analytic findings. Dissemination of analytic findings to study participants or members of their associated communities will not be accomplished.

Table 1. Demographic Characteristics of Participants *(N=3,377)*	*N*	*(%)*
Gender		
Men	1538	45.5
69 or Under	585	38.0
70-79	610	39.7
80 or older	343	22.3
Women	1839	54.5
69 or Under	812	44.2
70-79	633	34.4
80 or older	394	21.4
Race		
Men		
non-Black, non-Hispanic	1147	74.6
Black or African American	217	14.1
non-Black Hispanics	174	11.3
Women		
non-Black, non-Hispanic	1346	73.2
Black or African American	300	16.3
non-Black Hispanics	193	10.5
Education		
Men		
more than High School	884	57.5
High School or less	654	42.5
Women		
more than High School	1015	55.2
High School or less	824	44.8
Insurance Coverage		
Men		
Medicaid-Medicare	1080	83.9
Private	161	12.5
None	46	3.6
Women		
Medicaid-Medicare	1227	79.1
Private	250	16.1
None	75	4.8
Marital Status		
Men		
Married	1201	78.1
Not currently Married	337	21.9
Women		
Married	1085	59.0
Not currently Married	754	41.0
Partnership if non-Married		
Men		
No	231	77.5
Women		
No	659	93.1

RESULTS

A total of 3,377 participants were included in the analysis. The majority of participants (54.5%) were women. The largest percentage of men were in the 70-79 age group (39.7%) with the largest percentage of women in the 69 and under age group (44.2%). The sample was predominantly non-Black, non-Hispanic (73.8%, N=2493). Most participants had at least a high school education (56.2%, N=1899). More than two-thirds were married (67.7%, N=2286). Of those who indicated they were unmarried, 88.5% (N=890) were not in any romantic, intimate, or sexual partnerships. More than two-thirds had health care coverage in the form of Medicaid, Medicare, or a combination of both (81.3%, N=2307). Tables 1 and 2 provides a breakdown of the demographic characteristics and significant differences for variables that comprise the WCM constructs for men and women.

Table 2. Independent Samples T-tests and X^2 for Wilson Cleary Model construct-specific variables with Men and Women *(N=3,377)*

		Men	Women	X^2/T-test	*df*
BIOLOGICAL/ PHYSIOLOGICAL FUNCTION	BMI (normal)	36.5%	63.5%	29.0**	2
	Diastolic average	79.0±12.0	81.0±11.5	-6.4**	3255
	Systolic Average	138.0±.20.7	137.0±21.0	1.6	3255
	Pulse Average	67.7±12.1	69.8±11.2	-5.1**	3035
SYMPTOM STATUS	PAIN	43.8%	56.2%	8.9**	1
	PAIN: level (no pain)	50.0%	50.0%	11.2	6
	DEPRESSION (CESD total)[1]	1.8±0.3	2.0±0.4	-6.6**	3312
	ANXIETY (HADS total)[2]	1.8±0.5	1.8±0.4	-0.8	2627
	FATIGUE	54.7%	45.3%	3.1	3
	Urinary Incontinence	30.2%	69.8%	94.7**	1
	Stool Incontinence	30.4%	69.6%	15.5**	1
FUNCTIONAL STATUS	PHYSICAL FUNCTION No Difficulty	46.1%	53.9%	27.1	16
	Perceptions of Control	2.3±0.5	2.2±0.6	2.7**	2665
	Companionship	49.8%	50.2%	21.0**	3
	Feel left Out	54.0%	46.0%	3.1	3
	Feel Isolated	55.8%	44.2%	1.5	3
GENERAL HEALTH PERCEPTIONS	Self-rated physical health	3.2±1.1	3.2±1.0	-0.7	3370
	Self-rated mental health	3.7±1.0	3.6±1.0	3.2**	3372
	Seen the doctor in last year	3.0±1.5	3.04±1.5	-1.28	3367
	Rely on spouse/partner	63.3%	36.70%	26.92**	3
ENVIRONMENTAL CHARACTERISTICS	Rely on family	36.9%	63.1%	42.14**	3
	Close family/relatives	38.6%	61.4%	52.05**	5
	Rely on friends	44.3%	55.7%	71.78**	3
	Has friends	44.9%	55.1%	13.12*	5

Note. **p < 0.01, *p < 0.05; [1]Center for Epidemiological Studies Depression (CESD); [2]Hospital Anxiety and Depression Scale (HADS)

Bivariate correlation analyses were initially conducted to examine the associations between the outcome HRQoL variable and those that comprised the WCM constructs. For men, of the original 31 variables, bivariate correlation analysis led to the elimination of 6 variables, for women the elimination of seven variables. All significantly correlated variables were then screened by simple linear regression. For men, regression analysis led to the elimination of 13 variables, for women the elimination of 17 variables. HRQoL happiness scores were compared by the total scores for men, women and participants combined across the categorized age groups (69 or younger, 70-79, 80 or older). Significant results were observed across age groups for combined participants (X^2=18.6, p=.017) and for women (X^2=20.1, p=.010), both having significantly lower HRQoL score with increasing age.

Table 3. WCM Constructs and HRQoL Outcomes *(N=3,377)*

MEN	Partial R^2	Partial R^2 Rank	Effect Size (t-value)	Average R^2 Ranks	Average Effect Sizes (t-values)
GENERAL HEALTH PERCEPTIONS	0.24, 1.8	1, 3	8.3, 5.9	2	7.1
FUNCTIONAL STATUS	0.21, .07	2, 6	7.2, 2.2	4	4.7
SYMPTOM STATUS	0.14	4	4.8	4	4.8
ENVIRONMENTAL CHARACTERISTICS	0.09	5	3.0	5	3.0
WOMEN	**Partial R^2**	**Partial R^2 Rank**	**Effect Size (t-value)**	**Average R^2 Ranks**	**Average Effect Sizes (t-values)**
GENERAL HEALTH PERCEPTIONS	0.39	1	9.4	1	9.4
FUNCTIONAL STATUS	0.33	2	7.9	2	7.9
SYMPTOM STATUS	0.03	5	0.68	5	0.68
ENVIRONMENTAL CHARACTERISTICS	0.16, 0.12	3, 4	3.6, 2.6	3.5	3.09

A second linear regression analysis was conducted. Partial R^2 were ranked from 1 (most important) to 5 (least important) for men and women separately, with significant variables identified in the second linear regression analyses. Additionally, the last two columns on Table 3 contain the average of the R^2 ranking and the average effect sizes. The highest ranking variable for overall HRQoL happiness for men was General Health Perceptions (self-rated: mental health and physical health), Symptom Status (CESD- Depression score) and Functional Status (Lack companionship) both ranked second based on R^2 ranks, with Symptom Status having a greater average effect size. Physical Function Difficulty and Environmental Characteristics (Rely on spouse/partner) were last. Our regression analyses identified variables that, in the presence of all others, make a unique and direct contribution to HRQoL happiness.[10] The highest ranking variable for overall HRQoL for women was General Health Perceptions (mental health), followed by Functional Status (Lack of Companionship), Environmental Characteristics (Rely on spouse/partner and Number of close family members) and Symptom Status (urinary incontinence). The hierarch of contributing WCM constructs to overall HRQoL are ranked for men and women, Table 4.

Table 4. Hierarch of HRQoL Contributors based on Average Effect Sizes *(N=3,377)*

Rank		Item Descriptions
MEN		
1st	GENERAL HEALTH PERCEPTIONS	Self-rated: mental health and physical health
2nd	SYMPTOM STATUS	Depression
3rd	FUNCTIONAL STATUS	Lack companionship, Physical Function Difficulty
4th	ENVIRONMENTAL CHARACTERISTICS	Number of close friends
WOMEN		
1st	GENERAL HEALTH PERCEPTIONS	Self-rated: mental health
2nd	FUNCTIONAL STATUS	Lack companionship
3rd	ENVIRONMENTAL CHARACTERISTICS	Rely on spouse/partner and Number of close family members
4th	SYMPTOM STATUS	Urinary Incontinence

DISCUSSION

Understanding subjective well-being and its association with health in older adults is still in its early stages. Consequently, the extent to which a variety of bio-psychosocial factors attribute to well-being and account for gender-related differences remain unclear. To explore this further, we utilized the WCM which offers the most comprehensive view of pathways linking the most relevant bio-psychosocial variables to overall well-being defined as HRQoL happiness.[2,11,15,16] Epidemiologic studies of happiness have predicted long term morbidity and mortality. Previous studies have shown that subjective well-being is not universal across populations, yet Individual

Characteristics including, education and race/ethnicity, did not significantly contribute to HRQoL happiness in our population.[10] Our results did however, identify significant differences between men and women in the type and contribution of bio-psychosocial factors to HRQoL happiness. The overall models allowed for us to observe the interplay between various aspects of aging by gender.[11]

Mechanisms and Implications

Women reported significantly lower HRQoL than men. Our findings also indicated a significant decrease in HRQoL as age increased for the entire sample and for women. A decrease in HRQoL was also observed for men, but the results were not significant. Previous studies have identified lower HRQoL in populations of older women. It is hypothesized that gender-related differences in HRQoL of older adults may be in their perceptions of symptoms and illness progression, with men being less focused on symptom recognition until they are severe.[8] Interestingly, although there were no significant differences in perceptions of physical health between men and women in our analysis, it was the greatest contributor of HRQoL in men. Similarly, the third greatest contributor to HRQoL in men was the Functional Status level factor Physical Function Difficulty, also not observed in women. Prior studies have indicated that functional difficulty generally comprise the majority of an individual's functional health status, which in our study again was only associated with men. This is an interesting finding and may be attributed to the increased likelihood of men suffering from more severe and life threatening chronic conditions than women.[8] Instead, women are more likely to suffer from non-life threatening diseases including autoimmune disorders.[8] Social support significantly contributed to HRQoL in both men and women. The lack of companionship under the Functional Status level was significant in both groups. These findings align with the literature on loneliness in older ages and its adverse effects on HRQoL.[17,18] The reduction of inter-generational living and greater geographic expansion, has increased the report of loneliness in populations of older adults. Loneliness directly increases the likelihood of chronic diseases and all-cause mortality.[19] In our sample, the number of close family members was seen a significant contributor to HRQoL for women only. Having close family members may be more important to women, with 41 percent of the female sample reported being unmarried, only 21.9 percent of men. Additionally, HRQoL scores were significantly higher for married women. For those who reported being unmarried with a romantic, intimate, or sexual partner, men were significantly higher at 22.5 percent and women at 6.9 percent. Participants who reported greater social support from partners and relatives had higher HRQoL. Unhealthy familial relationships were predictors of loneliness in a prior study, particularly for the unmarried.[17,18] Their findings identify family ties as the most significant contributor to loneliness.[17,18] This aligns with our findings as women who reported a greater number of reliable family members had significantly higher HRQoL scores. Therefore, the need exists for the consideration of social networks[19,20] and their impact on HRQoL in risk assessment and intervention development to improve aging-related outcomes. Previous studies have also shown that men and women who were satisfied with their family relationship had 1.8 and 3.0 times higher odds of good HRQoL, respectively. Frequent contacts and visits with friends or family motivate the participation in activities and increase HRQoL.[20,21]

The highest level significant contributor to HRQoL in both men and women was the General Health Perceptions level which both comprised of mental health. In fact, those who reported better mental health outcomes reported higher HRQoL. Men reported better mental health at a significantly higher level than women. Yet, depression was the only significant factor for the Symptom Status level in men alone and was the second highest contributor to their HRQoL. Other studies have shown that mental health concerns and symptoms of depression significantly impact HRQoL.[2,11,22] Our findings align with the literature on depression, with depression in women reported to be higher.[15,23,2,11,24-27] In fact, in our sample, depression scores for women were significantly higher than for men. Yet, depression was a major contributor to HRQoL only in men. Studies have shown that unmarried men have lower HRQoL compared to married men. Our findings show significantly higher depression scores for married men in our sample. Those who reported having demanding or critical spouses or did not spend much time with their spouses had significantly higher Depression scores. Though not significant in the hierarchical model, women with demanding and critical spouses also reported significantly higher depression scores. These results further reinforce our findings that relationship quality is a major contributor to HRQoL. Urinary incontinence was the only significant factor in the Symptom Status level for women. Those with urinary incontinence had significantly lower HRQoL scores. Our findings align with the literature, with recent studies indicating that women were more likely to report urinary incontinence and impaired HRQoL.[28,29] Additionally, pelvic organ prolapse (POP), which often

peaks for women in their seventies, include the symptoms of urinary incontinence. Studies have shown significantly impaired quality of life for women with POP over the age of 50.[30] Symptomatic POP is evidenced to have a tremendous impact on general health-related quality of life and similar to disabilities, it can contribute to physical immobility, pain, diminished energy, sleep disturbance, emotional instability and social isolation.[30] Studies have also shown that self-image is considered to be more important to women than men. In fact, in a study comparing HRQoL indicators between older men and women, a positive attitude about oneself was ranked in the top ten only for women.[31,32] Urinary incontinence may impact self-image, increasing the likelihood of depression and social isolation. Our findings indicate women who report urinary incontinence had significantly higher Depression scores; consistent with the higher likelihood of Depression and anxiety disorders in women compared to men.[8]

Strengths and limitations

Our analysis was based on a cross-sectional, single wave (Wave 2) of the NSHAP data and does not allow for establishing a cause-effect relationship or the determination of changes in perceptions over time. Our analysis is also limited to define the WCM levels based on variables included in the NSHAP, a limitation inherent to secondary data analysis. However, with the variety of indicators that comprise the NSHAP, this was a minor limitation.

Variables that may indirectly impact HRQoL are not identified, yet our analytic approach provides a minimum collection of variables necessary to begin the development of structural equation models to observe directional relationships. In fact, our regression approach identified the variables that make a distinct and direct contribution to HRQoL; was measured with one item of self-reported happiness in the NSHAP. Our single item analysis may be considered less sensitive than the use of other HRQoL measures or validated tools. Yet, beyond the identified limitations, our study findings mirrored and reinforce prior research and further contributed to understanding HRQoL differences between older men and women while adjusting for confounders including age, race/ethnicity and socioeconomic status.

Conclusions and implications

The current analysis provides additional evidence to support insight into subjective well-being as it relates to successful aging. The findings of our analysis enhances our understanding of the bio-psychosocial factors that impact the HRQoL of older men and women. Our results add to the literature on successful aging in addition to the utility of the WCM in understanding the impact of HRQoL based on a variety of associated factors that comprise the models levels. We observed both similarities and differences between men and women based on the levels that best contribute to HRQoL. Further investigation is needed to determine the causal factors of the identified relationships between WCM levels and HRQoL. Other indicators of subjective well-being (e.g., life evaluations and eudemonic well-being) must also be assessed for collaborative care informed by mental and physical health. [10] In addition to informing the development of effective interventions to improve well-being independent of morbidity, income and other aging related factors that have adversely contributed to poor health outcomes.

Contributors:

The first author (MO) designed the work and analyzed the data. All authors assisted substantially in the data interpretation (MO, ND, OO, MP, RB), manuscript drafting (MO), revising for important intellectual content (MO, ND, OO, MP, RB, DB), final manuscript approval (MO, ND, OO, MP, RB, DB) and agreed accountability for all aspects of this work (MO, ND, OO, MP, RB, DB).

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years; (3) our authors spouses, partners, or children have no financial relationships relevant to the work that has been submitted; and (4) our authors have no non-financial interests relevant to the work that has been submitted.

Ethical approval: The NSHAP data analysis was carried out with de-identified, unrestricted Wave 2 Public Use File v1 designed for public dissemination. This dataset is appropriate for preliminary analyses and for the exploration of health and functioning of older American adults.

Data sharing: Wave 2 Public Use File v1 data for the National Social Life Health and Aging Project are available at http://www.icpsr.umich.edu/icpsrweb/NACDA/studies/34921.

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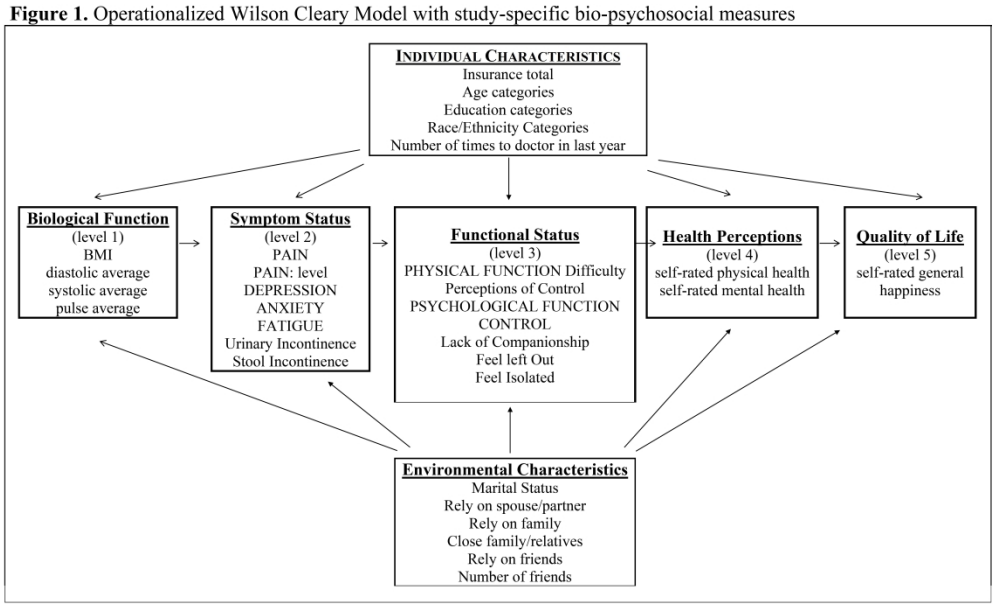

Figure 1. Operationalized Wilson Cleary Model with study-specific bio-psychosocial measures

603x365mm (300 x 300 DPI)

STROBE Statement—checklist of items that should be included in reports of observational studies

Correlates and Etiological Factors Associated with Hedonic Well-Being Among an Aging Population of US Men and Women: secondary data analysis of a national survey

Michelle Odlum, EdD, MPH[1], Nicole Davis, PhD, RN[2], Otis Owens, PhD, MPH, Michael Preston, PhD, MPH[4], Russell Brewer, DrPH, MPH[3], and Danielle Black, MS, MPH[5,1]

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract **pages 2, 9**
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found **page 2**
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported **pages 3, 4**
Objectives	3	State specific objectives, including any pre-specified hypotheses **page 2, 3**
Methods		
Study design	4	Present key elements of study design early in the paper **page 3, 4**
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection **page 3, 4**
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants **page 3, 4**
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable **page 4, 9**
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group **page 4**
Bias	9	Describe any efforts to address potential sources of bias **N/A**
Study size	10	Explain how the study size was arrived at **page 4**
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why **page 4, 5**
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding **page 5**
		(*b*) Describe any methods used to examine subgroups and interactions **page 5**
		(*c*) Explain how missing data were addressed **N/A**

(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed

Case-control study—If applicable, explain how matching of cases and controls was addressed

Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy **N/A**

(*e*) Describe any sensitivity analyses

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed **page 4**
		(b) Give reasons for non-participation at each stage **N/A**
		(c) Consider use of a flow diagram **N/A**
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders **page 4, 6**
		(b) Indicate number of participants with missing data for each variable of interest **N/A**
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		Cross-sectional study—Report numbers of outcome events or summary measures **page 6-8**
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included **page 5, 7**
		(*b*) Report category boundaries when continuous variables were categorized **N/A**
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses **page 5**
Discussion		
Key results	18	Summarise key results with reference to study objectives **page 6-8**
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias **page 9**
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence **page 8, 9**
Generalisability	21	Discuss the generalisability (external validity) of the study results **page 8, 9**
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based **page 10**

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Correlates and Etiological Factors Associated with Hedonic Well-Being Among an Aging Population of US Men and Women: secondary data analysis of a national survey

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ABSTRACT

Objective. To understand the gender-specific factors that uniquely contribute to successful aging in a US population of men and women, 57-85 years of age. This was achieved through the examination of the correlates of subjective well-being defined by health-related quality of life (HRQoL), across several biological and psychosocial determinants of health.

Design. Cross sectional study

Setting. The NSHAP (National Social Life, Health and Ageing Project, 2010-11) a representative sample of the US population.

Participants. 3,377 adults aged 57 to 85 (1538 men, 1839 women) from the NSHAP.

Main outcome measures. The bio-psychosocial factors of Biological/Physiological Function, Symptom Status, Functional Status, General Health Perceptions and HRQoL-happiness.

Method. HRQoL was measured using the NSHAP Wave 2 multistage, stratified area probability sample of US households (N=3,377). Variable selection was guided by the Wilson's and Cleary's Model (WCM) that classifies health outcomes at five main levels and characteristics.

Results. Our findings indicate differences in bio-psychosocial factors comprised in the WCM and their relative importance and unique impact on HRQoL by gender. Women reported significantly lower HRQoL than men (t=3.5, df=3366). The most significant contributors to HRQoL in women were mental health (B=0.31; 0.22, 0.39), loneliness (B=-0.26; -0.35, -0.17), urinary incontinence (B= -0.22; -0.40, -0.05) and support from spouse/partner (B=0.27; 0.10, 0.43), and family B=0.12; 0.03, 0.20). Men indicated mental health (B=0.21; 0.14, 0.29), physical health (B=0.17; 0.10, 0.23), functional difficulties (B=0.38; 0.10, 0.65), loneliness (B=-0.20; -0.26, -0.12), depression (B= -0.36; -0.58, -0.15) and support from friends (B=0.06; 0.10, 0.11) as significant contributors. Those with greater social support had better HRQoL (F=4.22, df=4). Lack of companionship and reliance on spouse/partner were significant HRQoL contributors in both groups.

Conclusion. Our findings offer insight into aging, gender and subjective well-being. The results provide an opportunity to identify bio-psychosocial factors to inform interventions to support successful aging.

Article Summary: Strengths and limitations of this study

- A variety of bio-psychosocial factors that contribute to well-being by gender were compared, where prior studies have not used gender as an independent variable.
- Effect sizes were used to summarize our regression analyses for a manageable and clinically interpretable picture of the unique contribution of gender across the comprehensive Wilson Cleary Model's (WCM), linking bio-psychosocial factors to overall well-being defined as Health Related Quality of Life - happiness.
- We were unable to establishing a cause-effect relationship or to determine changes in perceptions over time based on our cross-sectional analysis.
- We were limited to define the WCM levels based on variables in the NSHAP; yet with the variety of indicators captured in the NSHAP, this was a minor limitation.
- Beyond identified limitations, results mirrored prior research and contributed to the understanding of HRQoL gender-based differences, while controlling for potential confounders including age, race/ethnicity and socioeconomic status.

INTRODUCTION

Successful aging was traditionally defined as the absence of disease and associated functional limitations.[1] However, the definition has shifted to a multidimensional view that accounts for psychosocial and cultural aspects of health and health related quality of life (HRQoL).[1,2] This shift in definition is driven by patient center care, patient empowerment and shared decision making with providers in the healthcare setting.[2] In fact, HRQoL is now viewed as an important complement to biomedical measures of health.[3] An important indicator of successful aging is subjective well-being, an aspect of HRQoL. Subjective well-being, is a direct predictor of health outcomes affecting biological, physical, and psychosocial changes in older adults.[4,5] Improvements in population-level well-being is an aspiration of society, sparking policy and economic debates.[6] Studies of life satisfaction have shown that subjective well-being is affected by a multitude of additional factors, including social and familial relationships. These additional factors may be protective, potentially decreasing or eliminating the chronic disease and symptom burden.[6]

Three approaches exist to capture subjective well-being; these are life evaluation (e.g., life satisfaction); hedonic well-being (e.g., experienced happiness, anger); and eudemonic well-being (e.g., life meaning and purpose.[6] Researchers suggest subjective well-being as a measure for healthcare resources allocation. Therefore, the need exists to further identify and understand the factors associated with successful aging.[2,7] It is also essential to compare these factors between men and women to determine the unique contribution of gender.[2] Evidence to date remains unclear as prior studies of gender differences have focused on specific chronic diseases or on socioeconomic and demographic factors, usually controlling for gender as a potential confounder and not as an independent variable.[8] Therefore, we sought to identify the correlates and etiological factors associated with hedonic well-being, specifically feelings of happiness, through a bio-psychosocial lens, accounting for gender variability, in an aging population of US adults. Happiness, served as a proxy for HRQoL. It is a measure of life satisfaction, the absence or presence of desirable or undesirable feelings or experiences. It is proven useful in the analysis of HRQoL.[9]

Guided by the Wilson's and Cleary's Conceptual Model (WCM), Figure 1 we analyzed the National Social Life, Health and Aging Project (NSHAP), second wave data. We examined whether objective (e.g., biological/physiological) and self-perceived measures (e.g., functional status) of health explain gender differences in HRQoL (i.e., happiness). Self-rated perceptions of health have been observed to correlate with other health indicators including morbidity.[10] We determined the best models predicting the HRQoL of male and female US adults ages 57 to 85.[11] We explored the extent to which the WCM levels interact to predict HRQoL and provide greater insight into aging. The bio-psychosocial WCM was selected for our analysis as it considers health outcomes on a continuum of increasing complexity and health trajectories associated with aging. It is also shown to enhance knowledge about HRQoL in diverse populations.[11] The model classifies health outcomes at five main levels.[11] The first level Biological/Physiological function, examines the individual as a whole. Symptoms (level 2), are the perceptions of physical, emotional, and cognitive states. Symptoms are considered significant determinants of Functional Status (level 3), with biological and symptom variables evidenced to be correlated with Functional Status. General Health Perceptions (level 4) are subjective appraisals of health and Overall Quality of Life (level 5) as a whole.[11] Variables that comprise each level interact in complex ways to determine HRQoL. Arrows linking the five main levels indicate dominant causal relationships. In addition, the five main levels are influenced by individual (e.g., age, education) and environmental characteristics (e.g., social support).[11] Studies of hedonic states, including happiness, have predicted morbidity and mortality. However, cofounding factors indicate that well-being is coupled with additional factors such as education.[10] The WCM controls for potential confounding. Additionally, different than prior studies that compared the quantified HRQoL scores across gender, we identified the hierarchical differences of each WCM level and their weighted contribution to HRQoL (happiness).

METHODS

Participants. The second wave of the NSHAP survey, a National sample of US adults ages 57 to 85, was utilized in our analysis, was conducted from 2010-2011.[12] The survey focused on exploring interpersonal connections and overall health outcomes as they relate to: culture, gender and socioeconomic status; health behaviors; health care utilization, social support, and well-being.[12] Our current study utilized Wave 2 data to explore the relationship between the WCM constructs for both men and women. Wave 2, with its large sample size (N=3,377) and strong methodology, allowed us to systematically investigate important aspects of HRQoL and aging.

Measures. NSHAP variables used in our analysis were selected based on best fit with the WCM constructs. Thirty variables were selected. We categorized the five main levels and characteristics of the WCM under two overarching categories of Objective and Subjective health indicators, Figure 1. The Objective indicators of the first main level of Biological/Physiological Function were, categorical: Body Mass Index (BMI), and continuous: average pulse rate, and average blood pressure (systolic and diastolic). The last four main levels of the WCM comprised Subjective health indicators. These included the assessment of participant perceptions of health outcomes on both individual and societal levels. Variables that comprised Symptom Status were categorical: pain, pain level, fatigue, urinary incontinence, stool incontinence and continuous: depression, anxiety. Variables that comprised Functional Status were categorical: physical function difficulty, companionship and feeling left out or isolated and continuous: perceptions of control. Variables that comprised General Health Perceptions were continuous self-rated physical and mental health.

Our continuous outcome variable of interest for HRQoL in this study was defined by hedonic well-being: self-rated happiness, asked participants thoughts and feelings about their life overall. The WCM also accounts for important individual and environment influences directly impacting objective and subjective indicators. Variables that comprise Individual Characteristics were categorical: insurance coverage, age group, education, race/ethnicity, and provider visits. Variables that comprise Environmental Characteristics were categorical: marital status, reliance on spouse/partner, relatives and friends, and number of close family/relatives and friends.

Statistical analysis. The association between HRQoL (i.e., happiness) and the constructs of the WCM were examined in separate analyses for male and female participants. Descriptive statistics were conducted to characterize the sample and variable distributions. Participant characteristics were summarized with means and standard deviations for continuous variables and percentages and frequencies for categorical variables. Individual and environmental characteristics were also examined for potential confounding. Correlations were calculated to determine the relationship between the WCM construct and characteristic variables and reported HRQoL by participants. Bivariate analysis was conducted. Chi square analyses were used to assess differences in categorical variables and T-tests in continuous variables, by gender. Linear regression analyses were performed to assess the relevant importance of significantly correlated variables that potentially contribute to HRQoL. For model validation, our dataset was randomly divided, using a split-sample technique, into a developmental: n=1689 and validation: n=1688 group before identifying final model variables.[13] The development model was selected through a stepwise multiple regression to identify the model of best fit. To determine the accuracy of the developmental model, a regression model was calculated with the validation dataset for the retained variables. To choose the final model, adjusted R^2 values, Standardized βs and unstandardized slopes (B) were observed between the developmental and validation models to ensure analytic comparability. Variables with significant differences ($p<0.05$) were retained for additional analysis.

Two independent stepwise multiple regressions were then performed based on gender (i.e., men and women) to identify variables, by gender, best associated with HRQoL. Retained variables were ranked by partial R^2 order to determine their relative contribution. Effect sizes were also estimated for each retained variable with t-values corresponding to the coefficient estimates divided by the associated standard errors. To identify constructs with the most consistent associations with HRQoL, effect sizes and R^2 rankings were averaged per WCM construct for men and women. Data analysis was conducted with use of SPSS 22.0. The stepwise approach allows for the prevention of bias in the selection of variables in the final model.[14 15]

Table 1. Demographic Characteristics of Participants *(N=3,377)*	*N*	*(%)*
Gender		
Men	1538	45.5
69 or Under	585	38.0
70-79	610	39.7
80 or older	343	22.3
Women	1839	54.5
69 or Under	812	44.2
70-79	633	34.4
80 or older	394	21.4
Race		
Men		
non-Black, non-Hispanic	1147	74.6
Black or African American	217	14.1
non-Black Hispanics	174	11.3
Women		
non-Black, non-Hispanic	1346	73.2
Black or African American	300	16.3
non-Black Hispanics	193	10.5
Education		
Men		
more than High School	884	57.5
High School or less	654	42.5
Women		
more than High School	1015	55.2
High School or less	824	44.8
Insurance Coverage		
Men		
Medicaid-Medicare	1080	83.9
Private	161	12.5
None	46	3.6
Women		
Medicaid-Medicare	1227	79.1
Private	250	16.1
None	75	4.8
Marital Status		
Men		
Married	1201	78.1
Not currently Married	337	21.9
Women		
Married	1085	59.0
Not currently Married	754	41.0
Partnership if non-Married		
Men		
No	231	77.5
Women		
No	659	93.1

Patient Involvement. As an analysis of secondary data, no participants were not involved in the development of our research questions or with the analysis of the outcome measures. Additionally, participants were not involved with the interpretation of data or the writing of our analytic findings. Dissemination of analytic findings to study participants or members of their associated communities will not be accomplished.

RESULTS

A total of 3,377 participants were included in the analysis. The majority of participants (54.5%) were women. The largest percentage of men were in the 70-79 age group (39.7%) with the largest percentage of women in the 69 and under age group (44.2%). The sample was predominantly non-Black, non-Hispanic (73.8%, N=2493). Most participants had at least a high school education (56.2%, N=1899). More than two-thirds were married (67.7%, N=2286). Of those who indicated they were unmarried, 88.5% (N=890) were not in any romantic, intimate, or sexual partnerships. More than two-thirds had health care coverage in the form of Medicaid, Medicare, or a combination of both (81.3%, N=2307). Tables 1 and 2 provides a breakdown of the demographic characteristics and significant differences for variables that comprise the WCM constructs for men and women.

Table 2. Independent Samples T-tests and X^2 for Wilson Cleary Model construct-specific variables with Men and Women *(N=3,377)*

		Men	Women	X^2/T-test	*df*
BIOLOGICAL/ PHYSIOLOGICAL FUNCTION	BMI (normal)	36.5%	63.5%	29.0**	2
	Diastolic average	79.0±12.0	81.0±11.5	-6.4**	3255
	Systolic Average	138.0±.20.7	137.0±21.0	1.6	3255
	Pulse Average	67.7±12.1	69.8±11.2	-5.1**	3035
SYMPTOM STATUS	Pain	43.8%	56.2%	8.9**	1
	Pain: level (no pain)	50.0%	50.0%	11.2	6
	Depression(CESD total)[1]§	1.8±0.3	2.0±0.4	-6.6**	3312
	Anxiety (HADS total)[2]§	1.8±0.5	1.8±0.4	-0.8	2627
	Fatigue	54.7%	45.3%	3.1	3
	Urinary Incontinence§	30.2%	69.8%	94.7**	1
	Stool Incontinence	30.4%	69.6%	15.5**	1
FUNCTIONAL STATUS	No Physical Function Difficulty§	46.1%	53.9%	27.1	16
	Perceptions of Control	2.3±0.5	2.2±0.6	2.7**	2665
	Companionship§	49.8%	50.2%	21.0**	3
	Feel left Out	54.0%	46.0%	3.1	3
	Feel Isolated§	55.8%	44.2%	1.5	3
GENERAL HEALTH PERCEPTIONS	Self-rated physical health§	3.2±1.1	3.2±1.0	-0.7	3370
	Self-rated mental health§	3.7±1.0	3.6±1.0	3.2**	3372
INDIVIDUAL CHARACTERISTICS	Insurance	96.4%	95.2%	10.95**	1
	Age Category (≥70)	62%	55.8%	14.1**	1
	Education (> HS)§	57.5%	55.2%	1.78	1
	Race/Ethnicity (non-Black non-Hispanic)	74.6%	73.2%	3.39	1
	Seen the doctor in last year§	3.0±1.5	3.04±1.5	-1.28	3367
ENVIRONMENTAL CHARACTERISTICS	Rely on family	36.9%	63.1%	42.14**	3
	Has close family/relatives§	38.6%	61.4%	52.05**	5
	Rely on friends	44.3%	55.7%	71.78**	3
	Has friends§	44.9%	55.1%	13.12*	5
	Rely on spouse/partner§	63.3%	36.70%	26.92**	3

Note. **p < 0.01, *p < 0.05; [1]Center for Epidemiological Studies Depression (CESD); [2]Hospital Anxiety and Depression Scale (HADS)

§Variables that comprise the validated regression model and retained for subsequent gender-related regression analysis.

Bivariate correlation analyses were initially conducted to examine the associations between the outcome HRQoL variable and those that comprised the WCM constructs. For men, of the original 30 variables, bivariate correlation analysis led to the elimination of six variables (24 remaining), for women the elimination of seven variables (23 remaining). All significantly correlated variables that comprised the WCM constructs and characteristics were then validated by linear regression, reducing the variable list from 24 to 13 (Table 2), for final model development by gender. HRQoL happiness scores were compared by the total scores for men, women and participants combined across the categorized age groups (69 or younger, 70-79, 80 or older). Significant results were observed across age groups for combined participants (X^2=18.6, p=.017) and for women (X^2=20.1, p=.010), both having significantly lower HRQoL score with increasing age.

Table 3. WCM Constructs and HRQoL Outcomes *(N=3,377)*

MEN	**Partial R^2**	**Partial R^2 Rank**	**Effect Size (t-value)**	**Average R^2 Ranks**	**Average Effect Sizes (t-values)**
GENERAL HEALTH PERCEPTIONS	0.24, 1.8	1, 3	8.3, 5.9	2	7.1
FUNCTIONAL STATUS	0.21, .07	2, 6	7.2, 2.2	4	4.7
SYMPTOM STATUS	0.14	4	4.8	4	4.8
ENVIRONMENTAL CHARACTERISTICS	0.09	5	3.0	5	3.0
WOMEN	**Partial R^2**	**Partial R^2 Rank**	**Effect Size (t-value)**	**Average R^2 Ranks**	**Average Effect Sizes (t-values)**
GENERAL HEALTH PERCEPTIONS	0.39	1	9.4	1	9.4
FUNCTIONAL STATUS	0.33	2	7.9	2	7.9
SYMPTOM STATUS	0.03	5	0.68	5	0.68
ENVIRONMENTAL CHARACTERISTICS	0.16, 0.12	3, 4	3.6, 2.6	3.5	3.09

Separate linear regression analyses were conducted for men and women. Partial R^2 were ranked from 1 (most important) to 5 (least important) for men and women separately, with significant variables identified. Additionally, the last two columns on Table 3 contain the average of the R^2 ranking and the average effect sizes. The highest ranking variable for overall HRQoL happiness for men was General Health Perceptions (self-rated: mental health and physical health), Symptom Status (CESD- Depression score) and Functional Status (Lack companionship) both ranked second based on R^2 ranks, with Symptom Status having a greater average effect size. Physical Function Difficulty and Environmental Characteristics (Rely on spouse/partner) were last. Our regression analyses identified variables that, in the presence of all others, make a unique and direct contribution to HRQoL happiness.[10] The highest ranking variable for overall HRQoL for women was General Health Perceptions (mental health), followed by Functional Status (Lack of Companionship), Environmental Characteristics (Rely on spouse/partner and Number of close family members) and Symptom Status (urinary incontinence). The hierarch of contributing WCM constructs to overall HRQoL are ranked for men and women, Table 4.

Table 4. Hierarch of HRQoL Contributors based on Average Effect Sizes *(N=3,377)*		
Rank		Item Descriptions
MEN		
1st	GENERAL HEALTH PERCEPTIONS	Self-rated: mental health and physical health
2nd	SYMPTOM STATUS	Depression
3rd	FUNCTIONAL STATUS	Lack companionship, Physical Function Difficulty
4th	ENVIRONMENTAL CHARACTERISTICS	Number of close friends
WOMEN		
1st	GENERAL HEALTH PERCEPTIONS	Self-rated: mental health
2nd	FUNCTIONAL STATUS	Lack companionship
3rd	ENVIRONMENTAL CHARACTERISTICS	Rely on spouse/partner and Number of close family
4th	SYMPTOM STATUS	Urinary Incontinence

DISCUSSION

Understanding subjective well-being and its association with health in older adults is still in its early stages. Consequently, the extent to which a variety of bio-psychosocial factors attribute to well-being and account for gender-related differences remain unclear. To explore this further, we utilized the WCM which offers the most comprehensive view of pathways linking the most relevant bio-psychosocial variables to overall well-being defined as HRQoL happiness.[2,11,16,17] Epidemiologic studies of happiness have predicted long term morbidity and mortality. Previous studies have shown that subjective well-being is not universal across populations, yet Individual Characteristics including, education and race/ethnicity, did not significantly contribute to HRQoL happiness in our population.[10] Our results did however, identify significant differences between men and women in the type and contribution of bio-psychosocial factors to HRQoL happiness. The overall models allowed for us to observe the interplay between various aspects of aging by gender.[11]

Mechanisms and Implications

Women reported significantly lower HRQoL than men. Our findings also indicated a significant decrease in HRQoL as age increased for the entire sample and for women. A decrease in HRQoL was also observed for men, but the results were not significant. Previous studies have identified lower HRQoL in populations of older women. It is hypothesized that gender-related differences in HRQoL of older adults may be in their perceptions of symptoms and illness progression, with men being less focused on symptom recognition until they are severe.[8] Interestingly, although there were no significant differences in perceptions of physical health between men and women in our analysis, it was the greatest contributor of HRQoL in men. Similarly, the third greatest contributor to HRQoL in men was the Functional Status level factor Physical Function Difficulty, also not observed in women. Prior studies have indicated that functional difficulty generally comprise the majority of an individual's functional health status, which in our study again was only associated with men. This is an interesting finding and may be attributed to the increased likelihood of men suffering from more severe and life threatening chronic conditions than women.[8] Instead, women are more likely to suffer from non-life threatening diseases including autoimmune disorders.[8] Social support significantly contributed to HRQoL in both men and women. The lack of companionship under the Functional Status level was significant in both groups. These findings align with the literature on loneliness in older ages and its adverse effects on HRQoL.[18,19] The reduction of inter-generational living and greater geographic expansion, has increased the report of loneliness in populations of older adults. Loneliness directly increases the likelihood of chronic diseases and all-cause mortality.[21] In our sample, the number of close family members was seen a significant contributor to HRQoL for women only. Having close family members may be more important to women, with 41 percent of the female sample reported being unmarried, only 21.9 percent of men. Additionally, HRQoL scores were significantly higher for married women. For those who reported being unmarried with a romantic, intimate, or sexual partner, men were significantly higher at 22.5 percent and women at 6.9 percent. Participants who reported greater social support from partners and relatives had higher HRQoL. Unhealthy familial relationships were predictors of loneliness in a prior study, particularly for the unmarried.[18,19] Their findings identify family ties as the most significant contributor to loneliness.[18,19] This aligns with our findings as women who reported a greater number of reliable family members had significantly higher HRQoL scores. Therefore, the need exists for the consideration of social networks[20,21] and their impact on HRQoL in risk

assessment and intervention development to improve aging-related outcomes. Previous studies have also shown that men and women who were satisfied with their family relationship had 1.8 and 3.0 times higher odds of good HRQoL, respectively. Frequent contacts and visits with friends or family motivate the participation in activities and increase HRQoL.[21,22]

The highest level significant contributor to HRQoL in both men and women was the General Health Perceptions level which both comprised of mental health. In fact, those who reported better mental health outcomes reported higher HRQoL. Men reported better mental health at a significantly higher level than women. Yet, depression was the only significant factor for the Symptom Status level in men alone and was the second highest contributor to their HRQoL. Other studies have shown that mental health concerns and symptoms of depression significantly impact HRQoL.[2,11,23] Our findings align with the literature on depression, with depression in women reported to be higher.[16,24,2,11,25-28] In fact, in our sample, depression scores for women were significantly higher than for men. Yet, depression was a major contributor to HRQoL only in men. Studies have shown that unmarried men have lower HRQoL compared to married men. Our findings show significantly higher depression scores for married men in our sample. Those who reported having demanding or critical spouses or did not spend much time with their spouses had significantly higher Depression scores. Though not significant in the hierarchical model, women with demanding and critical spouses also reported significantly higher depression scores. These results further reinforce our findings that relationship quality is a major contributor to HRQoL. Urinary incontinence was the only significant factor in the Symptom Status level for women. Those with urinary incontinence had significantly lower HRQoL scores. Our findings align with the literature, with recent studies indicating that women were more likely to report urinary incontinence and impaired HRQoL.[29,30] Additionally, pelvic organ prolapse (POP), which often peaks for women in their seventies, include the symptoms of urinary incontinence. Studies have shown significantly impaired quality for women with POP over the age of 50.[31] Symptomatic POP is evidenced to have a tremendous impact on general health-related quality of life and similar to disabilities, it can contribute to physical immobility, pain, diminished energy, sleep disturbance, emotional instability and social isolation.[31] Studies have also shown that self-image is considered to be more important to women than men. In fact, in a study comparing HRQoL indicators between older men and women, a positive attitude about oneself was ranked in the top ten only for women.[32,33] Urinary incontinence may impact self-image, increasing the likelihood of depression and social isolation. Our findings indicate women who report urinary incontinence had significantly higher Depression scores; consistent with the higher likelihood of Depression and anxiety disorders in women compared to men.[8]

Strengths and limitations

Our analysis was based on a cross-sectional, single wave (Wave 2) of the NSHAP data and does not allow for establishing a cause-effect relationship or the determination of changes in perceptions over time. Our analysis is also limited to define the WCM levels based on variables included in the NSHAP, a limitation inherent to secondary data analysis. However, with the variety of indicators that comprise the NSHAP, this was a minor limitation.

Variables that may indirectly impact HRQoL are not identified, yet our analytic approach provides a minimum collection of variables necessary to begin the development of structural equation models to observe directional relationships. In fact, our regression approach identified the variables that make a distinct and direct contribution to HRQoL. Furthermore, our model validation ensured that variable selection for the gender models were not due to chance. HRQoL was measured with one item of self-reported happiness in the NSHAP. Our single item analysis may be considered less sensitive than the use of other HRQoL measures or validated tools. Yet, beyond the identified limitations, our study findings mirrored and reinforce prior research and further contributed to understanding HRQoL differences between older men and women while adjusting for confounders including age, race/ethnicity and socioeconomic status.

Conclusions and implications

The current analysis provides additional evidence to support insight into subjective well-being as it relates to successful aging. The findings of our analysis enhances our understanding of the bio-psychosocial factors that impact the HRQoL of older men and women. Our results add to the literature on successful aging in addition to the utility of the WCM in understanding the impact of HRQoL based on a variety of associated factors that comprise

the models levels. We observed both similarities and differences between men and women based on the levels that best contribute to HRQoL. Further investigation is needed to determine the causal factors of the identified relationships between WCM levels and HRQoL. Other indicators of subjective well-being (e.g., life evaluations and eudemonic well-being) must also be assessed for collaborative care informed by mental and physical health. [10] In addition to informing the development of effective interventions to improve well-being independent of morbidity, income and other aging related factors that have adversely contributed to poor health outcomes.

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Ethical approval: The NSHAP data analysis was carried out with de-identified, unrestricted Wave 2 Public Use File v1 designed for public dissemination. This dataset is appropriate for preliminary analyses and for the exploration of health and functioning of older American adults.

Data sharing: Wave 2 Public Use File v1 data for the National Social Life Health and Aging Project are available at http://www.icpsr.umich.edu/icpsrweb/NACDA/studies/34921.

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Figure 1. Operationalized Wilson Cleary Model with study-specific bio-psychosocial measures

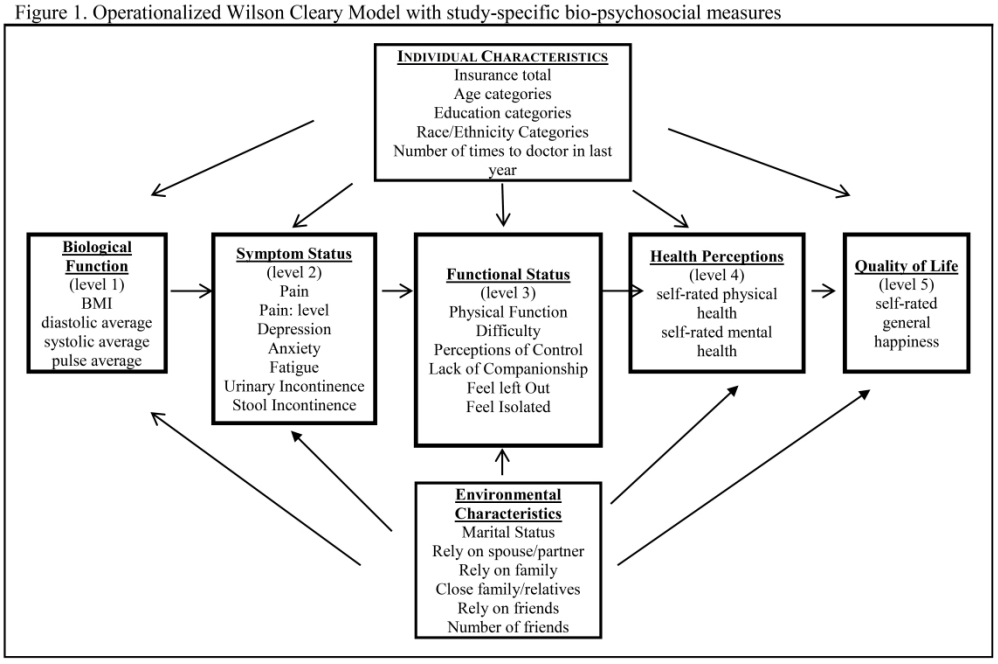

Figure 1 Operationalized Wilson Cleary Model with study-specific bio-psychosocial measures

564x372mm (300 x 300 DPI)

STROBE Statement—checklist of items that should be included in reports of observational studies

Correlates and Etiological Factors Associated with Hedonic Well-Being Among an Aging Population of US Men and Women: secondary data analysis of a national survey

Michelle Odlum, EdD, MPH[1], Nicole Davis, PhD, RN[2], Otis Owens, PhD, MPH, Michael Preston, PhD, MPH[4], Russell Brewer, DrPH, MPH[3], and Danielle Black, MS, MPH[5,1]

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract **pages 2, 9**
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found **page 2**
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported **pages 3, 4**
Objectives	3	State specific objectives, including any pre-specified hypotheses **page 2, 3**
Methods		
Study design	4	Present key elements of study design early in the paper **page 3, 4**
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection **page 3, 4**
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants **page 3, 4**
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable **page 4, 9**
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group **page 4**
Bias	9	Describe any efforts to address potential sources of bias **N/A**
Study size	10	Explain how the study size was arrived at **page 4**
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why **page 4, 5**
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding **page 5**
		(*b*) Describe any methods used to examine subgroups and interactions **page 5**
		(*c*) Explain how missing data were addressed **N/A**

(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed
Case-control study—If applicable, explain how matching of cases and controls was addressed
Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy **N/A**

(*e*) Describe any sensitivity analyses

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed **page 4**
		(b) Give reasons for non-participation at each stage **N/A**
		(c) Consider use of a flow diagram **N/A**
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders **page 4, 6**
		(b) Indicate number of participants with missing data for each variable of interest **N/A**
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		Cross-sectional study—Report numbers of outcome events or summary measures **page 6-8**
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included **page 5, 7**
		(*b*) Report category boundaries when continuous variables were categorized **N/A**
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses **page 5**
Discussion		
Key results	18	Summarise key results with reference to study objectives **page 6-8**
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias **page 9**
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence **page 8, 9**
Generalisability	21	Discuss the generalisability (external validity) of the study results **page 8, 9**
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based **page 10**

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Correlates and Etiological Factors Associated with Hedonic Well-Being Among an Aging Population of US Men and Women: Secondary Data Analysis of a National Survey

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ABSTRACT

Objective. To understand the gender-specific factors that uniquely contribute to successful aging in a US population of men and women, 57-85 years of age. This was achieved through the examination of the correlates of subjective well-being defined by health-related quality of life (HRQoL), across several biological and psychosocial determinants of health.

Design. Cross sectional study

Setting. The NSHAP (National Social Life, Health and Ageing Project, 2010-11) a representative sample of the US population.

Participants. 3,377 adults aged 57 to 85 (1538 men, 1839 women) from the NSHAP.

Main outcome measures. The bio-psychosocial factors of Biological/Physiological Function, Symptom Status, Functional Status, General Health Perceptions and HRQoL-happiness.

Method. HRQoL was measured using the NSHAP Wave 2 multistage, stratified area probability sample of US households (N=3,377). Variable selection was guided by the Wilson's and Cleary's Model (WCM) that classifies health outcomes at five main levels and characteristics.

Results. Our findings indicate differences in bio-psychosocial factors comprised in the WCM and their relative importance and unique impact on HRQoL by gender. Women reported significantly lower HRQoL than men (t=3.5, df=3366). The most significant contributors to HRQoL in women were mental health (B=0.31; 0.22, 0.39), loneliness (B=-0.26; -0.35, -0.17), urinary incontinence (B= -0.22; -0.40, -0.05) and support from spouse/partner (B=0.27; 0.10, 0.43), and family B=0.12; 0.03, 0.20). Men indicated mental health (B=0.21; 0.14, 0.29), physical health (B=0.17; 0.10, 0.23), functional difficulties (B=0.38; 0.10, 0.65), loneliness (B=-0.20; -0.26, -0.12), depression (B= -0.36; -0.58, -0.15) and support from friends (B=0.06; 0.10, 0.11) as significant contributors. Those with greater social support had better HRQoL (F=4.22, df=4). Lack of companionship and reliance on spouse/partner were significant HRQoL contributors in both groups.

Conclusion. Our findings offer insight into aging, gender and subjective well-being. The results provide an opportunity to identify bio-psychosocial factors to inform interventions to support successful aging.

Article Summary: Strengths and limitations of this study

- A variety of bio-psychosocial factors that contribute to well-being by gender were compared, where prior studies have not used gender as an independent variable.
- Effect sizes were used to summarize our regression analyses for a manageable and clinically interpretable picture of the unique contribution of gender across the comprehensive Wilson Cleary Model's (WCM), linking bio-psychosocial factors to overall well-being defined as Health Related Quality of Life - happiness.
- We were unable to establishing a cause-effect relationship or to determine changes in perceptions over time based on our cross-sectional analysis.
- We were limited to define the WCM levels based on variables in the NSHAP; yet with the variety of indicators captured in the NSHAP, this was a minor limitation.
- Beyond identified limitations, results mirrored prior research and contributed to the understanding of HRQoL gender-based differences, while controlling for potential confounders including age, race/ethnicity and socioeconomic status.

INTRODUCTION

Successful aging was traditionally defined as the absence of disease and associated functional limitations.[1] However, the definition has shifted to a multidimensional view that accounts for psychosocial and cultural aspects of health and health related quality of life (HRQoL).[1,2] This shift in definition is driven by patient center care, patient empowerment and shared decision making with providers in the healthcare setting.[2] In fact, HRQoL is now viewed as an important complement to biomedical measures of health.[3] An important indicator of successful aging is subjective well-being, an aspect of HRQoL. Subjective well-being, is a direct predictor of health outcomes affecting biological, physical, and psychosocial changes in older adults.[4,5] Improvements in population-level well-being is an aspiration of society, sparking policy and economic debates.[6] Studies of life satisfaction have shown that subjective well-being is affected by a multitude of additional factors, including social and familial relationships. These additional factors may be protective, potentially decreasing or eliminating the chronic disease and symptom burden.[6]

Three approaches exist to capture subjective well-being; these are life evaluation (e.g., life satisfaction); hedonic well-being (e.g., experienced happiness, anger); and eudemonic well-being (e.g., life meaning and purpose.[6] Researchers suggest subjective well-being as a measure for healthcare resources allocation. Therefore, the need exists to further identify and understand the factors associated with successful aging.[2,7] It is also essential to compare these factors between men and women to determine the unique contribution of gender.[2] Evidence to date remains unclear as prior studies of gender differences have focused on specific chronic diseases or on socioeconomic and demographic factors, usually controlling for gender as a potential confounder and not as an independent variable.[8] Therefore, we sought to identify the correlates and etiological factors associated with hedonic well-being, specifically feelings of happiness, through a bio-psychosocial lens, accounting for gender variability, in an aging population of US adults. Happiness, served as a proxy for HRQoL. It is a measure of life satisfaction, the absence or presence of desirable or undesirable feelings or experiences. It is proven useful in the analysis of HRQoL.[9]

Guided by the Wilson's and Cleary's Conceptual Model (WCM), Figure 1 we analyzed the National Social Life, Health and Aging Project (NSHAP), second wave data. We examined whether objective (e.g., biological/physiological) and self-perceived measures (e.g., functional status) of health explain gender differences in HRQoL (i.e., happiness). Self-rated perceptions of health have been observed to correlate with other health indicators including morbidity.[10] We determined the models predicting the HRQoL of male and female US adults ages 57 to 85.[11] We explored the extent to which the WCM levels interact to predict HRQoL and provide greater insight into aging. The bio-psychosocial WCM was selected for our analysis as it considers health outcomes on a continuum of increasing complexity and health trajectories associated with aging. It is also shown to enhance knowledge about HRQoL in diverse populations.[11] The model classifies health outcomes at five main levels.[11] The first level Biological/Physiological function, examines the individual as a whole. Symptoms (level 2), are the perceptions of physical, emotional, and cognitive states. Symptoms are considered significant determinants of Functional Status (level 3), with biological and symptom variables evidenced to be correlated with Functional Status. General Health Perceptions (level 4) are subjective appraisals of health and Overall Quality of Life (level 5) as a whole.[11] Variables that comprise each level interact in complex ways to determine HRQoL. Arrows linking the five main levels indicate dominant causal relationships. In addition, the five main levels are influenced by individual (e.g., age, education) and environmental characteristics (e.g., social support).[11] Studies of hedonic states, including happiness, have predicted morbidity and mortality. However, cofounding factors indicate that well-being is coupled with additional factors such as education.[10] The WCM controls for potential confounding. Additionally, different than prior studies that compared the quantified HRQoL scores across gender, we identified the hierarchical differences of each WCM level and their weighted contribution to HRQoL (happiness).

METHODS

Participants. The second wave of the NSHAP survey, a National sample of US adults ages 57 to 85, was utilized in our analysis, was conducted from 2010-2011.[12] The survey focused on exploring interpersonal connections and overall health outcomes as they relate to: culture, gender and socioeconomic status; health behaviors; health care utilization, social support, and well-being.[12] Our current study utilized Wave 2 data to explore the relationship between the WCM constructs for both men and women. Wave 2, with its large sample size (N=3,377) and strong methodology, allowed us to systematically investigate important aspects of HRQoL and aging.

Measures. NSHAP variables used in our analysis were selected based on best fit with the WCM constructs. Thirty variables were selected. We categorized the five main levels and characteristics of the WCM under two overarching categories of Objective and Subjective health indicators, Figure 1. The Objective indicators of the first main level of Biological/Physiological Function were, categorical: Body Mass Index (BMI), and continuous: average pulse rate, and average blood pressure (systolic and diastolic). The last four main levels of the WCM comprised Subjective health indicators. These included the assessment of participant perceptions of health outcomes on both individual and societal levels. Variables that comprised Symptom Status were categorical: pain, pain level, fatigue, urinary incontinence, stool incontinence and continuous: depression, anxiety. Variables that comprised Functional Status were categorical: physical function difficulty, companionship and feeling left out or isolated and continuous: perceptions of control. Variables that comprised General Health Perceptions were continuous self-rated physical and mental health.

Our continuous outcome variable of interest for HRQoL in this study was defined by hedonic well-being: self-rated happiness, asked participants thoughts and feelings about their life overall. The WCM also accounts for important individual and environment influences directly impacting objective and subjective indicators. Variables that comprise Individual Characteristics were categorical: insurance coverage, age group, education, race/ethnicity, and provider visits. Variables that comprise Environmental Characteristics were categorical: marital status, reliance on spouse/partner, relatives and friends, and number of close family/relatives and friends.

Statistical analysis. The association between HRQoL (i.e., happiness) and the constructs of the WCM were examined in separate analyses for male and female participants. Descriptive statistics were conducted to characterize the sample and variable distributions. Participant characteristics were summarized with means and standard deviations for continuous variables and percentages and frequencies for categorical variables. Individual and environmental characteristics were also examined for potential confounding. Correlations were calculated to determine the relationship between the WCM construct and characteristic variables and reported HRQoL by participants. Bivariate analysis was conducted. Chi square analyses were used to assess differences in categorical variables and T-tests in continuous variables, by gender. Linear regression analyses were performed to assess the relevant importance of significantly correlated variables that potentially contribute to HRQoL. For model validation, our dataset was randomly divided, using a split-sample technique, into a developmental: n=1689 and validation: n=1688 group before identifying final model variables.[13] The development model was selected through a stepwise multiple regression to identify the model of best fit. To determine the accuracy of the developmental model, a regression model was calculated with the validation dataset for the retained variables. To choose the final model, adjusted R^2 values, Standardized βs and unstandardized slopes (B) were observed between the developmental and validation models to ensure analytic comparability. Variables with significant differences ($p<0.05$) were retained for additional analysis.

Two independent stepwise multiple regressions were then performed based on gender (i.e., men and women) to identify variables, by gender, best associated with HRQoL. Retained variables were ranked by partial R^2 order to determine their relative contribution. Effect sizes were also estimated for each retained variable with t-values corresponding to the coefficient estimates divided by the associated standard errors. To identify constructs with the most consistent associations with HRQoL, effect sizes and R^2 rankings were averaged per WCM construct for men and women. Data analysis was conducted with use of SPSS 22.0. The stepwise approach allows for the prevention of bias in the selection of variables in the final model.[14 15]

Table 1. Demographic Characteristics of Participants *(N=3,377)*	*N*	*(%)*
Gender		
Men	1538	45.5
69 or Under	585	38.0
70-79	610	39.7
80 or older	343	22.3
Women	1839	54.5
69 or Under	812	44.2
70-79	633	34.4
80 or older	394	21.4
Race		
Men		
non-Black, non-Hispanic	1147	74.6
Black or African American	217	14.1
non-Black Hispanics	174	11.3
Women		
non-Black, non-Hispanic	1346	73.2
Black or African American	300	16.3
non-Black Hispanics	193	10.5
Education		
Men		
more than High School	884	57.5
High School or less	654	42.5
Women		
more than High School	1015	55.2
High School or less	824	44.8
Insurance Coverage		
Men		
Medicaid-Medicare	1080	83.9
Private	161	12.5
None	46	3.6
Women		
Medicaid-Medicare	1227	79.1
Private	250	16.1
None	75	4.8
Marital Status		
Men		
Married	1201	78.1
Not currently Married	337	21.9
Women		
Married	1085	59.0
Not currently Married	754	41.0
Partnership if non-Married		
Men		
No	231	77.5
Women		
No	659	93.1

Patient Involvement. As an analysis of secondary data, no participants were not involved in the development of our research questions or with the analysis of the outcome measures. Additionally, participants were not involved with the interpretation of data or the writing of our analytic findings. Dissemination of analytic findings to study participants or members of their associated communities will not be accomplished.

Table 2. Independent Samples T-tests and X^2 for Wilson Cleary Model construct-specific variables with Men and Women *(N=3,377)*

		Men	Women	X^2/T-test	*df*
BIOLOGICAL/ PHYSIOLOGICAL FUNCTION	BMI (normal)	36.5%	63.5%	29.0**	2
	Diastolic average	79.0±12.0	81.0±11.5	-6.4**	3255
	Systolic Average	138.0±.20.7	137.0±21.0	1.6	3255
	Pulse Average	67.7±12.1	69.8±11.2	-5.1**	3035
SYMPTOM STATUS	Pain	43.8%	56.2%	8.9**	1
	Pain: level (no pain)	50.0%	50.0%	11.2	6
	Depression(CESD total)[1]§	1.8±0.3	2.0±0.4	-6.6**	3312
	Anxiety (HADS total)[2]§	1.8±0.5	1.8±0.4	-0.8	2627
	Fatigue	54.7%	45.3%	3.1	3
	Urinary Incontinence§	30.2%	69.8%	94.7**	1
	Stool Incontinence	30.4%	69.6%	15.5**	1
FUNCTIONAL STATUS	No Physical Function Difficulty§	46.1%	53.9%	27.1	16
	Perceptions of Control	2.3±0.5	2.2±0.6	2.7**	2665
	Companionship§	49.8%	50.2%	21.0**	3
	Feel left Out	54.0%	46.0%	3.1	3
	Feel Isolated§	55.8%	44.2%	1.5	3
GENERAL HEALTH PERCEPTIONS	Self-rated physical health§	3.2±1.1	3.2±1.0	-0.7	3370
	Self-rated mental health§	3.7±1.0	3.6±1.0	3.2**	3372
INDIVIDUAL CHARACTERISTICS	Insurance	96.4%	95.2%	10.95**	1
	Age Category (≥70)	62%	55.8%	14.1**	1
	Education (> HS)§	57.5%	55.2%	1.78	1
	Race/Ethnicity (non-Black non-Hispanic)	74.6%	73.2%	3.39	1
	Seen the doctor in last year§	3.0±1.5	3.04±1.5	-1.28	3367
ENVIRONMENTAL CHARACTERISTICS	Rely on family	36.9%	63.1%	42.14**	3
	Has close family/relatives§	38.6%	61.4%	52.05**	5
	Rely on friends	44.3%	55.7%	71.78**	3
	Has friends§	44.9%	55.1%	13.12*	5
	Rely on spouse/partner§	63.3%	36.70%	26.92**	3

Note. **p < 0.01, *p < 0.05; [1]Center for Epidemiological Studies Depression (CESD); [2]Hospital Anxiety and Depression Scale (HADS)

§Variables that comprise the validated regression model and retained for subsequent gender-related regression analysis.

RESULTS

A total of 3,377 participants were included in the analysis. The majority of participants (54.5%) were women. The largest percentage of men were in the 70-79 age group (39.7%) with the largest percentage of women in the 69 and under age group (44.2%). The sample was predominantly non-Black, non-Hispanic (73.8%, N=2493). Most participants had at least a high school education (56.2%, N=1899). More than two-thirds were married (67.7%, N=2286). Of those who indicated they were unmarried, 88.5% (N=890) were not in any romantic, intimate, or sexual partnerships. More than two-thirds had health care coverage in the form of Medicaid, Medicare, or a combination of both (81.3%, N=2307). Tables 1 and 2 provides a breakdown of the demographic characteristics

and significant differences for variables that comprise the WCM constructs for men and women. Table 3 describes the baseline characteristics of the development and validation cohorts.

Table 3. Characteristics of the Developmental and Validation Models Wilson Cleary Model Construct-Specific Variables

		Developmental Cohort (N=1689)			Validation Cohort (N=1688)		
	Construct-Specific Variables	**Descriptives**	**β**	**95% CI**	**Descriptives**	**β**	**95% CI**
SYMPTOM STATUS	Depression (CESD total)[1]	1.9 ± .34	-.111*	-.537, -.061	1.9 ± .35	-.099**	-.447, -.094
	Anxiety (HADS total)[2]	1.8 ± .45	-.201**	-.499, -.291	1.8 ± .45	-.212**	-.563, -.270
	Urinary Incontinence	0.42	-.070*	-.112, .076	0.43	-.059*	-.238, .028
FUNCTIONAL STATUS	No Physical Function Difficulty	0.72	-.102**	-.288, -.118	0.72	-.107**	-.181, -.045
	Companionship	0.39	-.168**	-.238, -.075	0.40	-.166**	-.207, -.129
	Feel Isolated	0.27	-.146**	-.240, -.060	0.26	-.148**	-.229, -.113
GENERAL HEALTH PERCEPTIONS	Self-rated physical health	3.22 ± 1.05	.121*	.021, .175	3.19 ± 1.07	.123**	.061, .110
	Self-rated mental health	3.62 ± .96	.244**	.126, .283	3.62 ± .99	.240**	.153, .272
INDIVIDUAL CHARACTERISTICS	Education (> HS)	0.58	.074*	-.003, .281	0.58	.068*	-.025, .180
	Seen the doctor in last year	3.06 ± 1.5	-.099**	-.093, -.027	2.97 ± 1.5	-.105**	-.081, -.042
ENVIRONMENTAL CHARACTERISTICS	Has close family/relatives	0.98	.122**	.059, .150	0.98	.123**	.061, .110
	Has friends	0.97	.079*	-.001, .105	0.97	.066*	-.010, .136
	Rely on spouse/partner	0.96	.130**	.094, .357	0.97	.134*	.138, .330

Note. **p < 0.01, *p < 0.05; [1]Center for Epidemiological Studies Depression (CESD); [2]Hospital Anxiety and Depression Scale (HADS)

Bivariate correlation analyses were initially conducted to examine the associations between the outcome HRQoL variable and those that comprised the WCM constructs. For men, of the original 30 variables, bivariate correlation analysis led to the elimination of six variables (24 remaining), for women the elimination of seven variables (23 remaining). All significantly correlated variables that comprised the WCM constructs and characteristics were then validated by linear regression, reducing the variable list from 24 to 13 (Table 2), for final model development by gender. HRQoL happiness scores were compared by the total scores for men, women and participants combined across the categorized age groups (69 or younger, 70-79, 80 or older). Significant results were observed across age groups for combined participants (X^2=18.6, p=.017) and for women (X^2=20.1, p=.010), both having significantly lower HRQoL score with increasing age.

Table 4. WCM Constructs and HRQoL Outcomes

MEN	**Partial R^2**	**Partial R^2 Rank**	**Effect Size (t-value)**	**Average R^2 Ranks**	**Average Effect Sizes (t-values)**
GENERAL HEALTH PERCEPTIONS	0.24, 1.8	1, 3	8.3, 5.9	2	7.1
FUNCTIONAL STATUS	0.21, .07	2, 6	7.2, 2.2	4	4.7
SYMPTOM STATUS	0.14	4	4.8	4	4.8
ENVIRONMENTAL CHARACTERISTICS	0.09	5	3.0	5	3.0

WOMEN	**Partial R^2**	**Partial R^2 Rank**	**Effect Size (t-value)**	**Average R^2 Ranks**	**Average Effect Sizes (t-values)**
GENERAL HEALTH PERCEPTIONS	0.39	1	9.4	1	9.4
FUNCTIONAL STATUS	0.33	2	7.9	2	7.9
SYMPTOM STATUS	0.03	5	0.68	5	0.68
ENVIRONMENTAL CHARACTERISTICS	0.16, 0.12	3, 4	3.6, 2.6	3.5	3.09

Separate linear regression analyses were conducted for men and women. Partial R^2 were ranked from 1 (most important) to 5 (least important) for men and women separately, with significant variables identified. Additionally,

the last two columns on Table 4 contain the average of the R^2 ranking and the average effect sizes. The highest ranking variable for overall HRQoL happiness for men was General Health Perceptions (self-rated: mental health and physical health), Symptom Status (CESD- Depression score) and Functional Status (Lack companionship) both ranked second based on R^2 ranks, with Symptom Status having a greater average effect size. Physical Function Difficulty and Environmental Characteristics (Rely on spouse/partner) were last. Our regression analyses identified variables that, in the presence of all others, make a unique and direct contribution to HRQoL happiness.[10] The highest ranking variable for overall HRQoL for women was General Health Perceptions (mental health), followed by Functional Status (Lack of Companionship), Environmental Characteristics (Rely on spouse/partner and Number of close family members) and Symptom Status (urinary incontinence). The hierarch of contributing WCM constructs to overall HRQoL are ranked for men and women, Table 5.

Table 5. Hierarch of HRQoL Contributors based on Average Effect Sizes

Rank		Item Descriptions
MEN		
1st	GENERAL HEALTH PERCEPTIONS	Self-rated: mental health and physical health
2nd	SYMPTOM STATUS	Depression
3rd	FUNCTIONAL STATUS	Lack companionship, Physical Function Difficulty
4th	ENVIRONMENTAL CHARACTERISTICS	Number of close friends
WOMEN		
1st	GENERAL HEALTH PERCEPTIONS	Self-rated: mental health
2nd	FUNCTIONAL STATUS	Lack companionship
3rd	ENVIRONMENTAL CHARACTERISTICS	Rely on spouse/partner and Number of close family
4th	SYMPTOM STATUS	Urinary Incontinence

DISCUSSION

Understanding subjective well-being and its association with health in older adults is still in its early stages. Consequently, the extent to which a variety of bio-psychosocial factors attribute to well-being and account for gender-related differences remain unclear. To explore this further, we utilized the WCM which offers the most comprehensive view of pathways linking the most relevant bio-psychosocial variables to overall well-being defined as HRQoL happiness.[2,11,16,17] Epidemiologic studies of happiness have predicted long term morbidity and mortality. Previous studies have shown that subjective well-being is not universal across populations, yet Individual Characteristics including, education and race/ethnicity, did not significantly contribute to HRQoL happiness in our population.[10] Our results did however, identify significant differences between men and women in the type and contribution of bio-psychosocial factors to HRQoL happiness. The overall models allowed for us to observe the interplay between various aspects of aging by gender.[11]

Mechanisms and Implications

Women reported significantly lower HRQoL than men. Our findings also indicated a significant decrease in HRQoL as age increased for the entire sample and for women. A decrease in HRQoL was also observed for men, but the results were not significant. Previous studies have identified lower HRQoL in populations of older women. It is hypothesized that gender-related differences in HRQoL of older adults may be in their perceptions of symptoms and illness progression, with men being less focused on symptom recognition until they are severe.[8] Interestingly, although there were no significant differences in perceptions of physical health between men and women in our analysis, it was the greatest contributor of HRQoL in men. Similarly, the third greatest contributor to HRQoL in men was the Functional Status level factor Physical Function Difficulty, also not observed in women. Prior studies have indicated that functional difficulty generally comprise the majority of an individual's functional health status, which in our study again was only associated with men. This is an interesting finding and may be attributed to the increased likelihood of men suffering from more severe and life threatening chronic conditions than women.[8] Instead, women are more likely to suffer from non-life threatening diseases including autoimmune disorders.[8] Social support significantly contributed to HRQoL in both men and women. The lack of companionship

under the Functional Status level was significant in both groups. These findings align with the literature on loneliness in older ages and its adverse effects on HRQoL.[18,19] The reduction of inter-generational living and greater geographic expansion, has increased the report of loneliness in populations of older adults. Loneliness directly increases the likelihood of chronic diseases and all-cause mortality. [18,19] In our sample, the number of close family members was seen a significant contributor to HRQoL for women only. Having close family members may be more important to women, with 41 percent of the female sample reported being unmarried, only 21.9 percent of men. Additionally, HRQoL scores were significantly higher for married women. For those who reported being unmarried with a romantic, intimate, or sexual partner, men were significantly higher at 22.5 percent and women at 6.9 percent. Participants who reported greater social support from partners and relatives had higher HRQoL. Unhealthy familial relationships were predictors of loneliness in a prior study, particularly for the unmarried.[18,19] Their findings identify family ties as the most significant contributor to loneliness.[18,19] This aligns with our findings as women who reported a greater number of reliable family members had significantly higher HRQoL scores. Therefore, the need exists for the consideration of social networks[20,21] and their impact on HRQoL in risk assessment and intervention development to improve aging-related outcomes. Previous studies have also shown that men and women who were satisfied with their family relationship had 1.8 and 3.0 times higher odds of good HRQoL, respectively. Frequent contacts and visits with friends or family motivate the participation in activities and increase HRQoL.[21,22]

The highest level significant contributor to HRQoL in both men and women was the General Health Perceptions level which both comprised of mental health. In fact, those who reported better mental health outcomes reported higher HRQoL. Men reported better mental health at a significantly higher level than women. Yet, depression was the only significant factor for the Symptom Status level in men alone and was the second highest contributor to their HRQoL. Other studies have shown that mental health concerns and symptoms of depression significantly impact HRQoL.[2,11,23] Our findings align with the literature on depression, with depression in women reported to be higher.[16,24,2,11,25-28] In fact, in our sample, depression scores for women were significantly higher than for men. Yet, depression was a major contributor to HRQoL only in men. Studies have shown that unmarried men have lower HRQoL compared to married men. Our findings show significantly higher depression scores for married men in our sample. Those who reported having demanding or critical spouses or did not spend much time with their spouses had significantly higher Depression scores. Though not significant in the hierarchical model, women with demanding and critical spouses also reported significantly higher depression scores. These results further reinforce our findings that relationship quality is a major contributor to HRQoL. Urinary incontinence was the only significant factor in the Symptom Status level for women. Those with urinary incontinence had significantly lower HRQoL scores. Our findings align with the literature, with recent studies indicating that women were more likely to report urinary incontinence and impaired HRQoL.[29,30] Additionally, pelvic organ prolapse (POP), which often peaks for women in their seventies, include the symptoms of urinary incontinence. Studies have shown significantly impaired quality for women with POP over the age of 50.[31] Symptomatic POP is evidenced to have a tremendous impact on general health-related quality of life and similar to disabilities, it can contribute to physical immobility, pain, diminished energy, sleep disturbance, emotional instability and social isolation.[31] Studies have also shown that self-image is considered to be more important to women than men. In fact, in a study comparing HRQoL indicators between older men and women, a positive attitude about oneself was ranked in the top ten only for women.[32,33] Urinary incontinence may impact self-image, increasing the likelihood of depression and social isolation. Our findings indicate women who report urinary incontinence had significantly higher Depression scores; consistent with the higher likelihood of Depression and anxiety disorders in women compared to men.[8]

Strengths and limitations

Our analysis was based on a cross-sectional, single wave (Wave 2) of the NSHAP data and does not allow for establishing a cause-effect relationship or the determination of changes in perceptions over time. Our analysis is also limited to define the WCM levels based on variables included in the NSHAP, a limitation inherent to secondary data analysis. However, with the variety of indicators that comprise the NSHAP, this was a minor limitation.

Variables that may indirectly impact HRQoL are not identified, yet our analytic approach provides a minimum collection of variables necessary to begin the development of structural equation models to observe directional

relationships. In fact, our regression approach identified the variables that make a distinct and direct contribution to HRQoL. Furthermore, our model validation increased our confidence in the predictive validity of the models. HRQoL was measured with one item of self-reported happiness in the NSHAP. Our single item analysis may be considered less sensitive than the use of other HRQoL measures or validated tools. Yet, beyond the identified limitations, our study findings mirrored and reinforce prior research and further contributed to understanding HRQoL differences between older men and women while adjusting for confounders including age, race/ethnicity and socioeconomic status.

Conclusions and implications

The current analysis provides additional evidence to support insight into subjective well-being as it relates to successful aging. The findings of our analysis enhances our understanding of the bio-psychosocial factors that impact the HRQoL of older men and women. Our results add to the literature on successful aging in addition to the utility of the WCM in understanding the impact of HRQoL based on a variety of associated factors that comprise the models levels. We observed both similarities and differences between men and women based on the levels that best contribute to HRQoL. Further investigation is needed to determine the causal factors of the identified relationships between WCM levels and HRQoL. Other indicators of subjective well-being (e.g., life evaluations and eudemonic well-being) must also be assessed for collaborative care informed by mental and physical health. [10] In addition to informing the development of effective interventions to improve well-being independent of morbidity, income and other aging related factors that have adversely contributed to poor health outcomes.

Contributors: All authors assisted in the interpretation of data, the drafting and revising of important intellectual content and manuscript approval. The first author (MO) designed the work and analyzed the data. All authors assisted substantially in the data interpretation (MO, ND, OO, MP, RB), manuscript drafting (MO), revising for important intellectual content (MO, ND, OO, MP, RB, DB), final manuscript approval (MO, ND, OO, MP, RB, DB) and agreed accountability for all aspects of this work (MO, ND, OO, MP, RB, DB).

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Competing Interests: Authors have completed the Unified Competing Interest form at http://www.icmje.org/coi_disclosure.pdf (available upon request from the corresponding author) and declare that (1) our authors had no involvement with any company in the submission of this work; (2) our authors have no relationships with any companies that might may be interested in the work that has been submitted in the previous 3 years; (3) our authors spouses, partners, or children have no financial relationships relevant to the work that has been submitted; and (4) our authors have no non-financial interests relevant to the work that has been submitted.

Ethical approval: The NSHAP data analysis was carried out with de-identified, unrestricted Wave 2 Public Use File v1 designed for public dissemination. This dataset is appropriate for preliminary analyses and for the exploration of health and functioning of older American adults.

Data sharing: Wave 2 Public Use File v1 data for the National Social Life Health and Aging Project are available at http://www.icpsr.umich.edu/icpsrweb/NACDA/studies/34921.

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Figure 1. Operationalized Wilson Cleary Model with study-specific bio-psychosocial measures

Figure 1. Operationalized Wilson Cleary Model with study-specific bio-psychosocial measures

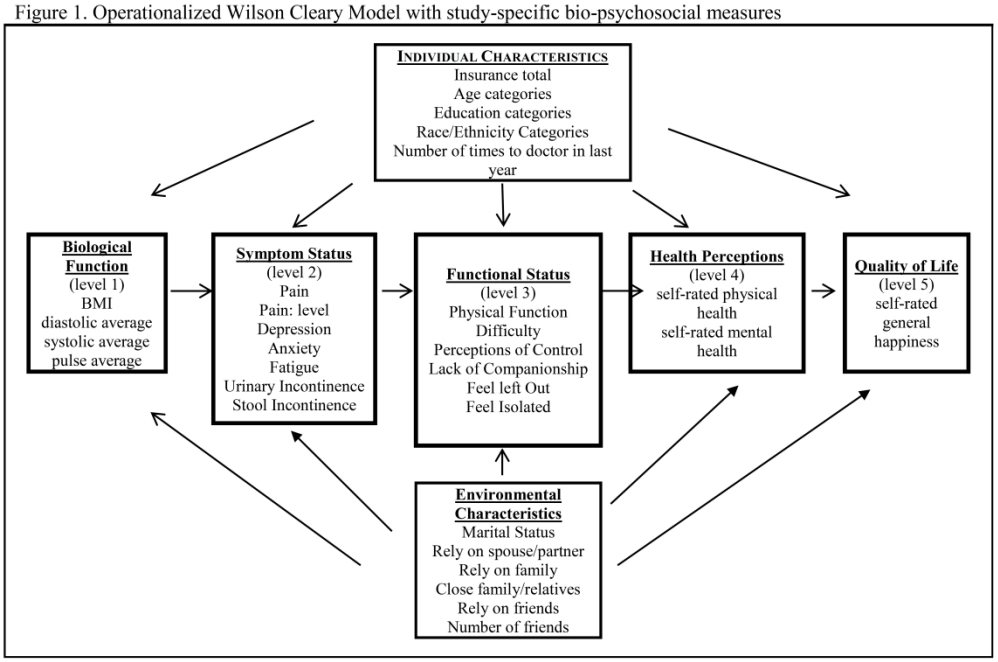

Figure 1 Operationalized Wilson Cleary Model with study-specific bio-psychosocial measures

564x372mm (300 x 300 DPI)

STROBE Statement—checklist of items that should be included in reports of observational studies

Correlates and Etiological Factors Associated with Hedonic Well-Being Among an Aging Population of US Men and Women: secondary data analysis of a national survey

Michelle Odlum, EdD, MPH[1], Nicole Davis, PhD, RN[2], Otis Owens, PhD, MPH, Michael Preston, PhD, MPH[4], Russell Brewer, DrPH, MPH[3], and Danielle Black, MS, MPH[5,1]

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract **pages 2, 9**
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found **page 2**
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported **pages 3, 4**
Objectives	3	State specific objectives, including any pre-specified hypotheses **page 2, 3**
Methods		
Study design	4	Present key elements of study design early in the paper **page 3, 4**
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection **page 3, 4**
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants **page 3, 4**
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable **page 4, 9**
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group **page 4**
Bias	9	Describe any efforts to address potential sources of bias **N/A**
Study size	10	Explain how the study size was arrived at **page 4**
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why **page 4, 5**
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding **page 5**
		(*b*) Describe any methods used to examine subgroups and interactions **page 5**
		(*c*) Explain how missing data were addressed **N/A**

(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed
Case-control study—If applicable, explain how matching of cases and controls was addressed
Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy **N/A**

(*e*) Describe any sensitivity analyses

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed **page 4**
		(b) Give reasons for non-participation at each stage **N/A**
		(c) Consider use of a flow diagram **N/A**
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders **page 4, 6**
		(b) Indicate number of participants with missing data for each variable of interest **N/A**
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		Cross-sectional study—Report numbers of outcome events or summary measures **page 6-8**
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included **page 5, 7**
		(*b*) Report category boundaries when continuous variables were categorized **N/A**
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses **page 5**
Discussion		
Key results	18	Summarise key results with reference to study objectives **page 6-8**
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias **page 9**
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence **page 8, 9**
Generalisability	21	Discuss the generalisability (external validity) of the study results **page 8, 9**
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based **page 10**

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.