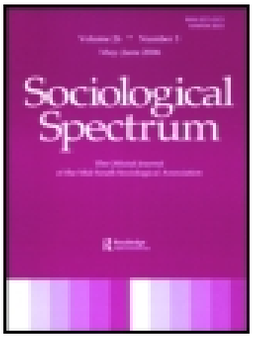

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Understanding Gender as a Fundamental Cause of Health: Simultaneous Linear Relationships between Gender, Mental Health, and Physical Health Over Time

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ABSTRACT

Responding to calls to move beyond mental or physical health examinations of gender and health, and to systemically understand the relationships between mental health, physical health, and social identity locations, we explored the extent to which gender is a fundamental cause of health by estimating the relationships between gender, mental health, and physical health simultaneously. We analyzed nationally representative longitudinal data from Waves I and III of the American Changing Lives Survey, and estimated general and gender-specific structural equation models to better understand direct and indirect effects of the structural relationships between gender, mental health, and physical health over time. Our findings suggest mental health outcomes drive the likelihood of physical health outcomes in the case of women only, whereas for men, there is no direct nor significant relationship. However, we find persistent effects of anxiety on limited daily activities for men, but not for women. In conclusion, we discuss potential lessons learned from using such analytic methods and the implications of our findings as they relate to gender and health.

An emerging line of interdisciplinary health research explores the ways social status may fundamentally cause disparate outcomes (Link and Phelan 1995) and provide greater clarity about relationships between physical health, mental health, and social identity locations (Needham and Hill 2010; Nowakowski and Sumerau 2015; Read, Porter, and Gorman 2016). Using biosocial data sets, including information on social status, important biomarkers, and mental and physical health outcomes (such as blood pressure or protein levels related to reported experiences of pain), for example, researchers have demonstrated some ways that social location and identity impact societal patterns of health inequality within and between populations (see, e.g., Nowakowski, Graves, and Sumerau 2016; Seeman and Crimmins 2001; Suzman 2009). In so doing, researchers have illuminated both disparities tied to social identity and experience, as well as the ways these facets of sociobiological experience influence disparate outcomes and may often outweigh the baseline effects of people's biology. Although these studies have importantly revealed racial, socioeconomic, and gendered health disparities related to social position and identity, examinations of the mental–physical health link (Read et al. 2016) as related to social position and identity are only beginning to receive systematic attention (Mirowsky and Ross 2003; Needham and Hill 2010; Nowakowski 2014; Nowakowski and Sumerau 2017; Read et al. 2016).

Responding to calls (Needham and Hill 2010; Read et al. 2016; Rieker, Bird, and long 2010) that emphasize the need to move beyond mental *or* physical health examinations of gender and

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health and to examine the intimate connection between mental and physical health both simultaneously and over time (Pearlin, Avison, and Fazio 2007; Read et al. 2016), we explored the mental–physical health link (Read et al. 2016) and the extent to which gender is a fundamental cause (Link and Phelan 2010, 1995). To this end, we analyzed nationally representative longitudinal data from Waves I and III of the American Changing Lives Survey (ACL), yielding a total sample of 2,559 U.S. adults over an eight-year period and estimated general and gender-specific models to better understand both direct and indirect effects of the structural relationships between gender, mental health, and physical health over time. Like other survey researchers, however, we do this using sex as a proxy for gender, as most surveys contain no direct measurement of gender and rely upon the assignment of respondents to sex and gender identifications (Westbrook and Saperstein 2015). In so doing, our work here estimates potential relationships between gender, mental health, and physical health but also continues calls for greater rigor in the collection and measurement of gender in contemporary survey design (Sumerau et al. 2017).

We use structural equation modeling to analyze ACL data because we consider it a theoretically driven methodological and analytical solution necessary in advancing current understandings of the nuanced relationships between social statuses (i.e., the social location of a person within systems of race, class, gender, sex, sexuality, and other structures), mental health, and physical health. Our approach goes beyond existing quantitative approaches (e.g., regression analyses, path models) by (1) allowing for the introduction of latent constructs that enable us to use multiple indicators rather than single-item measures for depression, anxiety, and physical health; (2) estimating multiple structural relationships in a simultaneous fashion while taking into account possible measurement errors; and (3) using nationally representative longitudinal data to take into account critical elements like generalizability, time, order, and direction. Our findings suggest that mental health outcomes drive the likelihood of physical health outcomes in the case of women only, whereas for men, there is no direct nor significant relationship between mental health and physical health. However, we find persistent effects of anxiety on limited daily activities for men but not for women. Our findings contribute to a systemic understanding of the complex and nuanced relationships between gender, mental health, and physical health.

We extend ongoing lines of research in two important ways. First, we demonstrate some ways that gendered disparities in mental health are linked to similar differences in physical health and demonstrate how gender-specific structural equation models suggest that the mental–physical health link does in fact differ by gender. Specifically, our analysis affirms Nowakowski and Sumerau's (2015) demonstration of the ways that gender facilitates negative biological physical health outcomes (i.e., C-Reactive Protein (CRP) levels; see also Marmot and Wilkinson 2005; Needham and Hill 2010; Read et al. 2016) and extend such findings by revealing some ways that mental health outcomes facilitate these physical health disparities. Second, in seeking to better understand such complex relationships, we emphasize the importance of methodological decisions and strategies, particularly the employment of longitudinal data and structural equation modeling to create a model that estimates structural relationships including both latent constructs and observed variables. Specifically, we discuss the need for examining social status (i.e., gender in the current study), mental health, and physical health, and the usefulness of examining these effects simultaneously and over time to uncover relationships between varied social, biological, and otherwise health-related factors. In doing so, we call for greater attention to interrelations between social status, mental health outcomes, *and* physical health disparities, which may provide useful guidance for both researchers and health practitioners throughout the United States.

Background

The analyses in this article draw on two distinct yet interrelated literatures concerning intersections of mental health, physical health, and gender. First, we use prior theory and research on

social conditions as fundamental causes of health to guide our endeavors. Then we draw upon and extend existing work on gender as a fundamental cause of health disparities by analyzing the way this social status plays out in relation to mental and physical outcomes. In the following sections, we outline the importance of these theoretical and empirical insights for the analyses that follow.

Social statuses as fundamental causes of health

Link and Phelan (2010, 1995) posited that social conditions and locations may fundamentally cause health disparities. Specifically, they outlined the ways that occupying differential social positions granted disparate access to resources that help produce, maintain, and guard health. Put simply, people's social locations impose health risks by exposing them to environmental, behavioral, and/or social situations wherein they are more likely to experience negative outcomes and more likely to face individual health risks that have long been the focus in interdisciplinary medical sciences. As such, social conditions place people into pathways that make better or worse health outcomes likely before any individual decision or intervention can take place. As a result, social conditions and location[1] can be seen as the elements of human experience that put people at risk of being at risk in the first place (Link and Phelan 2010).

The power of social conditions to influence health outcomes comes from the marginalization of people at lower rungs of a given social hierarchy and their experiences mentally (Cragun et al. 2016), physically (Mays, Cochran, and Barnes 2007), biologically (Nowakowski and Sumerau 2015), and socially (Miller and Grollman 2015). Public health researchers in fields including but not limited to medical science, sociology, psychology, sexualities studies, gender studies, biology, and biosocial research have consistently noted the effects of marginalization (or lack thereof) on the body, the mind, and the overall life course (see, e.g., Broman, Mavaddat, and Hsu 2000; Grollman 2012; Vogt Yuan 2007). For example, consistent marginalization related to (whether or not the respondent is conscious of such) race, gender, sexualities, and age all predict negative physical (Sanders-Phillips et al. 2009) and mental (Grollman 2014) health, including and often surpassing individual-based biological explanations. Understanding systemic patterns of mental and physical health disparity thus requires investigating the ways these outcomes reflect and/or challenge existing inequalities between given social statuses and identifications (Denton and Walters 1999).

These insights suggest that understanding links between mental health, physical health, and social status requires analyzing the complicated ways these factors may interact within and beyond individual lives and outcomes. However, as Chapman, Perry, and Strine (2005) noted, links between physical and mental health do not often receive as much attention as investigations focused on only one or the other (see also Cragun et al. 2016; Needham and Hill 2010; Read et al. 2016). As noted in the introduction, we thus use gender as a documented fundamental social cause of health inequality in this study to ascertain (1) the role it plays in both mental and physical health, and (2) the influence of gender on the mental–physical health link that suggests distinct pathways whereby mental health is linked to physical health in varied ways by gender. Before presenting our analysis, however, it is important to review patterns in gendered health disparities within current literatures.

[1]Social conditions such as contextual and systemic factors, along with both physical geographical locations and social locations, matter here. By social locations we mean that where one's intersecting identities of gender, race, class, and so on, symbolically place people in the overall structure of a society and thus resulting in differing experiences, rights and legal protections, day-to-day treatment from others, access to health-promoting resources, and life chance opportunities.

Gendered health disparities

Gender disparities in health have been well established in the past two decades (see Rieker et al. 2010 for reviews). Although almost entirely limited to the study of cisgender (those whose gender identity aligns with an expected sex category that has been socially defined as appropriate or normative; see Sumerau et al. 2017) women and men (but see Miller and Grollman 2015), the overwhelming finding throughout the literature suggests that gendered differences in physical health profiles are long beyond dispute in the United States (see, e.g., Read and Gorman 2010). Researchers have noted gender differences in overall mortality and morbidity rates (Read and Gorman 2010), and overall such studies show that except in the poorest countries, where life expectancy is low for women and men, women live longer lives than men (Rieker et al. 2010). In fact, Rieker et al. (2010) noted that in the United States, women experience lower mortality rates in every age group and for most causes of death (Rieker et al. 2010:53). Yet despite this advantage, women also live sicker lives compared to men, experiencing high rates of morbidity over the life course, mostly demonstrated through chronic conditions and lower quality of life in older age (Nowakowski et al. 2016; Rieker et al. 2010). It is important to note that when studies are not limited to cisgender notions of gender and health, data show that gender's most profound and negative impacts are faced by transgender individuals compared to cisgender individuals (Miller and Grollman 2015).

In fact, research has found persistent gendered physical health disparities tied to almost every aspect of life (Nowakowski and Sumerau 2017; Rieker et al. 2010) and has included reports showing biological differences that develop over time from the disparate performance of masculinity versus femininity in American society (Nowakowski and Sumerau 2015), gender effects on chronic health conditions versus acute health traumas (Crimmins, Kim, and Hagedorn 2002), disparities related to health care experience and access over time (Umberson 1992), and differences in reactions to and experiences with limited and altered functionality due to disease (Kiecolt-Glaser, Gouin, and Hantsoo 2010). These findings reveal the continued importance of centralizing studies of physical health, health outcomes, and gender.

Researchers have noted similar patterns in studies of mental health. Needham and Hill (2010), for example, outlined many ways that cisgender men are more likely to engage in externalizing behaviors and fall victim to externalizing conditions, such as impulse control, substance use, lack of attention to health care, and antisocial personality disorders (see also Needham et al. 2013; Read et al. 2016). As Courtenay (2000) noted, these patterns are almost a perfect map of contemporary American notions of masculinity or how one demonstrates to others that one is a "man." By the same token, such studies find that cisgender women mimic contemporary societal notions of what it means to be a "real woman" or "feminine" by engaging in more internalizing behaviors and thus experience more internalizing disorders or conditions, such as mood, anxiety, and depression issues in both chronic and acute cases (see also Bird 1999; Nowakowski et al. 2016). Read et al. (2016) advanced our knowledge of the possible effects of mental distress traditionally labeled "female-sensitive" (in their study, depression) and "male-sensitive" (in their study, heavy drinking) and found that women respondents who reported depression and men respondents who reported heavy drinking were more likely to self-report their health as poor.

By adopting societal notions of manhood predicated on aggression and womanhood based on passivity, such studies point out, women and men develop distinct mental health outcomes over time facilitated by their performance of gender in societally expected ways (Bird 1999). Although much less robust than existing literature on gendered physical health outcomes (Nowakowski and Sumerau 2017), this literature also reveals the importance of centering gender in analyses of mental health.

The current study approaches mental and physical health related to gender identification in this way. Following Nowakowski and Sumerau (2015), we seek to ascertain that gender may serve as a fundamental cause but go beyond their focus on physical health and biological markers to

ascertain relationships between physical health, mental health, and gender in the same model. As Nowakowski and Sumerau (2015) called for in their article, this represents an extension of existing literature wherein physical and mental health are examined in tandem rather than as isolated aspects of selfhood, health, and overall well-being (see Nowakowski et al. 2016 for a similar call for this type of analysis).

Specifically, we outline the ways respondents differ on both physical health (indicated by self-rated health, health satisfaction, activity daily limitations [ADL]) and mental health (depression and anxiety) by gender (determined by the assignment of gender to respondents in the survey protocol). Further, we outline the ways that mental health disparities between gendered beings occupying different social status may facilitate or otherwise predict disparate physical health outcomes. To this end, we draw on theoretical insights tied to fundamental causes of health scholarship as well as implications of such research for understanding interrelated and complex relationships between gender, mental health and physical health, and health disparities.

Data and methods

Data

The ACL is an ongoing, nationally representative and longitudinal study of middle-age to older adults in the United States. The ACL includes a host of social, psychological, and behavioral factors in health and health changes among aging adults over the adult life course (Institute for Social Research (ISR) at the University of Michigan 2012). To date, the ACL is the oldest of its kind and includes five waves of survey, telephone, and face-to-face interview data conducted by researchers at the University of Michigan and archived for public use with the Inter-University Consortium for Political and Social Research. The ACL suited the pursuits of our research in several important ways. First, the ACL provided key health information of interest for a nationally representative sample of adults living in the United States. Adult health is of specific concern, as the majority of both chronic and acute illnesses are developed by adulthood (see Nowakowski and Sumerau 2017), and the ACL's primary focus on health and health changes among adults over the adult life course enabled us to use multiple measures of mental (depression, anxiety) *and* physical health (self-rated health, health satisfaction, and ADL) in our analyses.

Second, the self-reported nature of the data allowed us to measure social identity and health on the respondents' own terms, which we found beneficial to the current investigation and has been shown as a useful method to data collection in terms of accuracy, such as in the case of sociodemographic characteristics and self-rated health. Third, a particularly important methodological feature of the ACL is its longitudinal design, which allowed us to improve our view of gender as a fundamental cause of health outcomes when observing the interplay of gender and health for the same cohort overtime. The longitudinal nature of the data also enabled us to delineate the elements of time, order, and direction, which we consider necessary given the intricacy of the relationships being explored, a feature less available in the majority of studies that employ cross-sectional analyses of gender and health (see, e.g., Cragun et al. 2016; Needham and Hill 2010; Nowakowski and Sumerau 2015 for examples and reviews). These features of the ACL provided an opportunity for more complex modeling of the relationships between gender, mental health, and physical health than presently available, which we considered necessary in advancing current understandings of these relationships.

We use data from Wave 1 (1986) and Wave 3 (1994) of the ACL. Wave 1 includes survey data on 3,617 adults ages 25+ living in the United States, and Wave 3 includes follow-up interview data with 2,559 survivor respondents from Wave 1. The decisions to use Waves 1 and 3 of the ACL survey were intentional. Most important, the initial process for selection of survey items was limited by availability of measures in each wave of the ACL, were informed by previous

TABLE 1. Sample characteristics.

Sociodemographic markers	Frequency ($N = 2559$)	Sample percentage
Sex		
Male	843	35.9%
Female	1,505	58.8%
Inapplicable or missing	211	8.2%
Race		
White	1,751	68.4%
Black	737	28.8%
American Indian	33	1.3%
Asian	20	0.8%
Hispanic	18	0.7%
Age		
24–34	565	22.1%
35–44	476	18.6%
45–54	312	12.2%
55–64	508	19.9%
65–74	509	19.9%
75+	189	7.4%
SES		
Low	660	25.8%
Lower middle	770	30.1%
Upper middle	792	30.9%
High	337	13.2%

Note. SES = socioeconomic status.

research, and were theoretically driven choices that we then tested using confirmatory factor analysis (CFA) for all indicators of each of our latent constructs. This process limited the selection variables to survey items only available in particular waves of the data but also that allowed for enough time lapsed (8-year period) between Wave 1 (Time 1) and Wave 3 (Time 2).

Over time throughout the ACL's five waves of data, the survivor respondents continued to decrease significantly, and some measures of possible interest included high frequencies of missing and/or irrelevant values in Waves 4 and 5. We did not include these waves in the current analysis, as this would make it more difficult to extract a large sample size that could confidently abide by suggested critical sample sizes for structural equation models.[2] We used previous research to select exogenous variables (specific sociodemographic information) available in Wave 1. We also used Wave 1 for Mental Health (latent constructs Depression and Anxiety with each of their indicators), as Wave 1 was the only wave in the ACL survey that included survey items for both latent constructs, Depression and Anxiety. To be consistent, we made sure that both Mental Health constructs with their indicators derived from the same wave of data (Time 1) rather than from separate waves or periods.

We used Wave 3 because it was the only wave that included all of the Physical Health measures we were interested in exploring (ADL indicators, Health Satisfaction, and Self-rated Health)[3] and to be consistent, we made sure that all Physical Health constructs with their indicators were derived from the same wave of data (Time 2) rather than from separate waves or periods. However, we first tested nonrecursive models with available mental health measures from Wave 3 and available physical health measures from Wave 1 to test the directionality of the relationship between Mental Health and Physical Health. These initial results supported previous findings (see Read et al. 2016, for an example) that report stronger associations from Mental Health to Physical Health rather than the reverse. This led us to solidify the decisions regarding these particular measures from Wave 1 and Wave 3, as previously stated.

[2]Critical total sample size varies by each model with the data and measures used; for our models the sample size was around 500, suggested for each measure included in the models estimated here.

[3]See Johnson and Wolinsky (1993), who demonstrate a particular ordering of these that we, too, find important as elaborated in the Discussion section of this article.

TABLE 2. Correlation matrix, means, and standard deviations.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1) Male	1.000															
(2) White	0.063	1.000														
(3) Marr	0.123	0.179	1.000													
(4) Bachd	0.116	0.107	0.029	1.000												
(5) Emply	0.249	−.049	0.009	0.146	1.000											
(6) Deprs	−.107	−.103	−.112	−.059	−.004	1.000										
(7) Sadnd	−.155	−.062	−.109	−.030	−.009	0.572	1.000									
(8) Lonly	−.101	−.107	−.259	−.032	−.040	0.445	0.469	1.000								
(9) Nervs	−.123	−.002	−.024	−.084	−.099	0.217	0.228	0.152	1.000							
(10) Worry	−.160	0.103	0.002	0.002	−.019	0.236	0.237	0.159	0.367	1.000						
(11) Highs	−.075	−.080	−.077	−.091	−0.19	0.260	0.234	0.196	0.417	0.271	1.000					
(12) Diffstairs	−.129	−.037	−.062	−.102	−.137	0.051	0.069	0.080	0.084	0.069	0.088	1.000				
(13) Diffwalk	−.073	−.025	−.065	−.096	−.181	0.039	0.023	0.038	0.047	0.048	0.085	0.397	1.000			
(14) Diffheavy	−.154	0.010	−.073	−.084	−.233	0.009	0.032	0.044	0.064	0.032	0.047	0.333	0.329	1.000		
(15) Sathlth	0.024	0.035	0.048	0.056	0.055	−.133	−.124	−.092	−.109	−.134	−.111	−.212	−.194	−.284	1.000	
(16) Selfrated	0.052	0.104	0.077	0.149	0.122	−.141	−.147	−.136	−.130	−.111	−.136	−.273	−.228	−.336	0.062	1.000
M	0.38	0.65	0.55	0.13	0.48	0.41	0.38	0.36	0.33	0.53	0.34	0.17	0.16	0.22	3.55	3.37
SD	0.487	0.452	0.484	0.386	0.485	0.485	0.473	0.467	0.460	0.499	0.462	0.314	0.282	0.410	0.949	0.948

Out of the final sample of 2,559 respondents, 58.8% were assigned female in the survey (35.9% were assigned male, 8.2% were inapplicable or missing for data on sex), 68.4% were white (28.8% were black, 1.3% were American Indian, 0.8% were Asian, 0.7% were Hispanic), 40.7% were 24 to 44 years of age (32.1% were 45 to 64 years of age; 27.3% were 65 years of age or older), and 25.8% reported low socioeconomic status (30.1% lower-middle, 30.9% upper-middle, 13.2% high) as presented in Table 1. It is important to note that the ACL purposefully oversampled black/African American respondents, and those 60 years of age and older.

Statistical procedures

We use structural equation modeling (Jöreskog and van Thillo 1972; Jöreskog 1977), a powerful multivariate data analysis method that goes beyond other analytic methods (e.g., regression analysis or classical path analysis) by allowing for the estimation of direct and indirect structural effects with the inclusion of both observed and latent variables. Latent variables or constructs (e.g., "health") are not directly observable themselves but are indicated by some imperfect observable measures (Mueller 1996), which allows for the current study to contribute to the existing literature by expanding the conceptualization and measurements of health included in our analyses. Structural equation modeling conceptually and statistically integrates path analysis with CFA and, unlike other analytic methods, allows for and includes measurement error in its calculations (Mueller 1996). The structural equation model includes several structural matrices along with variance/covariance matrices, including those of error terms, and generally consists of three main parts: (1) the structural coefficients relating endogenous latent variables to one another and to the exogenous latent variables, and the error terms associated with the endogenous latent variables; (2) the measurement model relating the exogenous observed variables to the exogenous latent constructs; and (3) the measurement model relating the endogenous observed variables to the endogenous latent constructs (outlined by Mueller 1996).

Before estimating our structural equation model, simple, descriptive, and inferential statistics were computed with the use of SPSS, which were then used to create syntax that would be compatible with LISREL. This syntax was then imputed into LISREL (Jöreskog and Sorbom 1993, 2001; Long 1983), a well-known data analysis program used for structural equation modeling. Specifically, the covariance, correlation, and standard deviation matrices were used to estimate the explained variance of the theoretical model, the measurement model, and the structural model. The correlations, means, and standard deviations are reported in Table 2.

TABLE 3. Factor loadings for the theoretically derived measurement model.

Construct *variable*	
Depression	
Depressed	0.741
Sad	0.772
Lonely	0.603
Anxiety	
Nervous	0.675
Worrier	0.521
High-strung	0.601
Activity daily limitations	
Stairs	0.609
Walking	0.578
Heavy housework	0.591
Satisfaction with health	
Satisfaction with health	1.000
Self-rated health	
Self-rated health	1.000

Measures

The survey included single measures for gender in addition to other theory-driven social identities included such as race, marital status, education, and employment status. Although the measures, like most surveys, contain no specific assessment of gender (Westbrook and Saperstein 2015), we follow other survey researchers throughout recent decades by using the assigned sex/gender provided in the survey as a proxy for gender. Aligned with routine practices of structural equation modeling, these social identities were treated as dichotomous exogenous variables was coded as a dichotomous variable, "Male," where respondents who self-identified as male in Wave 1 were given a value of 1 and respondents who self-identified as female in Wave 1 were given a value of 0.

Race was also recoded into a dichotomous variable, "White," where respondents self-identified their race as White in Wave 1 were given values of 1 and all other self-identified race labels were given values of 0. *Marital status* was recoded into a dichotomous variable, where those who reported being "Married" in Wave 1 were given values of 1 and all other self-identified marital statuses were recoded as 0. *Education attainment* was also recoded into a dichotomous variable, where those respondents who reported having received a bachelor's degree at Wave 1 were given values of 1 and those who reported any other educational attainment were given a value of 0. *Employment status* was recoded into a dichotomous variable, where respondents who reported being employed at Wave 1 were given values of 1 and those who reported having any other employment status were given values of 0.

The measurement model shows the factor loadings of the measurement variables onto the theory-driven latent constructs, which were confirmed through CFAs. Depression, Anxiety, and ADL were measured using multiple indicators, whereas Satisfaction with Health and Self-Rated Health were measured using single indicators. The factor loadings for the measurement variables onto the latent construct are reported in Table 3.

Depression is measured using items from Wave 1 and conceptualized as the individual's self-reported experiences with depression-related emotions over the past week. This construct includes three survey items used as measurement variables: (1) how often one has felt depressed during the past week, (2) how often one has felt sad during the past week, and (3) how often one has felt lonely during the past week. Possible responses were "hardly ever," "some of the time," or "most of the time." These three survey items were chosen as indicators for the latent construct Depression based on their extraction values in the CFA. Originally, we conducted an exploratory factor analyses (EFA) for 10 potential indicators of depression that were available in Wave I of the ACL survey, and the three indicators selected for our Depression construct were rendered

those with the closest and most significant values from the EFA, and therefore included in the CFA and associated values presented in Table 3. Each item was recoded into a dichotomous variable, where the responses "hardly ever" and missing values were coded as "not feeling depressed" and responses "some of the time" and "most of the time" were coded as "feeling depressed."

Anxiety is measured using items from Wave 1 and conceptualized as the individual's self-perception as described by characteristics associated with anxiety. This construct includes three survey items used as measurement variables: (1) considering oneself a nervous person, (2) considering oneself a worrier, and (3) considering oneself high-strung. Possible responses were "No," "Some of the time," or "Yes." These three survey items were chosen as indicators for the latent construct Anxiety based on their extraction values in the CFA. Originally, we used an EFA to test five potential indicators of anxiety that were available in Wave I of the ACL survey, and the three indicators selected for our Anxiety construct were rendered those with the closest and most significant values from the EFA, as shown in the CFA and associated values presented in Table 3. Each item was recoded into a dichotomous variable, where responses "No" and missing values were coded as "disagree with label" and responses "Some of the time" and "Yes" were coded as "agree with label."

ADLs was included to gauge respondents' day-to-day physical functionality and mobility. ADL is measured using items from Wave 3 and conceptualized as individuals' current self-assessment of difficulty with daily activities because of their health. This construct includes three survey items used as measurement variables: (1) Difficulty climbing a few flights of stairs because of one's health; (2) Difficulty walking several blocks because of one's health; and (3) Difficulty doing heavy work around the house such as shoveling snow or washing walls because of one's health. Possible responses were "Yes," "Because of my age only," and "No." These three survey items were chosen as indicators for the latent construct ADL based on their extraction values in the EFA. Originally, the EFA tested four potential indicators of ADL that were available in Wave 3, and the three indicators selected for our ADL construct were rendered those with the closest and most significant values from the EFA, as shown in the CFA and associated values presented in Table 3. Each item was recoded into a dichotomous variable, where responses "No" were coded as "No difficulty," missing values were coded as "missing," and responses "Because of my age only" and "Yes" were coded as "Experiences difficulty." Those who responded "Because of my age only" were included in the "Experiences difficulty" category because they still reported experiencing difficulty with the daily activity, despite attributing the difficulty with their age rather than (or also associated with) their health.

Satisfaction with Health is measured using a self-reported health satisfaction survey item from Wave 3 and conceptualized as the individual's self-reported satisfaction with one's health: The degree to which one is satisfied with their health, in general. Possible responses were *unsatisfied*, *not very satisfied*, *somewhat satisfied*, *satisfied*, and *very satisfied*. This item was kept as a Likert scale ranging from 1 to 5, with original responses representing their own category of satisfaction, where a value of 1 is *unsatisfied* and a value of 5 is *very satisfied*. Missing values were excluded from the analysis.

Self-rated Health is measured using a self-rated health survey item from Wave 3 and conceptualized as the individual's self-assessment of one's current health: How one would rate their health at the present time. Possible responses were *very poor*, *poor*, *fair*, *good*, and *excellent*. The item was kept as a Likert scale ranging from 1 to 5, with original responses representing their own category of self-rated health, where a value of 1 is *very poor* and a value of 5 is *excellent*.

Results

Structural relations models

After estimating the measurement model, the structural model was estimated. Based on theories in gender and health, the observed relationships between the latent constructs in the structural

TABLE 4. Completely standardized beta, gamma, and psi coefficients with t values.

Constructs	(1)	(2)	(3)	(4)	(5)	Male	White	Married	Bachd	Employ
(1) Depression	—	—	—	—	—	$\Upsilon = -0.15^{***}$ (-5.76)	$\Upsilon = -0.077^{**}$ (-3.04)	$\Upsilon = -0.165^{***}$ (−6.46)	$\Upsilon = -0.029$ (−1.16)	$\Upsilon = 0.020$ (0.77)
(2) Anxiety	$\varphi = 0.457^{***}$ (12.68)	—	—	—	—	$\Upsilon = -0.173^{***}$ (−5.97)	$\Upsilon = 0.027$ (0.96)	$\Upsilon = -0.036$ (−1.28)	$\Upsilon = -0.08^{**}$ (−2.90)	$\Upsilon = -0.031$ (−1.07)
(3) LDA	$\beta = -0.013$ (−0.319)	$\beta = -0.125^{**}$ (2.837)	—	—	—	$\Upsilon = -0.09^{**}$ (−3.24)	$\Upsilon = -0.010$ (−0.35)	$\Upsilon = -0.090^{**}$ (−3.18)	$\Upsilon = -0.09^{***}$ (−3.30)	$\Upsilon = -0.266^{***}$ (−8.93)
(4) Satisfaction	$\beta = -0.098^{**}$ (−3.029)	$\beta = -0.093^{**}$ (−2.671)	$\beta = -0.405^{***}$ (−11.66)	—	—	$\Upsilon = -0.08^{***}$ (−3.35)	$\Upsilon = 0.018$ (0.812)	$\Upsilon = -0.015$ (0.001)	$\Upsilon = -0.007$ (−0.30)	$\Upsilon = -0.061^{*}$ (−2.55)
(5) Self-rated	$\beta = -0.071^{**}$ (−2.719)	$\beta = -0.037$ (1.332)	$\beta = -0.272^{***}$ (−9.115)	$\beta = 0.471^{***}$ (23.02)	—	$\Upsilon = -0.05^{**}$ (−2.66)	$\Upsilon = 0.068^{***}$ (3.84)	$\Upsilon = -0.001$ (−0.03)	$\Upsilon = 0.069^{***}$ (3.86)	$\Upsilon = 0.012$ (0.62)

Note. Values in parentheses are *t* values. Bachd = bachelor's degree; LDA = limited daily activity.
$^{*}p < .05$.
$^{**}p < .01$.
$^{***}p < .001$.

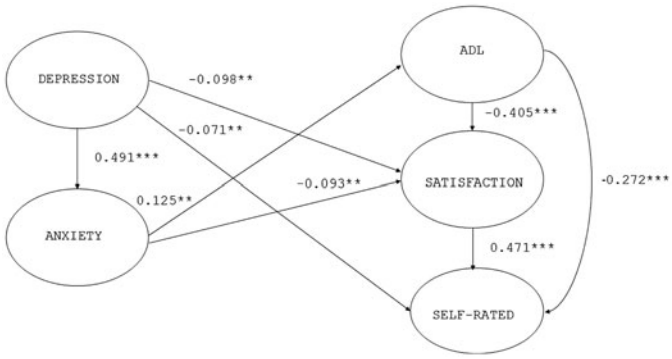

Figure 1. Completely standardized parameters for structural model. *Note.* ADL = activity daily limitations; root mean square error of approximation = 0.045, non-normed fit index = 0.955. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

model were, overall, expected. The completely standardized betas, gammas, and psi coefficients along with their t values and level of significance can be found in Table 4.

In the overall structural model, our results indicate direct and significant effects ($^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$) between mental health constructs, between mental health onto physical health, and between physical health outcomes. The relationship between depression and anxiety is significant only in one direction, where Depression has a direct and positive effect on Anxiety ($\varphi = 0.457^{***}$; $t = 12.68$). It is important to note that a nonrecursive relationship between Anxiety and Depression was estimated to test the directionality of the relationship between Anxiety and Depression, and this showed that despite the highly significant effect of Depression on Anxiety, Anxiety did not have a direct significant effect on Depression. This suggests a specific direction regarding the link between Depression and Anxiety in the current study.

The results indicate that mental health has some direct and significant effects on physical health. Depression has a direct and negative effect on Health Satisfaction ($\beta = -0.098^{**}$, $t = -3.029$) and on Self-Rated health ($\beta = -0.071^{**}$, $t = -2.719$). Further, Anxiety has a direct and positive effect on ADL $\beta = -0.125^{**}$, $t = 2.837$) and a direct and negative effect on Satisfaction ($\beta = -0.093^{**}$, $t = -2.671$). However, the effect of Depression on ADL was not a statistically significant effect, nor was the effect of Anxiety on Self-Rated Health. Our results also indicate direct and significant effects between several physical health outcomes. ADL has a direct and negative effect on health Satisfaction ($\beta = -0.405^{***}$, $t = -11.66$) and on Self-rated health ($\beta = -0.272^{***}$, $t = -9.115$). Further, Health Satisfaction has a direct and positive effect on Self-Rated health ($\beta = 0.471^{***}$, $t = 23.02$).

The results also indicate observed significant effects of the exogenous variables (sex [as a proxy for gender], race, marital status, education, and employment status) onto both mental health and physical health outcomes. These coefficients and t values are also found in Table 4. In summary, sex had a direct and significant effect on all of the mental health and physical health outcomes, whereas male sex had a direct and negative effect on Depression***, Anxiety***, Limited Daily Activity (LDA)**, Satisfaction***, and Self-rated Health**. Further, race had direct and significant effects onto two outcomes, where White race had a direct and negative effect on Depression** and a direct and positive effect on Self-rated Health***. In addition, marital status had a direct and significant effect on two outcomes, where Married status had a direct and negative effect on Depression*** and on LDA**. Education also had direct and significant effects on several outcomes, where Bachelor's Degree had a direct and negative effect on Anxiety** and on LDA*** and a direct and positive effect on Self-Rated Health***. Last, employment status had a direct and significant relationship with two outcomes, where Employed status had a direct and

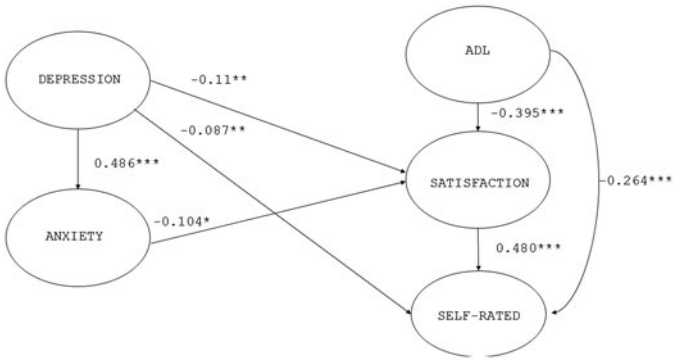

FIGURE 2. Women only: Completely standardized parameters for structural model. *Note.* ADL = activity daily limitations; root mean square error of approximation =0.043, non-normed fit index =0.952. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

negative effect on LDA*** and on Satisfaction*. There were numerous observed direct effects among many of the exogenous variables, such as the positive effect of White on Bachelor's Degree.

The model was proven to be a good fit based on several fit statistics. The root mean square error of approximation (RMSEA) is 0.045, which is below the 0.05 cutoff value. The normed fit index (NFI) is 0.95, which is above the 0.90 suggested NFI score. The minimum fit function chi-square value is 331.38 ($p = 0.0$) with 66 *df*. The Critical *N* (CN) is 586.51, which is above the suggested sample size of 200. The structural model, completely standardized coefficients, and the level of statistical significance are reported for the relationships between the latent constructs in Figure 1.

Structural Model: Women Only

Based on the highly statistical significant direct and negative effects of male on each mental and physical health outcome (Depression, Anxiety, LDA, Satisfaction, and Self-rated Health) in addition to theories on gender and health, separate structural models were estimated for men and women. The variable Male was removed from the original model and a gender-specific model for women using female respondents as a proxy for womanhood or the identity woman only was estimated ($n = 1{,}246$). The structural model, completely standardized coefficients, and the level of statistical significance for the relationships between the latent constructs in the model limited to women are reported in Figure 2.

In the gender-specific structural model for women, results indicate direct and significant effects between mental health outcomes, between mental and physical health outcomes, and between physical health outcomes. In summary, Depression had a direct and positive effect on Anxiety***. Further, Depression had a direct and negative effect on Satisfaction** and on Self-rated Health**, and Anxiety had a direct and negative effect on Satisfaction*. Effects between physical health outcomes were also significant, where ADL had a direct and negative effect on Satisfaction*** and on Self-rated Health***, and Satisfaction had a direct and positive relationship on Self-rated Health***. The effect of Depression on ADL was not statistically significant, nor were the effects of Anxiety on ADL or on Self-rated Health.

The gender-specific model for women was proven to be a good fit based on several fit statistics. The RMSEA is 0.043, which is below the 0.05 cutoff value. The NFI is 0.952, which is above the 0.90 suggested NFI score. The minimum fit function chi-square value is 198.95 ($p = .00$) with 60 *df*. The CN is 554.08 which is above the suggested sample size of 200.

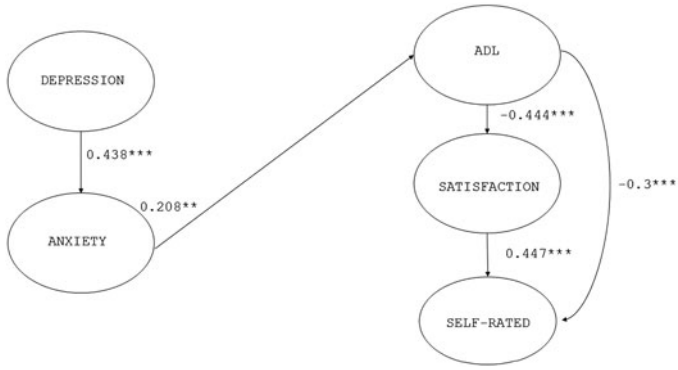

Figure 3. Men only: Completely standardized parameters for structural model. *Note.* ADL = activity daily limitations; root mean square error of approximation = 0.054, non-normed fit index = 0.951. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Structural Model: Men Only

After estimating the structural model for women, a structural model limited to men was estimated. The same proxy method was used for the men-only model as the women-only model, wherein respondents assigned male were used as markers for men. The sample size for the gender-specific model for men was 784. The drop-out rate for men between Wave 1 and Wave 3 is attributed mostly to more men dying over the eight-year period compared to women respondents over the same period. This change is expected given the research on gender differences in aging and mortality (see Rieker et al. 2010; Read and Gorman 2010). The structural model, completely standardized coefficients, and the level of statistical significance for the relationships between the latent constructs in the model limited to men are reported in Figure 3.

In the gender-specific structural model for men, results indicate some direct and significant effects between mental health outcomes, between mental and physical health outcomes, and between physical health outcomes. In summary, Depression had a direct and positive effect on Anxiety***. Anxiety had a direct and positive effect on ADL**. ADL had a direct and negative effect on Health Satisfaction*** and on Self-rated Health***. Satisfaction had a direct and positive effect on Self-rated Health***. The effects of Depression on ADL, Satisfaction, and Self-rated Health were not statistically significant, nor were the effects of Anxiety on Satisfaction or on Self-rated Health.

The model was proven to be a good to mediocre fit based on several fit statistics. The RMSEA is 0.054, which is slightly above the 0.05 cutoff value. The NFI is 0.951, which is above the 0.90 suggested NFI score. The minimum fit function chi-square value is 198.04 ($p = .00$) with 60 *df*. The CN is 350.43, which is above the suggested sample size of 200.

Discussion

In this study, we sought to explore questions proposed by previous studies at the intersections of mental health, physical health, and gender. Whereas much research explores gendered dimensions of health, researchers typically focus on either gendered influences on mental health or gendered influences on physical health (Needham and Hill 2010). Although each of these pathways represent important contributions to our knowledge of health outcomes, it is equally necessary to ascertain relationships between both mental and physical health and gender at the same time (Cragun et al. 2016; Cragun and Sumerau 2017a; Needham and Hill 2010; Read et al. 2016). Our analysis thus offers an example of this type of exploration by charting some ways mental health outcomes facilitate physical health outcomes and the ways these relationships differ between people of different gender identifications.

To this end, we examined how mental health impacted later physical health in models comparing respondents assigned or identified as women and men, with women only, and with men only. In so doing, we found differing relationships between mental and physical health outcomes between women and men. For women, mental health concerns indicated in Wave 1 are directly and significantly related to physical health over time as indicated by satisfaction with one's health and self-rated health in Wave 3. The direct and significant relationships between mental health and physical health were unique to women as such relationships were not shown to be direct or significant for men. This finding suggests that women's experiences with mental health conditions may be a useful indicator of women's physical health outcomes later in life. Further, our findings raise the possibility of different pathways in relationships between men's mental health experiences and physical health outcomes over time. Finally, these findings suggest that not only do women and men experience mental and physical health differently but also differences were observed over time as a result of divergent physical and mental health experiences between men and women at earlier points in the life course. As such, these findings reveal the importance of systematically studying relationships between gender and both mental and physical health as these elements play out simultaneously in the lives of women and men.

Alongside relationships between mental and physical health outcomes over time, we also explored links between gender and mental health. As other studies in the field have suggested (Needham and Hill 2010), men were significantly less likely to suffer from anxiety and depression. Considering that women's mental health experiences related to later physical health outcomes in our models, this lends weight to Nowakowski and Sumerau's (2015) observations of the role that "doing gender" plays in women's physical health outcomes over the life course (see also Nowakowski 2016). Put simply, our finding aligns with previous research suggesting that women suffer from more internalizing mental health issues and men are more like to suffer from externalizing disorders as a result of the different ways people are taught and held accountable for doing womanhood or manhood in contemporary society (see also Calasanti and Slevin 2001; Cragun and Sumerau 2017b; Needham et al. 2013). As such, women may experience more physical issues later due to experiencing more internalizing mental health issues earlier in life as a result of their performances of social expectations of femininity more highly correlated with expected encounters of anxiety, depression, and other forms of marginalization (see also Nowakowski et al. 2016). These findings suggest that it may be useful to ascertain links between variations in doing gender, development of internalizing and externalizing mental health concerns within and between differently gendered populations in earlier life stages, and accumulation of physical health outcomes in later life and that such analyses may dramatically expand our understandings of gender disparities in health overall.

Finally, we sought to understand links between daily activities and anxiety in the cases of the whole population, women, and men. In so doing, we found direct and significantly positive relationships in the overall model and in the gender specific model for men but not for women. Because women are more likely to suffer from anxiety in the first place (Needham and Hill 2010), this may suggest that women are less likely to see such experiences as a limited daily function (i.e., the experiences become normal over time as part of women's performance of gender and life; Nowakowski and Sumerau 2015). In fact, women may, as part of the expectations for doing womanhood, see difficulties functioning in daily tasks as necessary over time and thus not see these experiences as limiting in any absolute or specific sense. By the same token, the relationship between anxiety and daily functional limitation is the only relationship that links men's mental health to their physical health. This may suggest that men facing anxiety need more caregiving and experience greater perceived loss due to loss of daily function or difficulty with daily functioning (see also Cragun and Sumerau 2017b). This may also suggest that men facing anxiety do not possess the social support or coping mechanisms women do when facing these issues (see also Courtenay 2000). In either case, these findings suggest that there may be intriguing insights

to be found in analyses of the ways women and men experience, manage, and respond to anxiety in different ways over time.

Before proceeding to our conclusions, there are several limitations in the current study that may guide future research in intersections between gender and both mental and physical health. Although a major contribution of the current study is that our approach allowed for several indicators of latent constructs such in the case of depression and anxiety, one limitation concerns measurement of these available in the data set. The measures captured experiences with depression-related emotions over one week, but some people may have not been depressed or only experiencing depression-like emotions for a short time as a result. Future research should explore potential variation between perceived, short-term, and long-term depression, as well as chronic depression versus depression facilitated by external events. Similarly, the anxiety measures captured self-perception, but future studies could explore this measure in comparison to measures of anxiety over time, in relation to diagnosis, and in relation to other conditions or external stimuli. Especially considering previous research on men's mental health behaviors and conditions, future studies and data sets should also incorporate externalizing mental disorders in hopes of outlining potential pathways between these conditions and physical health outcomes over time (see Read et al. 2016). In fact, different measures could be used to compare the daily living activity findings here and those we might find with other activity lists, scales, and operationalizations in other data sets. Each of these measurement limitations could facilitate future studies capable of even more systematically teasing out relationships between gender and health in terms of mental and physical health outcomes and experiences.

It is also important to note that although self-reported measures are reliable measures of health status, illness and disease rates could be used to complement or as substitutes for comparison of the relationships outlined in this article. In fact, the self-reported nature of the data set presents a potential overall limitation, but future studies—especially with rising numbers of biosocial data sets across the sciences—could synthesize and compare both subjective and objective measures of health for even greater specificity. As Johnson and Wolinsky (1993) demonstrated, LDA, Satisfaction with Health, and Self-rated Health as indicators of a larger metalevel construct of Physical Health is troubling, as the structural relationships between these are rendered their own sequential ordering. For example, Johnson and Wolinsky (1993) suggested that the order of these, as they often occur in social life and human experience, should be conceptually modeled and should include Disease first, followed by Disability, Functional Limitation, and then Perceived Health. They explain that the sequential ordering of these are critical, for example, in the case of Functional Limitation and Perceived Health, where respondents may draw from their own perceptions of how limited they are in daily activities when rating their current health status. We agree that Johnson and Wolinsky's ascertains are critical to uphold in explorations of such structural relationships of Physical Health. However, to follow their suggestions fully, additional measures would have to be included in the current model, such as multiple indicators of Disease on an extensive list of conditions, which in our case could potential complicate the current models and likely shift focus away from the main questions sought out in the current study. However, our findings regarding the relationships between LDA, Satisfaction with Health, and Self-Rated Health suggest potential support for an ordering of these as presented by Johnson and Wolinsky. Therefore, we suggest that such endeavors are further taken into consideration in future studies to provide an even more comprehensive picture of these nuanced relationships and in relation to Mental Health.

Further, it should be noted that exogenous variables were recoded as dichotomous variables to assist in the interpretation of the results. However, it should not be assumed that recoded categories given suggest respondents are homogenous based on the recoding of these variables. Further, we note that these variables come from Wave 1 of the data and are not included again in Wave 3. It is possible that these categories change over the eight-year period between Wave 1 and

Wave 3. For example, a respondent could change their sex or their marital status, and therefore would have to be recoded into a different category than originally assigned from Wave 1 responses.

Although common in contemporary survey research (Westbrook and Saperstein 2015), another limitation concerns the interpretation of sex and gender in survey protocols. In this article, for example, sex and gender are used interchangeably in the analyses because data on gender identity were not available. We thus follow prior survey research in treating sex as a proxy for gender identification (Westbrook and Saperstein 2015). However, as others note (Sumerau et al. 2017), sex and gender are different concepts that require future research to take into consideration the distinction between the two and if there are other differences across gender identities. Further, this limited the current study by not allowing for any exploration of cisgender versus noncisgender comparisons regarding the relationships between gender and health. Finally, the data analyzed in the current research are specific to middle-age to older adults in the United States. The relationships observed between gender, mental health, and physical health can be generalized only to this specific population. Through a life course perspective, it is known that gender and health constantly change and hold different meanings throughout the life course. In addition, certain mental and physical health outcomes are more likely to be experienced in one stage of life compared to another. These differences should be understood and proceeded with caution in observing the relationship between gender and health.

Aligning with previous research on how men and women suffer from different types of mental health disorders, it is possible that the direct effects of mental health on physical health outcomes for women are due to women being more likely to internalize stress, whereas men are more likely to experience personality disorders and cope with these disorders and stress through the engagement in risky behaviors such as alcohol and drug abuse (Calasanti and Slevin 2001; Read et al. 2016). Future research could follow a similar methodological and analytical approach presented here and create a latent construct of mental health that includes a wider array of gender-specific and less specific mental health conditions.

For example, along with depression and anxiety, future research could include other mental health disorders that men are more likely to experience (e.g., personality disorders) and risky behaviors (alcohol and drug abuse). Further, researchers could examine additional protective factors or measures that assess one's access to quality health care and health-promoting resources (see Read et al. 2016) while using a similar methodological and analytical approaches (allowing for multiple indicators of latent variables for mental health and physical health). It is possible that engaging in risky behaviors as a way of externalizing stress or coping with mental disorders could, in fact, explain how the relationship between mental health and physical health are different processes for men and women; however, those analyses reach beyond the scope of the current analysis. The overall model and especially the gender-specified models presented here contribute significantly to research in gender and health, specifically on the relationships between gender and mental health, gender and physical health, mental health and physical health outcomes, gender and the mental–physical health link, and the notable effects of fundamental causes of health in adulthood.

Conclusion

The two most important contributions the current study offers are (1) the suggested differences between men and women regarding their mental health and how these differences manifest through physical health outcomes overtime, and (2) a theoretically driven methodological and analytical solution that is well suited to advance the current literature on the nuanced relationships between social statuses, mental health, and physical health.

Seeking to answer calls to move beyond mental or physical health examinations of gender and health, we examined relationships between gender, mental health, and physical health simultaneously. We also specified longitudinal models to ascertain the influence of gender, mental health, and physical health over time while exploring differences between women and men on mental and physical health outcomes over time. In so doing, our findings call attention to the ways that mental health outcomes may facilitate physical health outcomes while highlighting the ways these patterns may play out in similar and different ways for people occupying different gendered social locations.

It may be the case, as noted in our analysis, that mental health outcomes drive likelihood of physical health outcomes in the case of women only, but it also may be that the pathways of how this relationship plays out simply differ between women and men. At the same time, it may be that earlier experiences of physical health events may also facilitate later experiences of specific mental health outcomes within and between various gendered populations. In any of these cases, our analysis reveals that there may be much to learn by moving beyond studies of only mental or physical health in relation to gender, and further expanding studies of both mental and physical health influences into research concerning racial, class, sexual, and other health disparities in society.

These observations call us to theorize and systematically explore the many pathways relationships between physical and mental health can take in the lives of people occupying and experiencing biological and social life in different social locations (see also Grollman 2012). Rather than an exhaustive catalog, our findings here thus open the door to potential elaboration of the complexities of relationships between social location, mental health status and outcomes, and physical health status and outcomes over the life course. Walking through such a door may ultimately grant us with more comprehensive understandings of the way overall health shapes and is shaped by the lives that we live over time.

Author notes

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J. E. Sumerau, PhD, is the Director of Applied Sociology and Assistant Professor of Sociology at the University of Tampa. Her research focuses on intersections of sexualities, gender, health, and religion using mixed-methodological frameworks and has been published in numerous academic journal articles. She is the author of six books, and the co-creator of the academic blog Write Where It Hurts. For more information, visit www.jsumerau.com.

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