Changes in the Prevalence of Symptoms of Depression, Loneliness, and Insomnia in U.S. Older Adults With Type 2 Diabetes During the COVID-19 Pandemic: The Look AHEAD Study

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OBJECTIVE

To evaluate changes in the prevalence of depressive symptoms, loneliness, and insomnia among older adults with type 2 diabetes from 2016 to 2020 and to assess risk factors for these conditions including demographics, multimorbidity, BMI, treatment group, and pre-coronavirus 2019 (COVID-19) measure scores.

RESEARCH DESIGN AND METHODS

This was a prospective, observational study of participants from the Look AHEAD (Action for Health in Diabetes) cohort study. Data were from two assessments before COVID-19 (visit 1: April 2016–June 2018 and visit 2: February 2018–February 2020) and one assessment during COVID-19 (visit 3: July–December 2020). Surveys were administered to assess depressive symptoms, loneliness, and insomnia.

RESULTS

The study included 2829 adults (63.2% female, 60.6% White, mean [SD] age 75.6 [6.0] years). The prevalence of mild or greater depressive symptoms did not change significantly between the two pre-pandemic visits ($P = 0.88$) but increased significantly from pre- to during COVID-19 (19.3% at V2 to 30.4% at V3; $P < 0.001$). Higher odds of mild or greater depressive symptoms at V3 were associated with being female (adjusted odds ratio [OR] 1.4 [95% CI 1.1–1.7]), identifying as non-Hispanic White (OR 1.4 [95% CI 1.1–1.7]), having obesity (OR 1.3 [95% CI 1.0–1.5]), and reporting mild or greater depressive symptoms at V1 (OR 4.0 [95% CI 2.9–5.4]), V2 (OR 4.4 [95% CI 3.2–5.9]), or both visits (OR 13.4 [95% CI 9.7–18.4]). The prevalence of loneliness increased from 12.3% at V1 to 22.1% at V3 ($P < 0.001$), while the prevalence of insomnia remained stable across visits at 31.5–33.3%.

CONCLUSIONS

The prevalence of mild or greater depressive symptoms in older adults with diabetes was more than 1.6 times higher during COVID-19 than before the pandemic.

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**A complete list of the members of the Look AHEAD Research Group can be found in the supplementary material online.*

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On 21 January 2020, the first case of coronavirus disease 2019 (COVID-19) was confirmed in the U.S. On 19 March 2020, California was the first state to issue a stay-at-home order, with most states decreeing similar orders in the subsequent months (1). Since this time, much of the U.S. population has experienced a considerable decrease in in-person social contact. These physical distancing rules as well as other factors related to the pandemic (e.g., fear of illness and unemployment) may be related to increases in mental health conditions. Studies have suggested that the COVID-19 pandemic is associated with increased symptoms of depression (2,3), loneliness (4), and insomnia (5), but the majority of investigations have relied on cross-sectional data or comparisons of prevalence data ascertained in different samples at multiple time points. Temporal trends in prevalence are best derived through continuous monitoring; few prospective studies have been published that include assessments of mental health prior to the pandemic.

People >65 years of age and those with underlying medical conditions such as type 2 diabetes and obesity are particularly vulnerable to negative outcomes from COVID-19 (6,7). Little is known, however, about the impact of the COVID-19 pandemic and related mitigation strategies on psychosocial well-being in older adults with chronic conditions. This prospective, observational cohort study evaluated changes in depressive symptoms, loneliness, and insomnia in older adults with type 2 diabetes and overweight or obesity from the Look AHEAD (Action for Health in Diabetes) study. Look AHEAD was a randomized controlled trial that examined the effects of an intensive lifestyle intervention (ILI) compared with a diabetes support and education control group on cardiovascular morbidity and mortality (8) and was later converted to an observational cohort study in 2012. We hypothesized that the prevalence of mild or greater depressive symptoms, loneliness, and insomnia would be increased during the COVID-19 pandemic compared with pre-pandemic levels. We selected mild or greater depressive symptoms as our primary outcome to capture subthreshold changes in mood that may have occurred during the pandemic and to be consistent with our previous reports that used similar thresholds (9,10). We also examined changes in moderate or greater depressive symptoms. We analyzed risk factors for developing these adverse conditions during the pandemic, including race/ethnicity, age, multimorbidity, sex, BMI, treatment group, and pre-COVID scores on these measures. In addition, we assessed the cross-sectional prevalence of anxiety and level of personal perceived threat from COVID-19.

RESEARCH DESIGN AND METHODS

A total of 5,145 participants enrolled in Look AHEAD from 2001–2004 at 16 sites across the U.S. (8). Eligible individuals had type 2 diabetes, were 45–76 years of age, and had a BMI ≥25 kg/m^2 (or ≥27 kg/m^2 if taking insulin). Participants were excluded if they had a current diagnosis of psychosis or bipolar disorder or were hospitalized for depression in the past 6 months. Additional eligibility criteria have been reported previously (8). The Look AHEAD Extension Study was an observational cohort study that examined whether ILI, provided for 10 years during midlife, had enduring benefits that lasted beyond the intervention. The study included brief questionnaire assessments of depressive symptoms, loneliness, and insomnia, measured at one or two times before the COVID-19 pandemic: visit 1 (April 2016–June 2018) and visit 2 (February 2018–February 2020). All visit 2 assessments ended just prior to the pandemic. Follow-up assessments during the pandemic (visit 3) were completed using questionnaires, which were mailed to participants or administered by phone. These assessments were conducted from July to December 2020 to measure the impact of the ongoing COVID-19 pandemic on depressive symptoms, loneliness, and insomnia. Participants also completed measures of anxiety and perceived COVID-19 threat at this time, which were not included in the two prior visits. This study was approved by institutional review boards at the respective sites, and participants provided verbal or written informed consent.

Measures

Symptoms of Depression

Depressive symptoms were assessed using the Patient Health Questionnaire-8 (PHQ-8) (11), a clinically validated measure (that does not include the suicidality question contained in the PHQ-9). Symptoms were defined as none/minimal (0–4), mild (5–9), moderate (10–14), moderately severe (15–19), and severe (≥20). Binary classification of mild or greater depressive symptoms was defined by a score of ≥5 and moderate or greater symptoms by a score of ≥10 (11,12).

Anxiety

The Generalized Anxiety Disorder scale (GAD-7) was used to assess symptoms of anxiety (13). Scores were categorized into no/minimal anxiety (0–4), mild (5–9), moderate (10–14), and severe (15–21) (14). Binary classification of anxiety was determined by a score ≥10. The three-item Perceived Coronavirus Threat Questionnaire-Short was used to assess worry, fear, and threat related to COVID-19 (15). Scores range from 3 to 21, with higher scores indicating greater perceived threat.

Loneliness

Loneliness was assessed with the three-item UCLA Brief Loneliness Scale (16). A cutoff of ≥6 was used for high loneliness, as in previous studies (17).

Insomnia

The validated, five-item Women's Health Initiative Insomnia Rating Scale was used to evaluate perceived insomnia symptoms (18,19). A score of ≥9 indicates clinically significant insomnia (18,19).

Demographic and Clinical Subgroups

Sex was defined as a binary variable (male or female). Age was included as a continuous variable in regression analyses and classified as a categorical variable, either above or below the median age of 75 years, for graphical presentation. Weight was measured in clinic at visit 1 and visit 2. Self-reported weight was used to calculate BMI at visit 3. BMI was dichotomized as obese (≥30 kg/m^2) and nonobese (<30 kg/m^2). A multimorbidity index score was computed using a composite score of eight conditions: cancer, cardiac arrhythmia, chronic kidney disease, congestive heart failure, coronary artery disease, dyslipidemia, hypertension, and stroke (20).

Continuous values were used in regression analyses, and the median split was used to indicate low versus high comorbidities for graphical presentation. For primary analyses, race/ethnicity was categorized as a two-level variable due to sample size, defined as participants who identified as non-Hispanic White and participants from underrepresented populations. Exploratory, post hoc analyses were conducted with racial/ethnic subcategories.

Statistical Analysis

The main measures of interest were depressive symptoms, loneliness, and insomnia. Participants who completed these questionnaires, as well as the questionnaire on anxiety, during the COVID assessment were included in the data set. For each primary outcome, the sample included participants who had complete data at all applicable visits. We calculated the prevalence and 95% CIs of mild or greater depressive symptoms, moderate or greater depressive symptoms, loneliness, and insomnia at each visit and used McNemar's test to compare the prevalence between visits, both overall and within demographic and clinical subgroups. Continuous scores on the same measures were compared using paired *t* tests.

Cross-sectional analyses compared depressive symptoms, anxiety, perceived COVID-19 threat, loneliness, and insomnia symptoms between subgroups of interest. For these exploratory analyses, prevalence in subgroups was compared using χ^2 tests for categorical classifications and ANOVAs for continuous variables. We used a series of multivariable logistic regression models to estimate odds ratios (ORs) of mild or greater depressive symptoms at visit 3 for our subgroups of interest, controlling (as covariates) for other subgroups and mild or greater depressive symptoms at previous visits.

Similar analyses were conducted for moderate or greater depressive symptoms, anxiety, loneliness, and insomnia. Linear regression analyses were used to assess perceived COVID-19 threat. An UpSet plot was created to visualize the cross-sectional overlap among conditions potentially associated with clinically significant distress, including: moderate or greater depressive symptoms; moderate or greater anxiety; loneliness; and insomnia (21).

RESULTS

Participant Characteristics

Of a total of 3,315 contacted participants, 2,829 completed the survey for a completion rate of 85.3%. Responders, relative to nonresponders, were younger with lower multimorbidities and prior depressive and loneliness symptoms (Supplementary Table 1). Of responding participants, 2,652 had completed at least one of the longitudinal questionnaires of interest at visit 1, and 2,679 completed at least one at visit 2. The number of participants who completed questionnaires at each time point is shown in Supplementary Table 2. The visit 3 (COVID) questionnaire was administered a mean ± SD of 3.3 ± 0.6 years after visit 1 and 1.4 ± 0.6 years after visit 2. Table 1 presents sample demographic and clinical characteristics.

Depressive Symptoms

The sample reported a significant increase in mean depressive symptoms from 2.5 ± 3.3 at visit 2 to 3.5 ± 4.0 at visit 3 ($P < 0.001$) (Table 1). As shown in Supplementary Fig. 1, 30.4% ($n = 715$; 95% CI 28.5–32.2) of participants reported mild or greater depressive symptoms at visit 3, and 8.5% of the total cohort ($n = 200$; 95% CI 7.4–9.6) reported moderate or greater depressive symptoms. These prevalence values represented a significant increase from the 19.3% ($n = 454$; 95% CI 17.7–20.9) and 4.6% ($n = 109$; 95% CI 3.8–5.5) of participants who had reported mild or greater and moderate or greater depressive symptoms, respectively, at visit 2 (*P* values <0.001). Overall, the prevalence was 1.6 times higher for mild or greater depressive symptoms and 1.8 times higher for moderate or greater depressive symptoms at visit 3 than was the prevalence at visit 2. There were no significant changes in the prevalence of mild or greater and moderate or greater depressive symptoms from visit 1 to visit 2 ($P = 0.88$ and >0.99, respectively).

No subgroup demonstrated significant changes in mild or greater depressive symptoms from visit 1 to visit 2. By contrast, the prevalence of mild or greater depressive symptoms was significantly higher within every subgroup at visit 3 than at visit 2 (*P* values <0.001) (Fig. 1). Changes in moderate or greater depressive symptoms followed the same pattern. The prevalence of moderate or greater depressive symptoms was stable from visit 1 to visit 2, and it was significantly higher in every subgroup at visit 3 than at visit 2 (Fig. 1 and Supplementary Table 3). Higher odds of mild or greater depressive symptoms at visit 3 were associated with being female (adjusted OR 1.4 [95% CI 1.1–1.7]), identifying as non-Hispanic White (OR 1.4 [95% CI 1.1–1.7]), having obesity (OR 1.3 [95% CI 1.0–1.5]), and reporting mild or greater depressive symptoms at visit 1 (OR 4.0 [95% CI 2.9–5.4]), visit 2 (OR 4.4 [95% CI 3.2–5.9]), or both visits (OR 13.4 [95% CI 9.7–18.4]) (Table 2). In post hoc analyses, compared with participants who identified as non-Hispanic White, individuals who were American Indian/Native American/Alaskan Native or Hispanic had significantly lower odds of mild or greater depressive symptoms (Supplementary Table 4). Higher odds of moderate or greater depressive symptoms at visit 3 were associated with being female and reporting moderate or greater depressive symptoms at previous visits (Table 2).

Loneliness

The sample reported a significant increase in loneliness score from 3.8 ± 1.3 at visit 1 to 4.3 ± 1.6 at visit 3 ($P < 0.001$) (Table 1). At visit 3, 22.1% ($n = 579$; 95% CI 20.5–23.7%) of participants reported loneliness. This value represented a significant increase from the 12.3% ($n = 323$; 95% CI 11.1–13.6; $P < 0.001$) of respondents who reported loneliness at visit 1. The prevalence of loneliness was 1.8 times higher compared with the prevalence at visit 1. Female participants, and those who reported high loneliness at visit 1, had the highest odds of high loneliness at visit 3 (Table 2). Participants who were non-Hispanic White had higher odds of loneliness than those who were Black, American Indian/Native American/Alaskan Native Asian/Pacific Islander, and Hispanic, but lower odds of loneliness relative to individuals who were Asian/Pacific Islander or "other/mixed" (Tables 2 and Supplementary Table 4).

Table 1—Characteristics of the Look AHEAD cohort participating in the COVID-19 survey

Characteristics	Before COVID-19[a]		During COVID-19
	Visit 1	Visit 2	Visit 3
N	2,652	2,679	2,829
Sex (% female)	1,669 (62.9)	1,689 (63.1)	1,788 (63.2)
Race/ethnicity			
American Indian/Native American/Alaskan Native	155 (5.8)	156 (5.8)	165 (5.8)
Asian/Pacific Islander	29 (1.1)	31 (1.2)	31 (1.1)
Black	437 (16.5)	445 (16.6)	462 (16.3)
Hispanic	384 (14.5)	383 (14.3)	398 (14.1)
Other/mixed	55 (2.1)	55 (2.0)	58 (2.0)
White	1,592 (60.0)	1,609 (60.1)	1,715 (60.6)
Education[b]			
<13 years	514 (19.8)	521 (19.8)	553 (20.0)
13 to <16 years	955 (36.8)	968 (36.9)	1,023 (36.9)
≥16 years	1,126 (43.4)	1,136 (43.3)	1,193 (43.1)
Treatment (% in ILI)	1,361 (51.3)	1,371 (51.2)	1,458 (51.5)
Age (years), mean (SD)	72.2 (6.0)	74.1 (6.0)	75.6 (6.0)
Weight (kg), mean (SD)[c]	92.9 (20.0)	91.2 (19.6)	89.3 (19.8)
BMI (kg/m^2), mean (SD)[c]	34.2 (7.9)	33.5 (6.1)	31.9 (6.2)
Weight status (% with obesity)[c]	1,791 (71.8)	1,650 (68.6)	1,602 (57.6)
Multimorbidity, mean (SD)[d]	2.4 (0.9)	2.4 (0.9)	2.5 (0.9)
HbA_{1c} (%), mean (SD)	7.5 (1.4)	7.3 (1.3)	N/A
Depressive symptoms, mean (SD)[e]	2.5 (3.2)	2.5 (3.3)	3.5 (4.0)
Loneliness, mean (SD)[f]	3.8 (1.3)	N/A	4.3 (1.6)
Insomnia, mean (SD)[g]	7.0 (4.4)	7.1 (4.4)	6.7 (4.6)
Anxiety, mean (SD)[h]	N/A	N/A	2.4 (3.5)
Perceived COVID-19 threat, mean (SD)	N/A	N/A	10.6 (5.9)

Data are *n* (%) unless otherwise indicated. N/A, not available. [a]Includes only participants who completed visit 3. [b]Missing data for education were *n* = 57 at visit 1, *n* = 54 at visit 2, and *n* = 60 at visit 3. [c]Weights from visits 1 and 2 are from clinic visits. Weight from visit 3 was self-reported. [d]A multimorbidity index score was computed using a composite score of eight conditions: cancer, cardiac arrhythmia, chronic kidney disease, congestive heart failure, coronary artery disease, dyslipidemia, hypertension, and stroke. [e]Depressive symptoms assessed with the PHQ-8. [f]Loneliness determined by UCLA Brief Loneliness Scale. [g]Insomnia measured with Women's Health Initiative Insomnia Rating Scale. [h]Anxiety measured with GAD scale.

Insomnia

Overall, the sample reported a significant mean decrease in insomnia symptoms from 7.1 ± 4.4 at visit 2 to 6.7 ± 4.6 at visit 3 ($P < 0.001$). However, the categorical prevalence of insomnia did not change. At visit 3, 31.5% (*n* = 801; 95% CI 29.7–33.3%) of participants reported insomnia. This value was similar to the 33.3% of participants (*n* = 848; 95% CI 31.5–35.1%) at visit 2 ($P = 0.09$) and the 33.1% prevalence at visit 1 (*n* = 843; 95% CI 31.3–34.9%; $P = 0.13$). Of those who reported insomnia at visit 3, 42.5% had reported no or minimal symptoms at visit 2. Higher odds of insomnia at visit 3 were associated with being younger, reporting insomnia at visit 1, visit 2, or both visits, and identifying as non-Hispanic White (Table 2 and Supplementary Table 4).

Symptoms of Anxiety or Perceived COVID-19 Threat

Twenty percent (*n* = 565; 95% CI 18.5–21.4) of participants reported symptoms of mild or greater anxiety at visit 3, of whom 5.0% of the total cohort (*n* = 140; 95% CI 4.1–5.7) reported symptoms of moderate or greater anxiety. Females, compared with males, and participant who were younger had higher odds of moderate or greater anxiety (Table 2). The overall perceived coronavirus threat score was 10.6 ± 5.9. Greater perceived COVID threat was associated with being younger, female, and from underrepresented racial/ethnic groups (Table 2 and Supplementary Table 4).

Overlap in Symptoms During COVID-19

Figure 2 shows the overlap in symptoms of moderate or greater depressive symptoms, moderate or greater anxiety, loneliness, and insomnia at visit 3. Less than half of the sample (*n* = 1,234, 43.6%) met thresholds for at least one of these conditions. Of those participants, 40.4% (*n* = 499) of participants had insomnia alone, 19.5% (*n* = 241) had loneliness alone, and 15.5% (*n* = 191) had insomnia and loneliness.

CONCLUSIONS

Few studies have been able to identify and separate the mental health consequences of exposure to the COVID-19 pandemic from preexisting factors. Using a large cohort of older adults with type 2 diabetes and overweight/obesity from across the U.S., this prospective study showed that from pre-COVID to

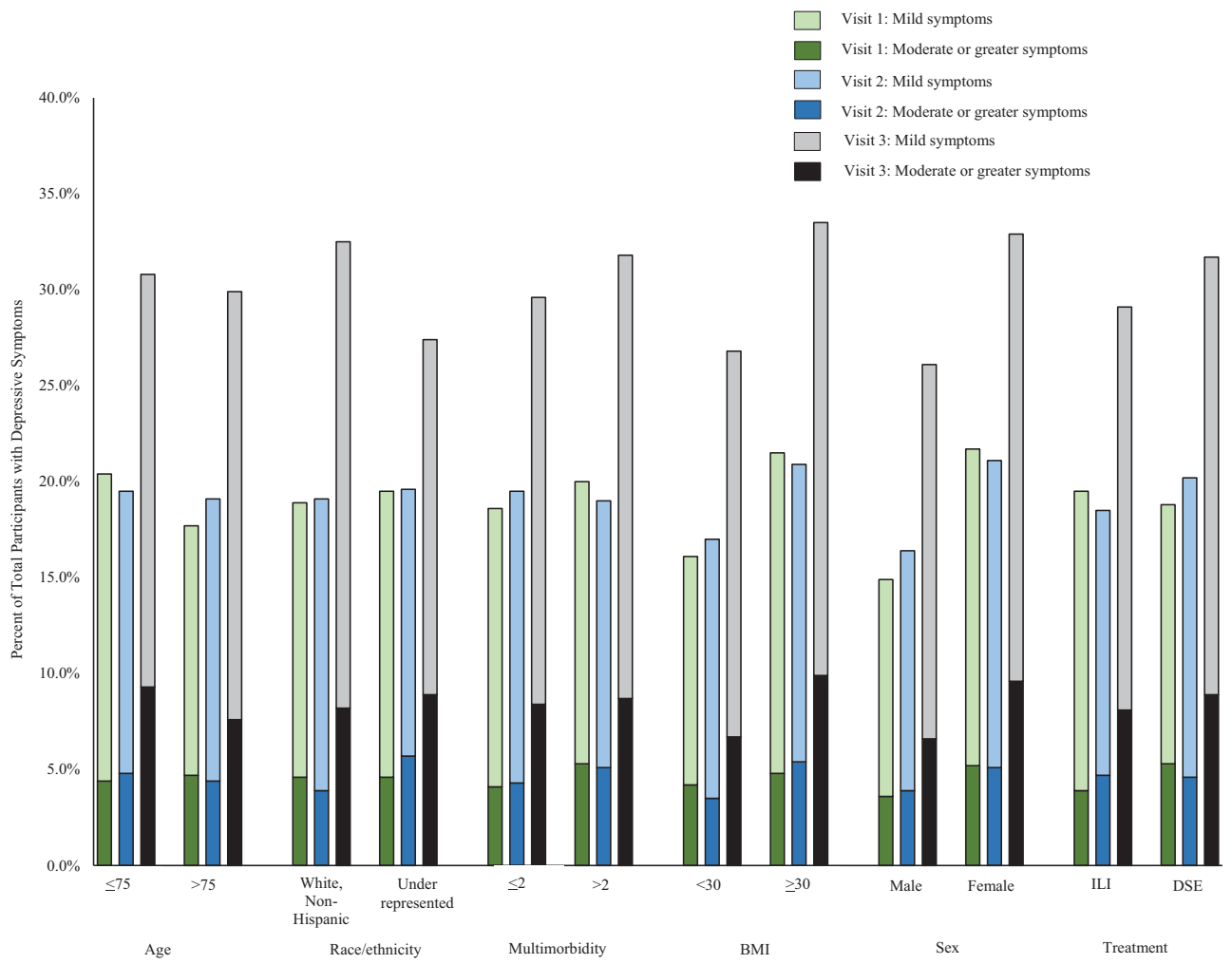

Figure 1—Prevalence of depressive symptoms before and during the COVID-19 pandemic by subgroup. Visit 1 was April 2016 to June 2018, visit 2 was February 2018 to February 2020, and visit 3 was July to December 2020. Depressive symptoms were measured with the PHQ-8. Scores are shown as moderate or greater (≥10) in the darker shade and mild (≥5 to <10) in the lighter shade. For each subgroup shown in the figure, within-group comparisons revealed that the percentages of participants who reported mild or greater depressive symptoms, as well as moderate or greater depressive symptoms, did not differ significantly from visit 1 to visit 2. By contrast, the percentage of participants who reported mild or greater depressive symptoms was significantly higher at visit 3 than at visit 2. The percentage that reported moderate or greater depressive symptoms was also significantly higher at visit 3 than visit 2.

during the COVID-19 pandemic, the prevalence of mild or greater depressive symptoms increased by 1.6 times, loneliness rose by 1.8 times, and insomnia remained stable. In the 3 years prior to the pandemic, the prevalence of these adverse conditions had been stable. While this study provides evidence that the pandemic was associated with increased prevalence of depressive symptoms and loneliness in some participants, more than half of participants remained free of adverse mental health conditions.

Similar to findings from cross-sectional analyses (2–4), our longitudinal results showed that depressive symptoms increased during the COVID-19 pandemic. Prior to the pandemic, 19.3% of this sample reported mild or greater depressive symptoms, of whom 4.6% had clinically significant symptoms that were moderate or greater. This prevalence is similar to the 18.4% prevalence of mild or greater symptoms (including 6.4% with moderate or greater symptoms) reported in older adults participating in the National Health Interview Study (22). During the pandemic, the prevalence of moderate or greater depressive symptoms rose to 8.5%, which is consistent with data from a representative panel survey of U.S. older adults showing a prevalence of 5.8% during the pandemic (23).

Our sample of participants had a heterogeneous response to the pandemic. While we observed increases in symptoms of adverse mental health conditions, the overall percent of the total sample affected, as well as the mean symptom scores, remained low. During the pandemic, more than half of the sample did not report symptoms consistent with impaired mental health. Several studies have suggested that, compared with younger adults, older individuals have had smaller increases in mental health conditions during the pandemic (23–26). In a community-based survey, the prevalence ratio of adverse mental or behavioral health

Table 2—Multivariable adjusted ORs or parameter estimates for psychosocial outcomes during COVID (visit 3) by demographic and clinical factors

	Milder or greater depressive symptoms		Moderate or greater depressive symptoms		Loneliness		Insomnia		Anxiety		COVID-19 threat	
Variable	OR (95% CI)	*P* value	OR (95% CI)	*P* value	OR (95% CI)	*P* value	OR (95% CI)	*P* value	OR (95% CI)	*P* value	Parameter estimate	*P* value
Age	1.00 (0.98–1.02)	0.76	0.99 (0.96–1.02)	0.50	1.00 (0.98 – 1.01)	0.66	0.98 (0.97–1.00)	0.04	0.95 (0.92–0.98)	0.001	−0.08 (−0.12 to −0.04)	<0.001
Sex		0.004		0.03		<0.001		0.78		0.003		<0.001
Male	1 (Reference)		1 (Reference)		1 (Reference)		1 (Reference)		1 [Reference)		1 (Reference)	
Female	1.37 (1.11–1.69)		1.46 (1.03–2.07)		2.11 (1.68–2.64)		1.03 (0.84–1.25)		1.86 (1.24–2.81)		1.01 (0.56–1.46)	
Race/ethnicity		0.002		0.70		0.002		0.01		0.33		<0.001
Underrepresented[a]	1 (Reference)		1 (Reference)		1 (Reference)		1 (Reference)		1 (Reference)		1 (Reference)	
Non-Hispanic White	1.39 (1.13–1.71)		1.07 (0.77–1.48)		1.41 (1.13–1.74)		1.30 (1.07–1.59)		1.20 (0.83–1.73)		−2.23 (−2.68 to −1.78)	
MMI	1.11 (0.99–1.25)	0.08	1.06 (0.88–1.28)	0.55	1.09 (0.97–1.23)	0.14	0.94 (0.84–1.05)	0.28	1.15 (0.94–1.41)	0.16	0.23 (−0.02 to 0.48)	0.07
BMI[b] (kg/m^2)		0.03		0.05		0.08		0.92		0.62		0.59
<30	1 (Reference)		1 (Reference)		1 (Reference)		1 (Reference)		1 (Reference)		1 (Reference)	
≥30	1.26 (1.03–1.54)		1.39 (1.00–1.93)		1.20 (0.98–1.48)		1.01 (0.84–1.22)		0.91 (0.64–1.30)		0.12 (−0.32 to 0.56)	
Treatment arm		0.36		0.85		0.91		0.94		0.87		0.72
DSE	1 (Reference)		1 (Reference)		1 (Reference)		1 (Reference)		1 (Reference)		1 (Reference)	
ILI	0.91 (0.75–1.11)		0.97 (0.71–1.32)		1.01 (0.83–1.23)		0.99 (0.82–1.19)		1.03 (0.73–1.46)		0.08 (−0.35 to 0.51)	
Previous score		<0.001		<0.001		<0.001		<0.001				
None	1 (Reference)		1 (Reference)		1 (Reference)		1 (Reference)					
Visit 1 only	3.99 (2.94–5.43)		5.65 (3.27–9.77)		7.43 (5.75–9.61)		2.87 (2.19–3.77)					
Visit 2 only	4.36 (3.21–5.92)		10.53 (6.39–17.36)				3.37 (2.59–4.40)					
Visit 1 plus visit 2	13.37 (9.69–18.43)		21.88 (10.48–45.68)				8.88 (7.04–11.20)					

ORs and parameter estimates are from multivariable models adjusted for demographic and clinical variables listed in the table. Complete case analysis was used for multivariable logistic regressions, which resulted in 2,315 participants for depressive symptoms, 2,780 for anxiety, 2,573 for loneliness, 2,505 for insomnia, and 2,766 for perceived COVID-19 threat. Mild or greater depressive symptoms were defined as a PHQ-8 score ≥5, moderate or greater depressive symptoms as a PHQ-8 score ≥10, anxiety as a GAD-7 score ≥10, loneliness as a three-item UCLA Brief Loneliness Scale score ≥6, and insomnia as a Women's Health Initiative Insomnia Rating Scale score ≥9. DSE, diabetes support and education; MMI, multimorbidity index score. [a]Underrepresented populations include participants who identified as American Indian/Native American/Alaskan Native, Asian/Pacific Islander, Hispanic, Black, or other/mixed. [b]BMI using self-reported weight from visit 3.

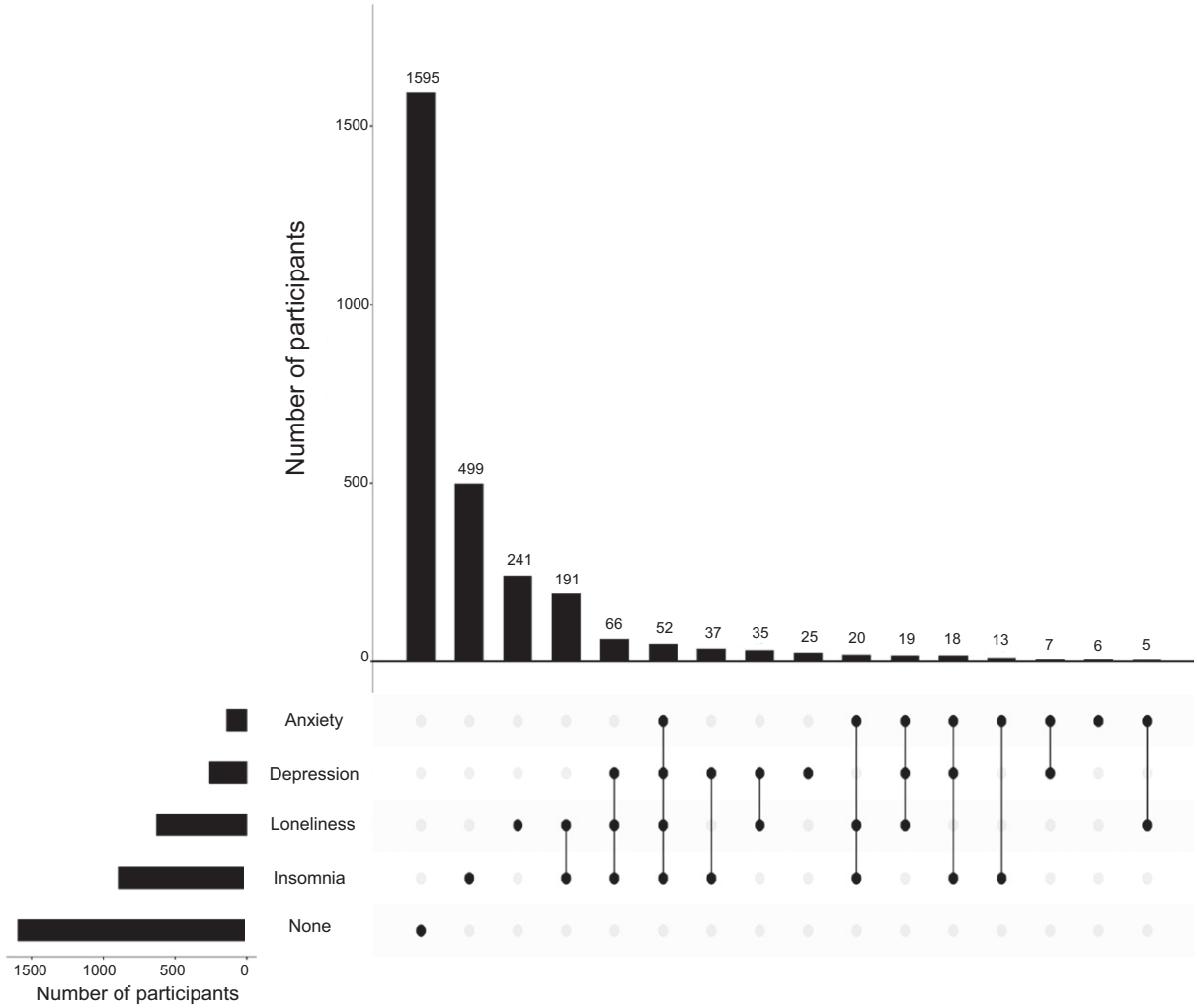

Figure 2—UpSet plot of overlap in categorical prevalence of depressive symptoms, anxiety, loneliness, and insomnia during COVID-19. Number of total participants (N = 2,829) with each mental health condition during the COVID-19 assessment. The strip at the bottom left shows the number of participants with each mental health condition. The dots and lines at the bottom right represent the subsets of overlap. The number of participants in each subset is represented in the histogram. Depressive symptoms were defined as a PHQ-8 ≥10, anxiety as a GAD-7 ≥10, loneliness as a UCLA Brief Loneliness ≥6, and insomnia as Women's Health Initiative Insomnia Rating Scale ≥9.

symptoms was 3.6 times higher in participants 18 to 24 years of age than in those ≥65 years (25).

Taken together, these data suggest that many older adults have shown resilience to potential adverse mental health consequences of the pandemic, even with the heightened risks they faced. The psychological resiliency of some older adults may be related to internal factors (e.g., biological stress response, personality traits, physical health, and retirement status), as well as external resources (e.g., social and familial support and financial stability). Preexisting psychological status was a consistent predictor of continuing to have this status during the pandemic. Relative to participants without a history of depressive symptoms in the previous 3 years, the odds of depressive symptoms during COVID were 4.0 and 4.4 times higher among individuals who reported these symptoms at visits 1 or 2, respectively, and 13.4 times higher among those who reported these symptoms at both visits. Similarly, compared with individuals without insomnia, odds of this condition at visit 3 were 2.8 and 3.4 times higher for those who had insomnia at visits 1 or 2, respectively, and 8.9 times higher among participants who had insomnia at both visits.

Sex and race/ethnicity were also predictors of impaired mental health. Women, relative to men, had greater odds of depressive symptoms, anxiety, loneliness, and perceived COVID-19 threat. Rates of depressive symptoms and anxiety are consistently higher in women than men in other studies (27,28), while the effects of sex on loneliness are mixed (29). Theories have suggested that during older age, women in heterosexual relationships may be lonelier than men because they live longer than their male spouses and may be more likely to be widowed (30). During the pandemic, women may not have been able to visit their social networks who lived outside of their households, such as friends or family, due to physical distancing (31). Compared with participants who were non-Hispanic White, those from underrepresented groups tended to have lower levels of depressive symptoms,

loneliness, and insomnia. Factors unrelated to the pandemic may account for these disparities, as racial/ethnic differences in the prevalence of mental health conditions have been noted prior to the pandemic (32). For example, compared with people who are non-Hispanic White, individuals who are Black or Hispanic are more likely to live in a multigenerational household, which could provide greater emotional support and companionship (33). However, further research is needed to test these hypotheses.

Stressful events, depressive symptoms, loneliness, and anxiety are often precipitating factors associated with insomnia (34). However, we found no significant change in the prevalence of insomnia from the pre-pandemic visit to during the pandemic. Nonetheless, insomnia was the most common condition observed in the study, reported by 31.5% of the sample at visit 3. Our pre-COVID prevalence estimates are similar to those of other studies that have found that insomnia symptoms range from 30–48% in older adults (35,36). These data suggest the need for sleep interventions in older adults.

Strengths of this study include the longitudinal and repeated-measures design. There was a high response rate. However, responders and nonresponders differed by age, multimorbidities, and prior depressive and loneliness symptoms, which may contribute to nonresponse bias. While we used well-established and validated screening measures of depressive symptoms and anxiety, a diagnosis of these conditions is ultimately made by a clinician. Further longitudinal studies will be necessary once the pandemic subsides to monitor for lasting psychological sequelae and to assess the clinical significance of our findings. The study sample was large and diverse, but all participants were from the Look AHEAD trial. Thus, outcomes may not fully generalize to the broader population of adults with type 2 diabetes. Findings related to sex and race/ethnicity may signal differences in some social, cultural, and economic factors that were not explicitly measured in this study; thus, findings of sex and racial/ethnic differences should be interpreted with caution. Other major societal events occurred during the pandemic (e.g., protests against police violence and a contentious political election). In addition, diabetes is a progressive condition. Data on the influence of societal events, A1C, and diabetes severity were not collected, but it is possible that these factors contributed to some of the study findings, including the reported increase in symptoms of depression.

In conclusion, our longitudinal study demonstrated that reports of mild or greater depressive symptoms, as well as loneliness, increased during the COVID-19 pandemic, yet over half of participants remained free of clinically significant levels of adverse mental health conditions. The prevalence of insomnia remained high but stable from before to during the pandemic. Participants at greatest risk of reporting symptoms of adverse mental health during COVID-19 were those who had reported such symptoms in the prior 3 years. Sex and race/ethnicity seemed to play an important role in these outcomes. Many older adults have demonstrated psychological resiliency amid the pandemic.

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