



Associations between living alone, depression, and falls among community-dwelling older adults in the US

Debasree Das Gupta^{a,*}, Uma Kelekar^b, Dominique Rice^c

^a Department of Kinesiology and Health Science, Emma Eccles Jones College of Education and Human Services, Utah State University, 7000 Old Main Hill, Logan, UT

^b Department Chair/Program Director of Healthcare Management, School of Business, Ideation, Leadership and Technology, Marymount University, Arlington, VA

^c Department of Kinesiology and Health Science, Emma Eccles Jones College of Education and Human Services, Utah State University

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ABSTRACT

Social isolation is closely linked to depression and falls in late life and are common among seniors. Although the literature has highlighted age-related variations in these three geriatric conditions, evidence on heterogeneities across older adult age categories is lacking. To address this gap, we present cross-sectional analyses using indicators of social isolation, depression, and falls of older adults constructed from the most recent Behavioral Risk Factor Surveillance System (BRFSS) data. An age-based understanding is critical to improve health interventions since health changes occur at a faster rate among seniors than in any other population subgroup. We included all adults 60 years and older ($n = 113,233$) in the 2018 BRFSS landline dataset and used the status of living alone, depressive disorder diagnosis, and fall incidences reported by these seniors to respectively create the social isolation, depression, and fall indicators. We conducted multivariable logistic regressions to compare findings on these indicators across the three age categories of 60–69, 70–79, and 80 and above after adjusting for a common set of covariates. Results indicate that the likelihood of seniors living alone and reporting depression is the highest among those 80 years and above. Conversely, the odds of depressed seniors reporting falls is the greatest among the 60–69 year olds. Accordingly, we highlight key implications for targeted health promotion and care delivery to seniors.

1. Introduction

A recent publication from the National Academy of Sciences (NAS) (2020) underscored the high prevalence of social isolation among older adults in the US. While adverse health outcomes associated with social isolation of the elderly have been documented for decades (NAS, 2020, 2018), lockdowns and physical distancing (Das Gupta and Wong, 2020a; Fong et al., 2020) during COVID19 are shining an intense spotlight on this topic (Holmes et al., 2020). Social isolation is closely linked to depression and falls in late life and are common among seniors (Cudjoe et al., 2020; Durbin et al., 2016; Deandrea et al., 2010; Fiske et al., 2009; Freedman and Nicolle, 2020; Hayashi et al., 2020; Health Resources and Services Administration [HRSA], 2019; Petersen et al., 2020; Quach and Burr, 2020). All three conditions are critical public health concerns (Fiske et al., 2009; Healthy People, 2020; Kelsey et al., 2012; NAS, 2020; Satcher and Druss, 2010) given the progressive aging of populations across the US (Das Gupta and Wong, 2020b).

A robust literature connects social isolation to older adult health

(NAS, 2020; Veazie et al., 2019) with analysts identifying the role of depression as a mechanism through which isolation may impact falls of seniors (Elliott et al., 2009; Faulkner et al., 2003; Iaboni and Flint, 2013; NAS, 2020; Painter et al., 2012). The evidence linking social isolation and depression (Domènech-Abella et al., 2019; Santini et al., 2020; Teo et al., 2015), and depression and falls (Biderman et al., 2002; Deandrea et al., 2010; Holloway et al., 2016; Iaboni and Flint, 2013; Kao et al., 2012; Painter et al., 2012; Turcu et al., 2004) of older adults is strong. Prior studies examining these linkages report higher levels of depression among socially isolated older adults (Domènech-Abella et al., 2019; Santini et al., 2020; Teo et al., 2015) and increased falls of depressed seniors (Biderman et al., 2002; Iaboni and Flint, 2013; Kao et al., 2012).

Additionally, the literature has highlighted inter-age heterogeneity in various geriatric conditions including social isolation (Hawkey and Kocherginsky, 2018; Liu and Waite, 2014; NAS, 2020; Wilkinson and Marmot, 2003), depression (Fiske et al., 2009; Weinberger et al., 2018), and falls (Ambrose et al., 2013; Chang et al., 2004; Gale et al., 2016; Karlsson et al., 2013; Tinetti et al., 1988) of older adults. In fact, it was

* Corresponding author.

E-mail address: debasree.dasgupta@usu.edu (D. Das Gupta).

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almost two decades back that the National Research Council (NRC, 2001) had underscored diversity in elderly health and comorbid conditions across chronological age ranges. Yet, evidence on how the relation between social isolation and depression and depression and falls may vary across older adult age categories remains under-explored (Fiske et al., 2009; Academies and of Sciences, Engineering, and Medicine (NAS), 2020; Academies and of Sciences Engineering, and Medicine (NAS), 2018).

To address the above-mentioned gap, we present cross-sectional analyses using indicators of social isolation, depression, and falls of older adults constructed from the 2018 Behavioral Risk Factor Surveillance System (BRFSS) data. More specifically, we conduct multivariable (logistic regression) analysis to evaluate how the relation between these elderly conditions vary across older adult age categories. Such a nuanced understanding is critical as health changes occur at a much faster rate among seniors than in any other population subgroup (Fiske et al., 2009; NAS, 2018; NRC, 2001). Consequently, the younger older adults (60–69 years for example) are a group with health and social care needs that are distinct and different from the oldest 80 years and above (Arfken et al., 1994; NRC, 2001; Santoni et al., 2015).

2. Methods

2.1. Data

We conducted analysis using the 2018 Behavioral Risk Factor Surveillance System (BRFSS) data (CDC, 2020) which is a leading source of health data in the US (Silva, 2014). Conducted annually since the 1984 by the US Centers for Disease Control and Prevention (CDC) in collaboration with state health departments, the BRFSS is a nationally representative telephone-based cross-sectional survey of community-dwelling adults (≥ 18 years) in the US. It includes questions on such topics as chronic conditions, health risk behaviors, and access to and use of health services in addition to socio-demographic information (CDC, 2020). Trained interviewers administer these questions from a standardized questionnaire with informed consent obtained, and confidentiality and voluntary participation highlighted at the outset. A probability-based multistage cluster sampling methodology is used to generate a representative sample in each of the 50 states, the District of Columbia, Guam, and Puerto Rico. In 2018, 437,436 adults participated in the survey and the median response rate across these states and regions was between 53.3% (landlines) and 43.4% (cellphones). Additional technical details on the complex survey design of the BRFSS are available at CDC (2020). The institutional review board (IRB) at CDC approved the BRFSS for research (CDC, 2018). Consequently, our secondary analysis using this de-identified publicly available data did not need additional IRB approvals or participants' informed consent.

2.2. Study sample

One in two older adults experience incident depression at/after age 60 (Brodaty et al., 2001; Fiske et al., 2009). We consider adults 60 years and older in the BRFSS dataset. In 2018, a majority of these older respondents (57%, $n = 113,233$) answered the BRFSS questions via a landline and constituted as the sample for this study.

2.3. Measures

Outcome and explanatory variables: The BRFSS survey questions are specifically designed to facilitate public health research and surveillance for the purpose of health promotion and practice (Rolle-Lake and Robbins, 2020; Remington et al., 1988). This dataset has been employed in prior studies to interpret depressive disorder (Miyakado-Steger and Seidel, 2019; Mazurek et al., 2020; Strine et al., 2008), falls (Barbour et al., 2014; Bergen et al., 2016; Crews et al., 2016; Grundstrom et al., 2012), and the status of living alone (Escobar-Viera et al., 2014;

Kawachi et al., 1999) in the US. The explanatory and outcome variables for our study were similarly constructed using specific relevant questions in the 2018 BRFSS data.

In 2018, the BRFSS included a question on lifetime diagnosis of depression that asked respondents: 'Has a doctor, nurse, or other health professional ever told you have a depressive disorder (including depression, major depression, dysthymia, or minor depression)?' It also asked respondents 45 years and older: 'In the past 12 months, how many times have you fallen?' (CDC, 2020). For each of these questions, we coded the responses into two categories to obtain the depression (yes = 1 vs. no = 0) and falls (yes = 1 for falls ≥ 1 vs. no = 0) indicator variables. The BRFSS also asked landline respondents: 'Excluding adults living away from home, such as students away at college, how many members of your household, including yourself, are 18 years of age or older?' (CDC, 2020). We coded the responses to this question also into two categories to obtain the living-alone (adults: 2 or more = 0 vs. adults: 1 = 1) indicator.

In the literature, the status of "living alone" is highlighted as an objective quantitative marker (Holt-Lunstad et al., 2015) that increases the risk of social isolation (Ortiz, 2011) and lowers the potential of social support (Ennis et al., 2014) of seniors. This single-item indicator has been frequently used in studies on the topic of social isolation (Havinghurst, 1978; Hunt, 1978; Holt-Lunstad et al., 2015; NAS, 2018; Pohl et al., 2018; Shaw et al., 2017; Wenger et al., 1996) and in others examining older adult falls (Elliott et al., 2009; Flabeau et al., 2013; Kharicha et al., 2007). In synergy, we operationalize seniors' status of living alone as a binary objective indicator distinct from the subjective perception of social isolation (Holt-Lunstad et al., 2015). While self-reported status of "living alone" is the explanatory variable of interest in the depression (outcome) model, in the fall (outcome) model, depressive disorder diagnosis reported by seniors is the main predictor.

Control variables: Prior analysts have reported common risk factors for older adult depression and falls (Biderman et al., 2002; Iaboni and Flint, 2013) that include socio-demographics (for example, age, sex, race, ethnicity) and socio-economics (for example, income, education, employment), and health conditions and health behaviors (NAS, 2020). Accordingly, in the multivariable analysis we considered age-categories, sex (male, female), race/ethnicity (White Non Hispanic (NH), Black NH, other NH, American Indian, and Hispanic), education (<high school, high school, attended college or technical school, \geq college or technical school), income (<\$15,000, 15,000–24,999, 25,000–34,999, 35,000–49,999, \geq 50,000), employment status and home ownership (no vs. yes) as socio-demographics and socio-economics. To adjust for individual health conditions, we included binary dummy variables (no vs. yes) for diabetes, cardiovascular diseases (coronary heart disease, myocardial infarction, or stroke), kidney disease, arthritis, difficulty walking, bathing, dressing, as well as body mass index (normal, underweight, overweight/obese). Health behaviors included alcohol consumption (any in last 30 days vs. none), physical activity (any in last 30 days vs. none), and sleep habits (≥ 8 h vs. < 8 h).

2.4. Statistical analysis

To examine inter-age variations, we estimated self-reported prevalence of living alone, depression, and falls among seniors stratified by the older adult age categories of 60–69 years, 70–79 years, and 80 years and above. We also computed descriptive statistics (percentages and standard errors) to summarize proportion of seniors reporting depressive disorder diagnosis and living alone, and proportion of seniors reporting depressive disorder diagnosis and falls stratified by the three older adult age categories.

Finally, we conducted multivariable (logistic regression) analysis to evaluate how the cross-sectional relations between the indicators of: i) social isolation and depression (depression model), and ii) depression and falls (fall model) vary across older adult age categories after controlling for a common and parsimonious set of control variables (NAS, 2020). In this analysis, we initially considered the three age categories of

60–69 years, 70–79 years, and 80 years and over [Models 1 and 3 under results]. To further probe the age-based variations, we then collapsed the three age categories into two [Models 2 and 4 under results] which we discuss in more detail in the following section. We performed all statistical analysis using Stata (version 15) and applying the appropriate methodology to account for the complex survey design of the BRFSS survey. We report weighted estimates and statistically significant findings at $p \leq 0.05$ (unless specified otherwise).

3. Results

Of the 113,233 older adults who participated in the 2018 BRFSS via the landline, 107,881 respondents provided information on all three questions based on which we constructed the three main indicator variables. Of the 5,352 (4.7%) older adult respondents with missing information (Fig. 1), nonresponses solely to the ‘number of adults in a household,’ or the ‘ever told you had a depressive disorder’ or the ‘had a fall in the past twelve months’ questions respectively were 6 (0.005%), 435 (0.38%), and 4,872 (4.3%). The rest (39, 0.034%) of the respondents did not provide answers to both the ‘ever told you had a depressive disorder’ and ‘had a fall in the past twelve months’ questions.

Note: Data extraction and statistical analysis were conducted by the study authors.

In Table 1, we present the self-reported prevalence of living alone (social isolation indicator), depressive disorder diagnosis (depression indicator), and fall indicator stratified by age. The proportion of seniors reporting living alone and falls increased over the elderly age categories with the reverse being true for the depression indicator. Over half of the older adults over 80 years (51.77%) were living alone, in contrast to about a third of the 70–79 year olds (33.82%), and about a quarter of the 60–69 year olds (24.56%). Whereas fall incidences reported were the highest among the 80-year olds (30.89%), the self-reported prevalence of depressive disorder was the highest among 60–69 year olds (19.47%). These age-based differences were statistically significant ($p < 0.05$).

3.1. Descriptive analysis

In Table 2, we present the proportion of seniors reporting – i) depressive disorder diagnosis and living alone, and ii) depressive disorder diagnosis and falls stratified by age. The proportion of seniors reporting living alone and a depressive disorder diagnosis increased progressively over the elderly age categories. In 2018, almost 60% of the older adults over 80 years who were living alone reported a depressive disorder diagnosis, while slightly over a third of the 60–69 year olds (31.61%) reported both these conditions. On the other hand, while almost 16% of those over 80 years reported a depressive disorder diagnosis and at least one fall, about 26% and 35% reported a depressive disorder diagnosis and falls in the age-groups of 70–79 years and 60–69 years respectively.

3.2. Multivariable analysis

In Table 3, we present results from two sets of logistic regression models. While the first set of models (models 1–2) report the cross-sectional association between the depression and social isolation

Table 1

Living alone (social isolation indicator), depressive disorder diagnosis (depression indicator), and falls reported by adults 60 years and older, BRFSS 2018.

	Unweighted (n = 107,881)		Weighted (N = 32,685,239)	
	n	%	%	(SE) [†]
Living alone (Social Isolation Indicator)				
60 years and older	50,801	47.09	34.00	(0.34)
60–69 years	15,596	36.77	24.56	(0.43)
70–79 years	18,935	46.65	33.82	(0.56)
80 and above	16,270	65.40	51.77	(0.84)
Depressive disorder diagnosis (Depression Indicator)				
60 years and older	16,456	15.25	15.54	(0.26)
60–69 years	8,178	19.28	19.47	(0.45)
70–79 years	5,968	14.70	15.01	(0.44)
80 and above	2,310	9.28	9.14	(0.45)
Falls				
60 years and older	30,569	28.34	27.72	(0.33)
60–69 years	11,273	26.58	26.42	(0.51)
70–79 years	11,260	27.74	27.22	(0.57)
80 and above	8,036	32.30	30.89	(0.76)

Note: [†] SE = standard error.

n = unweighted observations, N = weighted observations.

indicators, in the second set (models3-4), we examine the cross-sectional association between the depression and falls indicators. All models are adjusted for the covariates that included sociodemographics, socioeconomic, and health conditions and behaviors of respondents we listed in the previous section. In order to observe the differences across the elderly age categories, we interacted the age variable with the two key explanatory variables – the social isolation and depression indicators – in two separate sets of regression models, while also controlling for the main effects of these explanatory variables. While in Models 1 and 3, we compared the differences across the three age-groups of 60–69 years, 70–79 years, and 80 years and above, we collapsed these age-groups into two categories for further analysis in Models 2 and 4.

Social isolation and depression indicators (Models 1–2): Model 1 reveals that the older adults who reported living alone (compared to those who did not) were more likely to also report a depressive disorder diagnosis (OR = 1.18, 95% CI = 1.04, 1.34). Together, the interaction terms in Model 1 indicate that the likelihood of self-reported depressive disorder may be the highest among seniors 80 years and older and living alone. To probe this result further, we collapsed the age categories into the two groups of 60–79 years and 80 years and above in Model 2. Similar to Model 1, Model 2 indicates that the older adults who reported living alone (compared to those who did not) were more likely to also report a depressive disorder diagnosis (OR = 1.11, 95% CI = 1.00, 1.23). This likelihood was higher among the 80 years and older living alone (Model 2 interaction term: OR = 1.45, 95% CI = 1.01, 2.09). Although Pseudo-R2 in logistic regression is usually low since observed outcomes are either 0 or 1 but predicted values are in between these two 0/1 values, the Pseudo R2 values in both Models 1 and 2 indicate modestly strong models.

Depression and fall indicators (Models 3–4): Models 3 and 4 reveal a positive association between self-reported depressive disorder diagnosis

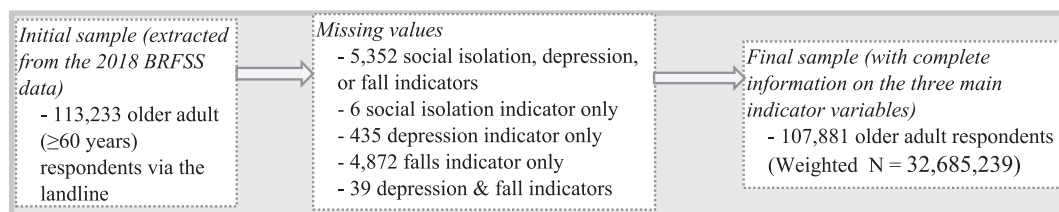


Fig. 1. Selection of the study sample.

Table 2

Self-reported depressive disorder diagnosis (depression indicator) and falls (fall indicator): Weighted estimates (% (standard error)) stratified by older adult age groups, BRFSS 2018.

	Depression Indicator (Older adults reporting depression)			Fall Indicator (Older adults reporting falls)		
	60–69 years [2]	70–79 years [3]	80 years and above 4]	60–69 years [5]	70–79 years [6]	80 years and above [7]
n	42,410	40,592	24,879	42,410	40,592	24,879
N	13,573,722	11,778,049	7,333,467	13,573,722	11,778,049	7,333,467
Social Isolation (Living alone)	0.00 [†]	0.00 [†]	0.01 [†]	–	–	–
No = 0	68.39 (1.24)	58.66 (1.57)	41.79 (2.68)	–	–	–
Yes = 1	31.61 (1.24)	41.34 (1.57)	58.21 (2.68)	–	–	–
Depression	–	–	–	0.00 [†]	0.00 [†]	0.00 [†]
No = 0	–	–	–	64.88 (1.17)	74.12 (1.10)	84.37 (0.96)
Yes = 1	–	–	–	35.12 (1.17)	25.88 (1.10)	15.63 (0.96)

Note: [†] χ^2 p-value;

n = unweighted observations, N = weighted observations.

Table 3

Multivariable analysis: Self-reported depressive disorder diagnosis (depression indicator) and falls (fall indicator) of older adults, BRFSS 2018

	Depression Indicator	
	Model 1	Model 2
	OR [95% CI]	OR [95% CI]
Age		
70–79 years [Ref: 60–69 years]	0.58 ^{†††} [0.51, 0.66]	–
80 years and above [Ref: 60–69 years]	0.20 ^{†††} [0.16, 0.25]	–
80 years and above [Ref: 60–79 years]	–	0.27 ^{†††} [0.22, 0.32]
Social isolation indicator		
Living alone [Ref: Not living alone]	1.18 ^{††} [1.04, 1.34]	1.11 ^{††} [1.00, 1.23]
Interaction effects [3 age groups]		
70–79 years	1.16 [0.83, 1.61]	–
80 years and above	1.46 [0.98, 2.17]	–
Interaction effects [2 age groups]		
80 years and above	–	1.45 ^{††} [1.01, 2.09]
Pseudo R2	0.1023	0.0940
Log pseudolikelihood	–9287040.9	–9372898.2
Falls Indicator		
Model 3		Model 4
OR [95% CI]		OR [95% CI]
Age		
70–79 years [Ref: 60–69 years]	1.00 [0.90, 1.10]	–
80 years and above [Ref: 60–69 years]	1.09 [0.98, 1.22]	–
60–69 years [Ref: 70 years and above]	–	0.97 [0.89, 1.06]
Depression indicator		
Depressive disorder [Ref: No depressive disorder]	2.30 ^{†††} [2.02, 2.62]	1.94 ^{†††} [1.70, 2.21]
Interaction effects [3 age groups]		
70–79 years	1.89 [†] [1.33, 2.65]	–
80 years and above	2.25 [1.56, 3.25]	–
Interaction effects [2 age groups]		
60–69 years	–	2.29 [†] [1.67, 3.16]
Pseudo R2	0.0870	0.0867
Log pseudolikelihood	–15464074	–15469985

Note:

Multivariable models include sex, race/ethnicity (socio-demographics), education, income, employment status and home ownership (socio-economic status), diabetes, cardiovascular diseases, kidney disease, arthritis, difficulty walking/bathing/dressing, body mass index (health status), alcohol consumption, physical activity, and sleep habits (health behavior) as covariates.

††† p < 0.01, †† p < 0.05, † p < 0.10; OR = odds ratio; CI = confidence interval.

and falls (Model 3: OR = 2.30, 95% CI = 2.02, 2.62; Model 4: OR = 1.94, 95% CI = 1.70, 2.21). In addition, the Model 3 interaction terms together indicate a lower likelihood of self-reported falls among both older categories of 70–79 years and 80 years and older who reported a

depressive disorder diagnosis. To examine this variation in the age-based association further, we compared differences across the two age groups of 60–69 years and 70 years and above in Model 4. We found that the likelihood of a fall among those reporting a depressive disorder diagnosis was higher in the 60–69 year old category (OR = 2.29, 95% CI = 1.67, 3.16) compared to seniors 70 years and older. The Pseudo R2 values in both Models 3 and 4 indicate a modest model fit.

4. Discussion

Using the 2018 BRFSS dataset, we examined how the associations between: i) living alone (social isolation indicator) and depressive disorder diagnosis (depression indicator), and ii) depressive disorder diagnosis (depression indicator) and falls reported by noninstitutionalized older adults varied across older adult age categories after controlling for a parsimonious set of individual characteristics. One of our key findings is that the likelihood of self-reported depressive disorder diagnosis is higher among the oldest old (80 years and above) living alone. Previous studies have found social isolation to be the most apparent in older adults who live alone (Victor et al., 2000), and reported an increase in isolation with progressive aging of seniors (Hawkey and Kocherginsky, 2018; Victor et al., 2000; Holmen et al., 1992). Additionally, studies examining the etiology of older adult depression have highlighted social isolation (Fiske et al., 2009; NAS, 2020; Schwarzbach et al., 2014). We add to this evidence-base by highlighting that the 80 years and older may warrant targeted consideration specifically in programs addressing depressive disorder among those living alone. Such an age-based approach may be necessary to improve health interventions since the elderly are indeed a heterogeneous group (NAS, 2020).

A variety of interventions has been employed to alleviate social isolation of depressed seniors who live alone. Among them, the role of healthcare is discussed in the literature (Veazie et al., 2019). Health providers, particularly formal home-based care, present an avenue since these providers may be the only form of social contact for the severely isolated 80 years and older (Academies and of Sciences, Engineering, and Medicine (NAS), 2020) and, as consumption of home visits is higher among those living alone (Gerst-Emerson and Jayawardhana, 2015). For example, Medicare and Medicaid’s Togetherness Program was launched in 2017, incorporates a home visit component, and is showing signs of initial success in improving older adult health (NAS, 2020). Similar opportunities to address isolation of elders living alone exist in Medicaid’s home health care services and such other outreach programs as Meals on Wheels (MOW) (2020) (NAS, 2020).

Our second key finding from the multivariable analysis (Table 3) indicated a higher likelihood of falls among seniors reporting a depressive disorder diagnosis. Additionally, we found this likelihood to be higher among the 60–69 year olds reporting a depressive disorder diagnosis. In synergy, the literature provides evidence on increased falls of depressed seniors (Biderman et al., 2002; Iaboni and Flint, 2013; Kao

et al., 2012). Our finding of age-based variation in the relation between depression diagnosis and falls reported by older adults is however in need of further research. While our analysis using the BRFSS dataset did not allow investigation on the effect of pharmacology, medications prescribed for older adult depression may have played a role (Iaboni and Flint, 2013). Antidepressants are known to increase seniors' fall risk (Darowski et al., 2009; Iaboni and Flint, 2013; Tinetti, 2003). Why and how this effect may (or may not) be more pronounced in the younger 60–69 year olds, and consequently their falls will be requisite questions for future research.

Nevertheless, given that antidepressants can increase fall risk, consensus exists regarding exercise-based interventions for managing depression among fall-prone older adults (Iaboni and Flint, 2013). Our results from the multivariable analysis supported such an alternative path – not being physically active increased the likelihood of self-reported falls among seniors. Group-based exercise, fitness, and activity programs, such as *A Matter of Balance* (AMOB) (Evidence-Based Leadership Council [EBLC], 2020) or, SilverSneakers (Tivity Health Inc, 2020), are especially highlighted as these interventions also help to address social isolation of seniors (Brady et al., 2020; NAS, 2020; Veazie et al., 2019). Studies demonstrate benefits associated with such evidence-based falls prevention programs in increasing physical activity, reducing falls and social isolation, and improving older adult health (Brady et al., 2020; Choi et al., 2019). Given that we found a higher likelihood of falls among the 60–69 year olds (compared to the 70 years and older) reporting a depressive disorder diagnosis, physical activity programs for this group may be beneficial. Tailoring may also be warranted as the 60–69 year olds are typically more active physically and are in better health (Kelsey et al., 2012; Li et al., 2006) than the older 70 years and above.

5. Limitations

Use of the BRFSS data limited us to self-reported information, which most often suffers from recall bias and under-/over-reporting of health by respondents. Nevertheless, prior studies have examined and reported on the acceptable reliability of prevalence estimates and validity of BRFSS questions (Hsia et al., 2020; Pierannunzi et al., 2013). However, self-reporting of health status, such as depressive disorder diagnosis, in BRFSS is distinct from medical diagnosis of health conditions. Despite this divergence, we contend that the findings of our study are of relevance to public health promotion and practice as evidence in prior studies indicate self-reported health to be valid predictors of individual health outcomes (NRC, 2001; Lorem et al., 2020).

Secondary analysis using the BRFSS dataset also meant that we could not incorporate certain potential confounders, such as effects of a/any medications or polypharmacy, to name a couple, in our analysis. We also could not examine factors that influence gait balance and mood of seniors, such as vitamin B12 deficiency, as the BRFSS survey did not collect information on these variables. Additionally, our results indicated associations, and not causation, since we conducted a cross-sectional analysis of the three geriatric conditions. Lastly, we used the status of “living-alone” to represent social isolation and therefore could not take into account quality and quantity of social interactions, engagement, and support. Nonetheless, as we indicated earlier, the status of living alone provides a useful starting point to represent and interpret isolation of seniors and has been used most frequently in prior studies (Havinghurst, 1978; Hawkey and Kocherginsky, 2018; Holmen et al., 1992; Holt-Lunstad et al., 2015; Hunt, 1978; NAS, 2018; Pohl et al., 2018; Shaw et al., 2017; Wenger et al., 1996; Victor et al., 2000).

6. Conclusion

Social isolation, depression, and falls of older adults are high priority topics in public health. Most prior studies have conducted analysis in which older adults constituted one single group. Instead, acknowledging

age-based heterogeneity of seniors, we examine cross-sectional variations across the age-categories of 60–69 years, 70–79 years, and 80 years and older using indicators of social isolation, depression, and falls. Our results indicated a higher likelihood of self-reported depression among the oldest 80 years and above who reported living alone. Conversely, among seniors reporting a depressive disorder diagnosis, the 60–69 year olds had a higher likelihood of reporting a fall. These findings are relevant for health promotion and care delivery for seniors. In connection, we highlighted the salience of home-based health care for the 80 years and older living alone and tailored exercise-based programs for the 60–69 year olds with a diagnosis of depression.

7. Financial disclosure

The authors acknowledge there are no financial disclosures to provide.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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