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The influences of depression and loneliness on A1C among middle-aged and older adults with diabetes

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ABSTRACT

Even before increased social isolation associated with the COVID-19 pandemic, 43% of adults aged 60 and older reported experiencing loneliness. Depression and loneliness often co-exist and are significant issues faced by middle-aged as well as older adults because each condition is likely to worsen health outcomes. This study of middle-aged and older adults examined how depression and loneliness affect diabetes (DM) control (A1C levels). This study is a secondary analysis of data from the Midlife in the United States Refresher (MIDUS-R) survey, a national survey of adults aged 25–74 years. Correlation analyses were conducted, and a hierarchical logistic regression was estimated to predict A1C levels ≤7% (recommended goal) or >7 using 1) demographics and physical health (ethnicity, gender, education, age, and comorbidities), 2) family and friend support, and 3) depression and loneliness. The sample of 92 participants with DM and A1C data from the MIDUS-R had mean age = 57.37, were 51% male, 68% non-Hispanic White; 39.1% had A1C >7. The average level of depression was low (CES-D mean 9.42) and loneliness was moderate (UCLA scale mean 12.43). Loneliness was correlated with A1C (r= .26, p< .05); depressive symptoms (r= .71, p< .001), family and friends support (r= −.36, r= −.38, respectively, both p< .001). Only loneliness significantly predicted higher A1C levels. People with higher levels of loneliness had increased odds of having A1C >7 (OR = 1.18, p < .05) after controlling for depression and all other variables. Loneliness had a greater impact than depression on A1C level among persons with DM. Healthcare providers should assess patients for loneliness as well as depression and reduce adverse health impacts by referring to psychosocial support as needed.

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Middle-aged adults (45–65 years [MA]) and older adults (≥65 years [OA], Livingston et al., 2020) comprise a large and growing proportion (42.7%) of the overall U.S. population (United States Census Bureau, 2020). Diabetes mellitus (DM) among MA and OA is a major health concern (Centers for Disease Control and Prevention, 2022), especially because MA and OA are at risk for social isolation and loneliness. The National Academies of Sciences, Engineering, and Medicine ([NASEM], 2020) reported

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that 24% of community-dwelling OA were socially isolated; and 35% of adults aged ≥45, and 43% at ≥60 years reported loneliness prior to the COVID-19 outbreak. People with DM engage in ongoing efforts to maintain blood glucose levels within a therapeutic range (A1C >7%) to prevent severe diabetes complications, such as retinopathy, nephropathy, and neuropathy (American Diabetes Association, 2022).

Social connectedness, a multifactorial construct and important health determinant, comprises two functional components: social support and loneliness (NASEM, 2020). Social support reflects positive perceptions about the availability of emotional and instrumental help and information from relationships. In contrast, loneliness reflects negative feelings about insufficient social connections (Cacioppo et al., 2014; Ong et al., 2016; Peplau & Perlman, 1982). Both social support and loneliness impact health behaviors and health status. People with smaller social networks or who felt lonely reported lower levels of physical activity, consumed fewer fruits and vegetables daily, were more likely to be overweight or obese, and to smoke (Ho et al., 2018; Kobayashi & Steptoe, 2018).

Social support and loneliness also associated with worse DM-specific self-management behaviors and outcomes. A systematic review of 37 studies of people with type 2 DM (T2DM) concluded that having higher social support was associated with better A1C, blood pressure, and lipid levels, fewer depressive symptoms, and lower diabetes-related distress (Strom & Egede, 2012). In contrast, loneliness is associated with higher A1C and body mass index (Shiovitz-Ezra & Parag, 2019). Loneliness may be worsened by DM-related complications, which often hinder patients' physical mobility, decrease engagement in social interactions, or strain relationships (Petitte et al., 2015).

Loneliness is associated with depression, and depression is highly prevalent among people with DM (Beutel et al., 2017; Egede & Ellis, 2010). The relationship between loneliness and depression may be bi-directional; both hinder self-management behaviors, and worsen metabolic control (Kusaslan Avci, 2018; Shiovitz-Ezra & Parag, 2019). People with depression and T2DM frequently have significantly higher A1C when compared to people with T2DM without depression (Papelbaum et al., 2011; Sharif et al., 2019). Research on the relationship between depression and A1C has been inconsistent and has not examined the impact of loneliness on the relationship. This study examines associations among loneliness, depression, and A1C among MA and OA with DM, controlling for demographics, physical health, and social support.

Methods

Study design and sampling

This study analyzes data from the Midlife in the United States – Refresher (MIDUS-R), a large national survey funded by the National Institute on Aging to investigate age-related variations in health and well-being among U.S. adults 25–74 years. This study sampled from 863 adults who also participated in the Biomarker sub-project (Weinstein et al., 2019) and included all participants who answered 'Yes' to 'Was your diabetes diagnosed by a physician?' and had data for A1C, loneliness, depression, and social support (n = 92).

Measures

Demographic and health data included age, sex, marital status, ethnicity, and education level, and the summed number of diagnosed chronic diseases (hypertension, heart disease, cancer, or arthritis).

Higher scores on four items asking how much friend and family members care, understand, are reliable, and can be confided in (response options '0 = not at all' to '4 = a lot' were summed and averaged by MIDUS-R) indicate more perceived support from family and friends. Because only total scores were reported, reliability is not available (Ryff et al., 2017).

The 20-item Center for Epidemiologic Studies Depression Scale (CES-D) asked about the frequency of depressive symptoms during the past week (response options 0 = never to 3 = most of the time or always). For this study, 'I felt lonely' was removed from the scale to prevent multicollinearity. Total scores ranged from 0 to 57; higher scores indicated more and higher frequency of depressive symptoms, $\alpha = 0.86$.

Seven items adapted from the University of California, Los Angeles Loneliness Scale (Russell, 1996) for MIDUS-R were summed; range of scores = 1–28; higher scores indicated more loneliness. Total scores were constructed by MIDUS-R, thus reliability data are not available.

The outcome variable is A1C. Higher levels indicate worse diabetes control (American Diabetes Association, 2022). Blood samples were collected and processed at clinical research units then analyzed in the MIDUS BioCore Lab (Weinstein et al., 2019). For this study, A1C was dichotomized using a cutoff of 7.0% (0 = A1C≤7, 1 = A1C>7) representing optimal and sub-optimal DM control (American Diabetes Association, 2022).

Data analysis

Data were managed and analyses computed using SPSS 25 for Windows statistical software (IBM Corp, 2017). Descriptive, Chi-square, correlations, and t-test were used to describe, examine associations, and compare differences between people in the two A1C groups. Hierarchical logistic regression estimated high versus therapeutic A1C level, entering sets of variables sequentially. Step 1 entered age, gender, marital status, and number of other chronic diseases. Step 2 entered family and friend support. Step 3 entered depressive symptoms. Step 4 entered loneliness. The significance level for all inferential statistics was 0.05.

Results

Participants (n = 92) mean age was 57; over two-thirds were non-Hispanic White; over half were married or partnered; and nearly all had at least a high school education; most had comorbid conditions; 29.3% had one comorbid condition and 29.3% had two or more. Most participants reported moderate support from family and friends. Depressive symptoms were low; loneliness was moderate. The mean A1C was just above the goal (7.11 ± 1.74, range 4.4–14.3); 39% of participants had A1C >7%. See, Table 1.

Table 1. Demographics and study variables information.

	All (N = 92)	A1C ≤ 7 (n = 56)	A1C > 7 (n = 36)	
Variables	Mean ± SD or n (%)	Mean ± SD or n (%)	Mean ± SD or n (%)	t-test/χ^2
Demographics				
Age	57.37 ± 11.83	56.98 ± 11.94	57.97 ± 11.80	−0.39
Male	47 (51.1%)	24 (42.9%)	23 (63.9%)	3.88*
Married/stay with significant one	51 (55.4%)	29 (51.8%)	22 (61.1%)	0.77
Ethnicity				1.43
White	63 (68.5%)	36 (66.7%)	27 (75.0%)	
Black	14 (15.2%)	10 (18.5%)	4 (11.1%)	
Hispanic	4 (4.3%)	3 (5.6%)	1 (2.8%)	
Other	9 (9.8%)	5 (9.3%)	4 (11.1%)	
High school degree or above	90 (97.8%)	55 (98.2%)	35 (97.2%)	0.10
Physical health factors				
Number of chronic diseases	1.67 ± 1.11	1.73 ± 1.17	1.58 ± 1.02	0.63
Social support factors				
Family support	3.25 ± 0.83	3.27 ± 0.86	3.21 ± 0.78	0.36
Friend support	3.20 ± 0.74	3.26 ± 0.67	3.10 ± 0.83	0.98
Psychological factors				
CES-D	9.42 ± 7.44	8.59 ± 6.48	10.72 ± 8.67	−1.35
Loneliness	12.93 ± 4.72	11.96 ± 4.00	14.44 ± 5.37	−2.37*

* $p < 0.05$, ** $p < 0.01$, $p < 0.001$.

Comparison between A1C groups and correlations among psychological and support variables

A1C >7% was associated with being male and higher loneliness scores. Other variables did not differ significantly between the two A1C groups (see, Table 1). Family and friend support moderately negatively correlated with loneliness and friend support negatively correlated with depressive symptoms. Depressive symptoms and loneliness were highly correlated. Family support was negatively correlated with friend support. Being married or partnered correlated with fewer depressive symptoms and lower loneliness scores. Loneliness correlated with being younger (see, Table 2).

Hierarchical logistic regression analysis

In the final regression model, loneliness was the only significant predictor of A1C levels (A1C >7) after controlling for demographics and number of chronic illnesses, family and friend social support, and depressive symptoms. The odds of having A1C >7 is slightly but significantly higher for people who perceive more loneliness (OR = 1.18, $p < 0.05$, see, Table 3).

Discussion

Perceiving more loneliness significantly predicted A1C >7% after controlling for demographics, number of chronic conditions, social support, and depressive symptoms, consistent with research showing higher levels of loneliness correlated significantly with higher A1C (O'Luanaigh et al., 2012). Biomarkers of systemic inflammation interleukin-6 (IL-6), fibrinogen, and C-reactive protein (CRP) are significantly associated with loneliness (Nersesian et al., 2018). IL-6 and CRP levels increase risk of subsequent depressive

Table 2. Association between study variables.

	1	2	3	4	5	6	7	8	9	10
1 A1C ≥ 7										
2 Age	0.04									
95% CI	−0.01, 0.01									
3 Male	0.21*	−0.35**								
95% CI	0.00, 0.40	3.68, 12.91								
4 Married	0.09	0.14	−0.26*							
95% CI	−0.12, 0.30	−1.65, 8.17	−0.06, −0.47							
5 Race	−0.04	−0.08	0.28**	−0.02						
95% CI	−0.13, 0.09	−3.56, 1.54	−0.25, −0.04	−.12, 0.10						
6 High school	−0.03	0.06	−0.15	0.02	0.01					
95% CI	−0.81, 0.59	−11.89, 21.84	−0.19, 1.23	−0.66, 0.77	−1.35, 1.44					
7 Number of chronic diseases	−0.07	0.33**	−0.11	0.03	−0.01	−0.04				
95% CI	−0.12, 0.06	1.44, 5.65	−0.05, 0.14	−0.08, 0.11	−0.20, 0.18	−0.03, 0.02				
8 Family support	−0.04	0.18	0.05	.18	0.14	−0.05	0.12			
95% CI	−0.15, 0.10	−0.37, 5.51	−0.16, 0.10	−.01, 0.24	−0.08, 0.41	−0.05, 0.03	−0.12, 0.44			
9 Friend support	−0.10	0.21*	0.17	0.09	−0.15	0.02	0.08	0.26*		
95% CI	−0.21, 0.07	0.07, 6.64	−0.25, 0.03	−0.08, 0.20	−.47, 0.09	−0.04, 0.05	−.20, 0.43	0.06, 0.51		
10 Depressive	0.14	−0.31*	0.17	−0.24*	0.06	−0.08	0.02	−0.18	−0.26*	
95% CI	−0.00, 0.02	−0.81, −0.18	−0.03, 0.00	−0.03, −0.00	−0.02, 0.04	−0.01, 0.00	−0.03, 0.04	−0.04, 0.00	−0.05, −0.01	
11 Loneliness	0.26*	−0.32**	0.08	−0.23*	−0.06	−0.07	−0.13	−0.36***	−0.38***	0.71***
95% CI	0.01, 0.05	−1.3, −0.31	−0.03, 0.01	−0.05, −0.00	−0.06, 0.03	−0.01, 0.00	−0.08, 0.02	−0.10, −0.03	−0.09, −0.03	.88, 1.35

* $p \leq 0.05$, ** $p < 0.01$, ***$p < 0.001$.
CI = Confidence interval.

Table 3. Hierarchical Logistic Regression Model of A1C (N = 92).

Predictors	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Demographics and physical health factors								
Age	1.00	[.96, 1.05]	1.00	[.96, 1.05]	1.02	[.97, 1.07]	1.02	[.97, 1.07]
Males	2.40	[.93, 6.20]	2.16	[.80, 5.85]	2.56	[.86, 7.62]	2.56	[.86, 7.62]
Married	1.20	[.59, 2.96]	1.27	[.50, 3.21]	1.53	[.56, 4.14]	1.53	[.56, 4.14]
Number of other chronic disease	.85	[.56, .28]	.85	[.56, 1.28]	.86	[.55, 1.32]	.86	[.55, 1.32]
Social support factors								
Family support			.97	[.55, 1.70]	1.21	[65, 2.25]	1.21	[65, 2.25]
Friend support			.81	[.43, 1.54]	1.10	[.53, 2.27]	1.10	[.53, 2.27]
Psychological factors								
Depressive symptoms					1.10	[1.00, 1.14]	1.00	[.92, 1.10]
Loneliness							1.18*	[1.01, 1.39]

* $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$.

symptoms (Valkanova et al., 2013). Thus, inflammation associated with depression and loneliness may account for the strong correlation between loneliness and depressive symptoms. Moreover, elevated CRP is associated with increased likelihood of higher A1C among people with DM (Malenica et al., 2017). Patients with more loneliness are extra challenged to adhere to healthy diet, exercise, and medication routines (Kusaslan Avci, 2018).

This study found that loneliness contributes independently to A1C. Depressive symptoms were not significantly predictive of A1C. Diabetes distress is another significant predictor of A1C (Fisher et al., 2010; Jeong & Reifsnider, 2018). MIDUS data do not capture diabetes distress nor type of DM. Patients with type 1 DM experienced significantly higher loneliness (Kusaslan Avci, 2018; Zhou et al., 2019) and participants in our sample with higher loneliness levels may have had type 1 DM. Future studies should also measure the duration of diagnosis to better understand the impact of loneliness on A1C. NASEM (2020) recommended that healthcare providers assess perceptions of loneliness, depression, and diabetes distress and intervene to prevent worsening A1C. Our findings suggest that research should differentiate the impact of loneliness, distress, and depression on daily DM management behaviors and A1C.

This study did not control for spousal/partner support because of the limited sample size; however, spouses significantly impact loneliness and DM self-management (Gupta et al., 2019; Khan et al., 2013), and indirectly impact A1C (Maki, 2020). The cross-sectional design does not allow for evaluation of cause-effect relationships. Longitudinal designs are needed to study relationships among loneliness and self-management behaviors and A1C over time and the mediation effects of loneliness on A1C. This study relies on participants' subjective self-reports, which may have been affected by participants' recall bias or socially desired responses.

Conclusion

Higher levels of loneliness are associated with worse A1C, and loneliness was a stronger statistical predictor of A1C than depressive symptoms. These clinically significant findings suggest that healthcare providers should regularly assess patients' loneliness and support.

Compliance with Ethnical Standards

This study has been approved by the University Institutional Review Board.

Disclosure statement

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