Mediators of Functional Disability at Mid- and Late-Life

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Abstract

As the number and proportion of older adults living in the U.S. increases, growing evidence shows that people are entering late life with more functional disability than in previous generations. Using data from the 2020 Behavioral Risk Factor Surveillance System survey, we sought to identify the contributions of demographic variables and health conditions to functional disability. Specifically, we tested the associations among age, sex, race, chronic physical health conditions, depression, and functional ability among 243,693 adults, ages 45 years and older. Model testing, implemented in AMOS 29.0.0, resulted in an acceptable fit of the model to the data, X^2 ($DF = 18$, $N = 243,693$) = 19,512.64, $p < .001$; CFI = 0.909; TLI = 0.774; RMSEA = 0.066; R^2 Function = .267. The findings from the present study replicate previous research that age, sex, and racial background differences influence functional disability. We extend the literature to examine physical and emotional health as potential pathways to intervene in midlife.

Disability is the experienced difficulty completing activities in any domain of one's life due to health or physical conditions (Verbrugge & Jette, 1994). Disabilities are often evident in the completion of basic activities of daily living (ADLs) and instrumental activities of daily living (IADLs). ADLs include hygiene and personal care tasks such as eating, bathing, dressing, and grooming. IADLs include higher-order tasks such as using a telephone, shopping, managing medications, doing household chores, and meal preparation (Verbrugge & Jette, 1994). Because disabilities may limit one's independence, identifying precursors and correlates of disability at midlife may help to reduce disability in late life. The scientific study of functional disability has a long history. Across decades of work, a set of demographic predictors of disability has been identified. In addition, the important contributions of both physical and emotional well-being to functional disability have also been examined. A limitation to the extant literature, however, is that rarely have these two categories of predictors been examined in a single model with a sufficiently large number of middle-aged and older adults. To fill that gap, we examined the influences of age, sex, race, physical health conditions, emotional well-being, and functional ability using a large, national data set.

Demographic Correlates of Functional Disability

Among the most studied demographic correlates of functional disability are age, sex, and race. The strongest correlate of functional disability may be chronological age (Patrick et al., 2022). For example, adults ages 70 years old and older were 2.6 times more likely to experience functional disabilities, relative to peers in their 60s (Vaish et al., 2020). Although disability may be more prevalent in late life, there has been a shift to examine disability status in midlife. Using the National Health Interview Survey (NHIS) data, Zajacova and Montez (2018) reported an increase in functional limitations from the year 2002 to 2016. Whereas approximately 37% of the adults reported functional limitations in 2002, 45% of the middle-aged adults reported functional limitations in 2016 (Zajacova & Montez, 2018). Other research suggests that the proportion of midlife adults experiencing functional disability is increasing,

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while rates among older adults are stabilizing (Karvonen-Gutierrez & Strotmeyer, 2020).

Female sex has also been linked to increased functional disability across the globe, with similarities in the direction and magnitude of experiencing poorer functioning among females (Patrick et al., 2022; Wheaton & Crimmins, 2015). Age interacts with sex, such that 19% of women ages 40 to 55 years old reported functional limitations in the SWAN study, and as many as 50% of women ages 56 to 66 years old had functional limitations (Karvonen-Gutierrez & Strotmeyer, 2020).

Members of marginalized racial and ethnic groups experience functional disability at greater rates compared to non-Hispanic, white Americans. For example, Black, non-Hispanic, and Hispanic Americans experience substantially greater functional limitations within ADLs than white, non-Hispanic adults (Dunlop et al., 2007). The cumulative inequality theory has shown great promise in explaining the persistence of racial and ethnic health disparities (Ferraro et al., 2017). The cumulative inequality theory (Ferraro & Shippee, 2009) suggests the social systems in place create inequality, which develops across a person's life course. Those who are disadvantaged are more likely to be exposed to risk and their life course trajectories will be shaped by the accumulation of risks, resources, and human agency (Ferraro & Shippee, 2009). For example, National Health Interview Survey data from 1999 to 2018 found that across the 20-years, the uninsured rate decreased across all racial groups (Mahajan et al., 2021). However, a gap continued to persist in the prevalence of uninsured Black, Hispanic, and white uninsured, with Hispanics reporting the highest uninsured rates compared to other groups. There was no change in the health status of racial minority group members across the 20-year span, with low-income, Black participants reporting the highest prevalence of poor or fair health status. Additionally, across the 20 years functional limitation prevalence also increased for Black, Hispanic, and white participants (Mahajan et al., 2021). Research continues to support the notion that minority groups are at a higher risk for disability.

Demographic Correlates of Well-Being

Depression is among the most common forms of chronic emotional conditions (Villarroel & Terlizzi, 2020). Research has shown that depression contributes to functional disability (Patrick et al., 2004). Data from the CDC's National Health and Nutrition Examination Survey showed that from 2013 to 2016, middle-aged adults (ages 40–59 years old) reported and experienced higher levels of depression compared to younger adults (ages 20–39 years old) and older adults (60-years old and older; Brody et al., 2018). Additionally, in 2019, middle-aged adults experienced higher rates of moderate and severe forms of depression compared to older

adults (Villarroel & Terlizzi, 2020). The phenomenon of middle-aged adults entering late-life with high degrees of functional impairment is beginning to receive more empirical attention (Patrick et al., 2022).

In addition to age, depression exhibits strong associations with female sex, with females more likely to be diagnosed with depression than males (Casey, 2017), with some estimates that females experience depression at rates of 1.5 to 3.0 times more than males (Wong et al., 2014).

There are racial differences in the rates of diagnosis of depression. For example, African Americans have been found to have lower rates of depression, and those diagnosed are also less likely to take antidepressants (Cohen et al., 2005). Bailey et al. (2019) reported that roughly 17.9% of white adults had been diagnosed with major depressive disorder, whereas 10.4% of Black Americans were diagnosed. Additionally, research has found weaker associations between Major Depressive Episodes (MDE) in African American, Latino, and Asian adults compared to white adults (Flores et al., 2021). However, it is important to note that cultural factors may influence individuals' access and ability to seek help (e.g., economic barriers, lack of [good] insurance, or immigration status).

Well-Being Correlates of Functional Disability

A cross-sectional study of Medicaid recipients was among the first to demonstrate that depressed affect was associated with cognitive IADLs and physical IADLs (Patrick et al., 2004). Higher levels of depression were also related to higher levels of impairments in physical and cognitive IADLs. As a result of these associations, disabilities in basic activities of daily living (BADLs) were also affected (Patrick et al., 2004).

Additionally, meta-analytic work has found that both baseline depression and incident depression were independent predictors that showed that depression symptoms predicted the onset of disabilities in IADLs, ADLs, and mobility across a 2-year period (Kong et al., 2019). These studies illustrate the increased risk of developing functional disabilities due to the presence of depression symptoms or diagnosed depression.

Demographic Correlates of Chronic Health Conditions

Similar to age, sex, and race differences in chronic emotional conditions, significant group differences are observed for chronic physical health conditions, as well. Across mid- to late-life, individuals are likely to experience new chronic health conditions (Verbrugge & Jette, 1994). Whereas 37.1% of adults ages 55 to 64 years old report having two or more chronic physical conditions, more than half (56%) of adults ages 65 years and older
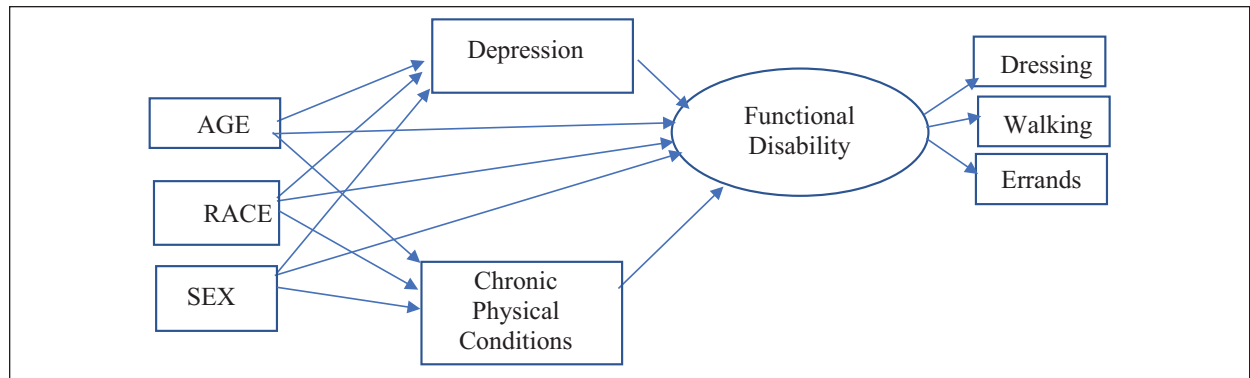
Figure 1. Conceptual model.

report having two or more chronic health conditions (Centers for Disease Control and Prevention [CDC], 2009). Older adults tend to have a higher prevalence rate of chronic health conditions, but adults who develop chronic health conditions earlier, like in midlife, are at a much greater risk for functional disabilities later (Karvonen-Gutierrez & Strotmeyer, 2020; Verbrugge & Jette, 1994).

Sex also influences chronic health conditions. Women are also more likely to perceive their health as worse and report more functional limitations compared to men (Helgeson & Zajdel, 2017). Once diagnosed with a chronic physical condition, women have more difficulty adjusting emotionally than men (Helgeson & Zajdel, 2017).

For decades, it has been known that Black and white Americans differ in their health. Relative to white adults, Black adults rate their health more poorly, have shorter life expectancies, live more of their lives with disabilities, and are diagnosed more frequently with heart disease, cancer, and other leading causes of death in America (Ferraro et al., 2017). Additionally, research has found that Asian adults, Black adults, and Latino adults are more likely to have undiagnosed chronic physical conditions compared to whites (Kim et al., 2018).

Chronic Physical Health Conditions and Functional Disability

Chronic physical health conditions influence one's ability to complete self-care tasks without assistance. Having more chronic health conditions is associated with greater functional disability (Ryan et al., 2015; Williams & Egede, 2016). Specific diagnoses may be related to specific areas of functional disability, as well (Patrick et al., 2004).

Individually, depression and chronic physical health conditions predict functional disability status. Participants with chronic physical health conditions who were also diagnosed with major depressive disorder were roughly 13 times more likely to experience moderate to severe functional disability (Deschênes et al.,

2015). Given these associations, it is important to examine the influence of known demographic predictors (i.e., age, sex, race), and both emotional and physical health conditions on functional disability in mid- and late life.

The Current Study

The current study sought to examine the relations among these variables. The hypotheses depicted in Figure 1 are derived from the current literature and seek to elucidate potential pathways for intervention. The hypotheses were examined in the context of a path analytic model in which each path is considered a unique hypothesis. We expected that chronic physical health conditions and depression would relate to higher functional disability. Although we hypothesized that older age, female sex, and identifying as a member of a marginalized racial or ethnic group would be associated with more functional disability directly, we also anticipated that the effects of such demographic social determinants of health would be mediated by the more proximal constructs of physical and emotional health.

Method

Data Source

We used the CDC's 2020 Behavioral Risk Factor Surveillance System (BRFSS) publicly available data (CDC, 2021). The BRFSS is an annual interview administered to assess Americans' health behaviors, chronic conditions, risks, and use of health services. We chose to examine ages most likely to experience age-related functional disability, thus, we focus on mid- and late-life adults.

Participants

Participants included 243,693 community-dwelling adults from all 50 United States (55.9% females). Age was measured as a continuous variable, and for the current study, age ranged from 45 to 80+ years old ($M=64.2$, $SD=10.4$). All participants were asked to

report their racial background. The sample identified as African American (7.2%), American Indian or Alaskan Native (1.6%), Asian (1.7%), Hispanic or Latino (6.1%), or White, non-Hispanic (80.7%). Participants were also asked about their annual household income, with options ranging from below $10,000 and above $75,000, the average was roughly $50,000. More than half of the adults were married (56.9%). When asked to report their highest level of education completed, a large percentage of the sample reported completing 4 or more years of college (39.9%). Another 27.4% reported having completed some college and 26.2% reported high school or its equivalent as their highest level attained.

Functional disability: Functional disability was assessed as a latent construct comprising three items asking whether participants experienced difficulty dressing or bathing (4.2%), doing errands alone (7.3%), and/or walking or climbing stairs (18.9%). As might be expected for a 3-item scale comprised of dichotomous questions among a community-dwelling sample, the internal consistency index was low, $\alpha = .59$.

Chronic Physical Health Conditions: Participants indicated whether they had ever been diagnosed with angina or coronary heart disease (7.8%), stroke (5%), heart attack (7.2%), asthma (12.4%), COPD, emphysema or chronic bronchitis (9.9%), kidney disease (4.8%), diabetes (17.1%), and arthritis (40.6%). The number of affirmative responses was summed to create a total number of chronic health conditions ranging from zero to eight. The current sample had an average of 1.05 conditions ($SD = 1.2$). Notably, 40.6% of the sample reported that they had never been diagnosed with any of the eight conditions. Exploratory analyses examined whether a log transformation of the skewed chronic health conditions variable was needed. Results with the raw and transformed index were essentially the same, so we report raw scores herein. Additional exploratory *t-tests* were conducted to examine potential sex differences in these diagnoses. As expected, sex differences were evident in the specific conditions.[1] Females reported more chronic health conditions ($M = 1.06$, $SD = 1.2$) than males ($M = 1.02$; $SD = 1.2$; t (227,396) $= -7.20$, $p < .001$), but the magnitude was quite small.

Depression: The BRFSS uses a single item to assess depression. Adults indicate whether they have ever been told they had depression, major depression, dysthymia, or minor depression. Approximately 17.5% reported that they had ever been told they had depression. Of note, a significant sex difference was observed, with 21.4% of females and 12.3% of males reporting a depression diagnosis (t ($DF = 237,376$) $= -.59.74$, $p < .001$).

Results

Correlations

Bivariate associations were examined using Pearson correlation coefficients for continuous variables and Spearman correlations for categorical variables. Due to the large sample used for the current study, smaller correlations reached statistical significance, thus, for interpretation, we focus on magnitude greater than .20 and p-values smaller than .001. Coefficients are presented in Table 1. Income and education were included in the correlation table, however, due to the small correlations they were not included in the model. Additionally, the income measure does not account for the number of people in a household or where a person lives so we are limited in our understanding.

Hypothesis Testing

The analytic version of the model shown in Figure 1 was tested using a path analysis implemented in AMOS v. 29.0.0. AMOS uses maximum likelihood procedures to estimate all paths of the model simultaneously. Model fit is assessed using the chi-square, for which nonsignificant values are sought. However, because chi-square is sensitive to minor differences between the observed and inherent model (Arbuckle, 2011), we used additional indices of model fit. Specifically, we relied upon Byrne's (2010) recommendations for the comparative fit index (CFI), for which values greater than .90 suggest an acceptable fit, with values greater than .95 being preferred. We also examined the Tucker-Lewis Index (TLI), for which values greater than .90 indicate an acceptable fit. We also used the root mean square error of approximation (RMSEA), for which values less than .08 are considered acceptable, and values less than .05 indicate a close fit of the model to the data. In addition, we examined each path in the model and evaluated the significance using the critical ratio (CR). CRs > 1.96 are significant at the $p < .05$ level. Results of the path analysis suggest an acceptable fit of the model to the data, X^2 ($DF = 18$, $N = 243,693$) $= 19,512.64$, $p < .001$; CFI $= 0.909$; TLI $= 0.774$; RMSEA $= 0.066$; R^2 Function $= .267$; R^2 Chronic Health Conditions $= .056$; R^2 Depression $= .024$.

In addition, AMOS assesses both the measurement model and the structural path model simultaneously. As shown in the upper portion of Table 2, the three functional disability variables loaded onto a single latent construct. The lower portion of the table displays the individual regression paths. When inspecting individual regression paths, it is important to remember that due to the large sample size of the current study, very small beta weights resulted in significant effects. Thus, we conservatively interpret only those estimates that are significant at or below $p < .001$.

As shown in Table 2, more chronic physical health conditions were associated with more functional disability ($\beta = .408$, $p < .001$), depression[2] was associated with higher functional disability ($\beta = .196$, $p < .001$), and the covariance between chronic physical health conditions and depression was significant ($r = .237$, $p < .001$).

As shown in Table 2, demographic variables were directly associated with functional disability, with

Table 1. Correlations (N = 243,693).

	Walk	Dress	Errands	Chronic physical conditions	Depression	White	Black	Hispanic	Sex (female)	Age	Education	Income
Difficulty walking	1.0	.370**	.412**	.375**	.187**	−.058**	.054**	.029**	.067**	.159**	−.183**	−.308**
Difficulty dressing		1.0	.442**	.184**	.145**	−.053**	.039**	.035**	.004	.022**	−.091**	−.171**
Difficulty errands			1.0	.223**	.194**	−.049**	.039**	.027**	.068 **	.057**	−.120**	−.228**
Chronic Physical Conditions				1.0	.200**	−.006**	.040**	−.025**	.027 **	.231**	−.154**	−.226**
Depression					1.0	.020**	−.018**	.001	.200**	−.084**	.034**	−.147**
White						1.0	−.625**	−.575**	−.014**	.020**	.122 **	.188**
Black							1.0	−.073**	.027**	−.018**	−.063**	−.111**
Hispanic								1.0	−.002	.001	−.124**	−.147**
Sex (female)									1.0	.051**	−.008**	−.108**
Age										1.0	−.057**	−.153**
Education											1.0	.441**
Income												1.0

**p ≤ .001.

Table 2. Results of Model Testing of the Direct Effects of Functional Ability ($N = 243,693$).

			β	Estimate	S.E.	C.R.	*p*
Measurement model							
Difficulty walking	←	Functional ability	.680				
Difficulty dressing	←	Functional ability	.583	.438	.002	205.92	***
Difficulty alone	←	Functional ability	.647	.634	.003	214.57	***
Structural model							
Depression	←	Age	−.092	−.003	.000	−46.59	***
Depression	←	Sex	.122	.094	.002	61.94	***
Depression	←	Black	−.027	−.039	.003	−13.34	***
Depression	←	Hispanic	−.012	−.018	.003	−5.75	***
Chronic health conditions	←	Age	.231	.027	.000	119.21	***
Chronic health conditions	←	Sex	.003	.006	.005	1.39	.166
Chronic health conditions	←	Black	.050	.231	.009	25.54	***
Chronic health conditions	←	Hispanic	.010	.047	.010	4.84	***
Functional ability	←	Age	.065	.002	.000	28.19	***
Functional ability	←	Sex	.044	.024	.001	19.79	***
Functional ability	←	Black	.065	.066	.002	29.01	***
Functional ability	←	Hispanic	.068	.074	.002	30.26	***
Functional ability	←	Depression	.196	.137	.002	83.91	***
Functional ability	←	Chronic Health Conditions	.408	.091	.001	161.61	***

Note. X^2 ($DF = 18$, $N = 243,693$) $= 19,512.64$, $p < .001$; R^2 Function $= .267$; CFI $= .909$; TLI $= .774$; RMSEA $= .066$. R^2 Chronic Health Conditions $= .056$; R^2 Depression $= .024$.

significant associations with female sex (β = .044, $p < .001$), older age (β = .065, $p < .001$), Black race (β = .065 $p < .001$), and Hispanic ethnicity (β = .068 $p < .001$). Of note, however, these associations were small in magnitude.

Mediation Analysis

We also examined whether chronic physical health conditions and depression mediated the effects of the demographic variables (i.e., age, sex, race) on functional ability. These results are shown in Table 3.

The specific indirect effect (.002) of age on functional ability via chronic physical health conditions was significant [bias-corrected 95% CI [0.002, 0.002], $p = .001$]. Similarly, the indirect effect (.000) of age on functional ability via depression was significant [bias-corrected 95% CI [0.000, 0.000], $p = .001$]. The total effect (.002) of age on functional ability was significant [bias-corrected 95% CI [0.004, 0.004], $p = .001$].

The specific indirect effect (.000) of sex on functional ability via chronic physical health conditions was not significant [bias-corrected 95% CI [0.000, 0.001], $p = .389$]. However, the specific indirect effect (.013) of sex on functional ability via depression was significant [bias-corrected 95% CI [0.012, 0.013], $p = .001$]. The total effect (.037) of sex on functional ability was significant [bias-corrected 95% CI [0.035, 0.039], $p = .001$].

The specific indirect effect (.021) of Black race on functional ability via chronic physical health conditions was significant [bias-corrected 95% CI [0.019, 0.022], $p = .001$]. The indirect effect (−.005) of Black race on

functional ability through depression was significant [bias-corrected 95% CI [−0.006, −0.005], $p = .001$]. The total effect (.081) of Black race on functional ability was significant [bias-corrected 95% CI [0.076, 0.086], $p = .001$].

The specific indirect effect (.004) of Hispanic race on functional ability through chronic physical health conditions was significant [bias-corrected 95% CI [0.003, 0.006], $p = .001$]. The specific indirect effect (−0.002) of Hispanic race on functional ability via depression was significant [bias-corrected 95% CI [−0.003, −0.002], $p = .001$]. The total effect (.075) of Hispanic race on functional ability was significant [bias-corrected 95% CI [0.070, 0.081], $p = .001$].

Discussion

The advantages and disadvantages which people experience throughout their lifetimes may accumulate, influencing health and well-being as one enters late life (Ferraro et al., 2017). The associations between age and sex with late-life health, coupled with the literature regarding racial group health disparities, are well established. However, the understanding of the specific pathways whereby one demographic group experiences more weathering or other ill-effects is not well understood. The current study sought to examine demographic social determinants of health, the number of chronic physical health conditions, and depression as correlates of functional disability in middle-aged and older adults. Previous research has found that chronic physical health conditions and depression are predictive of functional

Table 3. Mediation Analyses.

Indirect effects	Point estimate	95% CI	*p*
Age → Chronic Health Conditions → Functional ability	.002	[0.002, 0.002]	***
Age → Depression → Functional ability	.000	[0.000, 0.000]	***
Sex → Chronic Health Conditions → Functional ability	.000	[0.000, 0.001]	.39
Sex → Depression → Functional ability	.013	[0.012, 0.013]	***
Black → Chronic Health Conditions → Functional ability	.021	[0.019, 0.022]	***
Black → Depression → Functional ability	−.005	[−0.006, −0.005]	***
Hispanic → Chronic Health Conditions → Functional ability	.004	[0.003, 0.006]	***
Hispanic → Depression → Functional ability	−.002	[−0.003, −0.002]	***
Direct Effects			
Age →Chronic Health Conditions	.027	[0.027, 0.027]	
Age →Depression	−.003	[−0.003, −0.003]	
Age → Functional Ability	.002	[0.002, 0.002]	
Sex → Chronic Health Conditions	.004	[−0.004, 0.012]	
Sex → Depression	.094	[0.091, 0.096]	
Sex → Functional Ability	.024	[0.022, 0.026]	
Black → Chronic Health Conditions	.229	[0.213, 0.244]	
Black → Depression	−.039	[−0.044, −0.034]	
Black → Functional Ability	.066	[0.061, 0.070]	
Hispanic → Chronic Health Conditions	.047	[0.031, 0.063]	
Hispanic → Depression	−.018	[−0.023, −0.013]	
Hispanic → Functional Ability	.074	[0.069, 0.078]	

disability, with the risk of functional disability significantly increasing when an individual is diagnosed with both depression and chronic health conditions. Importantly, research has also shown that adults are entering late life with higher levels of functional disability than in prior generations (Karvonen-Gutierrez & Strotmeyer, 2020). Identifying potential pathways to promote functioning is essential. Thus, the current sought to explicitly examine potential mediating pathways between age, sex, and race and functional disability. We chose two constructs as potential mediators, which were identified from the past 50 years of research (i.e., physical and emotional health).

To that end, we used a large national data set to re-examine long-standing important contributors to the functional disability hypothesis related to double- and multiple-jeopardy of demographic variables and functional disability (Dannefer, 2020; Ferraro et al., 2017). We extend the literature by explicitly testing whether the influences of age, sex, and race are partially mediated by chronic physical and emotional health conditions. Results of our path analyses and the post-hoc mediation analyses show that, in general, our model fit the data well. However, the mediation analyses indicate relatively small effects. That is not to suggest that such small effects are not clinically or practically important. Rather, we interpret the magnitude and direction of these findings to suggest that the field requires additional and more nuanced investigations of a broader variety of

social demographic and individual determinants of health and functional ability. In the following section, we briefly identify particularly fruitful areas for future research.

Patrick et al. (2004) found that higher levels of depression were related to higher levels of physical and cognitive IADLs. Depression affected basic activities of daily living (BADLs) as well. As such, we expected that depression would be associated with higher functional disability. The current study found support for this hypothesis, replicating previous research, such that participants with depression were more likely to experience functional limitations, compared to those who had never been diagnosed with depression. Providing accessible and affordable mental health care as a form of preventative treatment may decrease the prevalence and progression of disability among middle-aged and older adults. We do note, however, that in this sample of middle-aged and older adults, that younger ages were associated with higher reports of depression. Emotional well-being at midlife warrants further investigation.

Previous research has found that participants diagnosed with multiple chronic health conditions were more likely to experience worse ADLs and IADLs than those with fewer chronic or no chronic conditions (Williams & Egede, 2016). The number of chronic physical health conditions was expected to be associated with higher functional disability. In the current study, the hypothesis was supported, with more chronic health

conditions being associated with more functional disability. Replicating other research, we suggest that a lifespan focus on health and well-being may be one avenue to decrease disability among middle-aged and older adults (Patrick et al., 2022).

In keeping with the literature (e.g., Millán-Calenti et al., 2010), we expected that female sex would be associated with more functional disability. Indeed, females did report more functional disability than males, supporting our hypothesis. However, the influence of sex was amplified by its association with depression. Our exploratory analyses revealed sex differences in prevalence for most of the diagnoses examined, but the influence of sex on disability was not altered by physical health conditions. We suspect that the non-significant indirect effect of sex on functional disability via physical health is related to the types of chronic health conditions included and the way in which these conditions were measured. Additional investigation into the length of diagnoses, severity of symptoms and comorbidities may provide important information regarding health at late life, especially for females. Thus, both physical health and emotional health pathways through which sex might influence disability merit further investigation.

Black Americans are approximately 1.5 to 2 times more likely to experience functional disabilities relative to white Americans (Nuru-Jeter et al., 2011), thus, we anticipated finding this difference, as well. Correlation coefficients and standardized beta weights with functional disability were stronger for Black Americans than for other racial groups. Hispanic Americans were also likely to report higher functional disability in comparison to white adults and other racial groups. Again, support was provided for our hypothesis. Additionally, depression and chronic health conditions were found to mediate the relation between Black race and functional disability. A closer inspection of the direction of these associations, however, suggests that it is non-Black Americans whose depression increases functional disability The standardized beta for depression to functional disability for Black Americans was negative. However, a positive beta emerged for the relation between physical health conditions and disability among Black Americans. Given that the direct effect of Black race on functional disability is stronger than either indirect effect, there are additional mechanisms to be identified. However, our mediation analysis does suggest that more attention to physical health conditions among Black Americans is warranted. Additional investigation into the length of diagnoses, severity of symptoms and comorbidities may provide important information regarding health at late life, especially for Black Americans.

Similar patterns of associations emerged for Hispanic Americans. Like Black Americans, the paths between Hispanic identity and both depression and chronic health conditions with functional disability were significant. Like Black Americans, the path between depression and disability for Hispanic Americans was negative in

direction, suggesting that the links between depression and disability are stronger among white Americans. Given the rich empirical literature detailing racial and minority stresses (e.g., Duran & Pérez-Stable, 2019), we view this finding as a result of the way in which depression is assessed in the BRFSS, of course. But there are also race-related differences in access to care, education, and income, which also influence functional ability (Patrick et al., 2022). More in-depth investigations of the ways in which these structural determinants of health mediate the influences of race and ethnicity on disability are important next steps for the field.

Limitations and Future Directions

Although the BRFSS provides a rich and current accounting of Americans' health, some measures are limited. We note that the CDC continues to improve the item pool in the BRFSS and is eager for improvements to assessments of emotional well-being. In the 2020 interview data, only a single, straight-forward question addresses depression: "Have you ever been told that you had a depressive disorder, including depression, major depression, dysthymia, or minor depression?" (CDC, 2021). As a surveillance item in a lengthy battery, it may be sufficient for many uses, but adding a few additional items would benefit the field. Including questions regarding emotional health in a community-based health surveillance survey is an important first step to improving health outcomes.

Similarly, it should be noted that the BRFSS includes only three well-documented ADL/IADL items, difficulty dressing, doing errands, and climbing stairs. Although there are more comprehensive scales that include a wider range of functional abilities, these three do capture a good estimate of independent community living. These three items (dressing, bathing, walking, and errands) appear to be comprehensive and form a reasonable latent construct to represent a person's disability status and provide a good image of Americans' functional disability. In prior work with older rural Medicaid recipients, Patrick et al. (2004) depression was associated with more disability in cognitive IADLS and physical IADLs which in turn predicted disability in basic self-care ADLs. By including a broader range of functional ability items in community health surveillance surveys, future research may be able to test those results in a more current sample of community-dwelling adults. Until then, however, those seeking to conduct a more in-depth analysis of ADLS, IADLS, and motor functioning might choose other data sets.

The current study examined only a few demographic social determinants of health. The current study did not include education and income as contributors to functional disability. We did not include income due to a high percentage of missing data. In preliminary analyses, nearly 43,000 people did not report their income. Moreover, annual income in dollars may not be a robust

index of wealth or financial security. More nuanced measures of this construct are needed, but are not able to be calculated in the public-access data sets. Ceiling effects in education contributed to our decision to exclude it from our models. Approximately 94% of the sample had graduated high school, with nearly two-thirds having completed at least some college. Like income, the influence of education is more complex than simply an additive effect of more of the underlying construct. For middle-aged and older adults, the majority are 20 or more years away from their highest level of formal education. In terms of functional disability, the influence of both education and income is likely related to their influence on other social determinants of health. For example, income and education are often related to lifestyle behaviors, including exercise, nutrition intake, cigarette smoking and alcohol consumption (CDC, 2021). A few of these items are included in the 2020 BRFSS in a dichotomous format, but a comprehensive assessment of lifestyle behaviors was not available. Thus, missingness, ceiling effects, and measurement issues rendered these variables less useful for the current study.

Implications

There is evidence that persons are entering late life with more functional disability than in previous generations (He & Larsen, 2014). The negative correlation and negative beta weight between age and depression in the current study also show that effect. Given that depression is associated with a host of ill effects, including decreased functional ability, we strongly advocate for policies and programs that support emotional well-being across the lifespan.

Similarly, we advocate for better support for adults with physical challenges at midlife. Declines that begin in midlife can be reversible, so understanding and addressing problems earlier may help reduce the number of adults living with functional disabilities. For example, data from the Health and Retirement study found that 37% of midlife adults who developed a new ADL impairment were able to regain their independence within 2 years (Karvonen-Gutierrez & Strotmeyer, 2020). Of the 37% who regained their independence, 28% were able to remain independent for the next 10 years (Karvonen-Gutierrez & Strotmeyer, 2020). This suggests that if functional disability is detected early and addressed, people can regain or remain independent for longer. As we have advocated previously (Patrick et al., 2022), adjusting private and public insurance to include midlife adults may be a cost-savings in the long-term.

Conclusion

Given that middle-aged adults are entering late life less healthy than prior generations and that declines in midlife may be reversible (Karvonen-Gutierrez & Strotmeyer, 2020), the results of the current study should be regarded as a warning of what is to come for at-risk groups and a call to action for creative and timely programs to intervene earlier in the lifespan to minimize risks to functional ability. Accessible treatment and preventative programs are needed to enhance and preserve functional ability across the lifespan.

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Notes

1. Kidney disease was the only condition used in the present analyses that did not exhibit sex differences in prevalence. Males reported higher frequency of the following diagnoses: heart attacks, angina, stroke, and diabetes. Females reported a higher frequency of diagnoses of arthritis and COPD. We emphasize that the BRFSS does not inquire about duration of diagnosis, severity of conditions, or whether people get help with tasks due to their diagnoses, which clearly are important for functional disability.
2. A parallel, post hoc analysis was conducted using the number of mental health days variable instead of the depression variable. The number of poor mental health days and depression variables produced similar results and were not significantly different. Thus, we retained the depression item in the current study as it was most similar to the physical health condition items.

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