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Original Research

The impact of the COVID-19 pandemic on individuals with pre-existing diabetes mellitus

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Abstract

Objectives: To examine the psychosocial impact of the COVID-19 pandemic on patients with a diagnosis of diabetes mellitus (DM).

Methods: Semi-structured interviews were conducted with 31 individuals with DM attending a diabetes clinic to determine the impact of the COVID-19 restrictions on anxiety and depressive symptoms, social and occupational functioning and quality of life. Anxiety symptoms were correlated with functioning, quality of life and diabetes self-management.

Results: Likert data demonstrated that social functioning (mean = 5.5, SD = 3.7) and quality of life (mean = 4.1, SD = 3.1) were most impacted by the COVID-19 pandemic. Anxiety symptoms were prevalent with 13 individuals (41.9%) scoring above cut-off scores for the presence of anxiety symptoms based on the Beck Anxiety Inventory. Diabetes self-management was significantly correlated with functioning ($r = 0.51$, $p = 0.006$) and inversely correlated with anxiety symptoms ($r = -0.51$, $p = 0.007$). A prior history of a depressive or anxiety disorder was associated with significantly increased anxiety symptoms, as well as impaired global functioning ($p < 0.01$), poorer self-care of diabetes ($p = 0.014$) and satisfaction with diabetes treatment ($p = 0.03$).

Conclusions: The psychological and social impact of COVID-19 restrictions on individuals with DM was significant, with poorer management of diabetes correlated with anxiety symptom severity.

Keywords: Anxiety symptoms; COVID-19; diabetes mellitus

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Introduction

On March 11th 2020, COVID-19, the infectious disease associated with the coronavirus, SARS-CoV-2 was characterised as a global pandemic by the World Health Organisation (WHO). This pandemic resulted in significant economic and societal disruption worldwide, and as of October 2nd, 2023 there have been approximately 770 million COVID-19 cases and approximately 7 million deaths attributable to COVID-19 (World Health Organisation 2023). Subsequent robust public containment measures, resulted in the closure of many facilities deemed as 'non-essential' and included facilities attended by individuals with both physical and mental health disorders such as day centres. Throughout the pandemic, periods of gradual easing and re-implementation of restrictions in Ireland, (until February 28th, 2022) were based on the advice of the National Public Health Emergency Team. Additionally, many therapeutic interventions normally available for individuals outside of health services such as support groups were unattainable during this time and where these continued, most had to adapt to a range of public health measures, with for example face-to-face interactions often replaced by teleconsultations (Kopelovich *et al.*, 2021; Rojnic-Kuzman *et al.*, 2021; Li *et al.*, 2021).

The impact of these prolonged periods of restrictions and lockdowns for individuals' mental well-being is somewhat unclear with divergent data available to date. Early research documented an initial increase in the prevalence of anxiety and depressive symptoms in general population cohorts, in individuals attending primary care services and in individuals attending mental health services during 2020 (COVID-19 Mental Disorders Collaborators 2021; Hao *et al.*, 2020; Hyland *et al.*, 2020; Li *et al.*, 2020; Twenge and Joiner 2020), although this was not a universal finding (Plunkett *et al.*, 2021; Fahy *et al.*, 2021; McLoughlin *et al.*, 2022). The longer-term veracity of this assertion has been challenged on the grounds that data were collected during the nascent phase of COVID-19 (early 2020), where symptomatology was representative of an acute reaction/distress to an unknown, unexpected, and unfolding crisis (Daly and Robinson 2022). Subsequent studies revealed that some initial increase in symptoms at pandemic onset were not sustained, and declined significantly as the pandemic progressed, reverting to pre-pandemic levels within months of the initial outbreak (Bendau *et al.*, 2021; Fancourt *et al.*, 2021; Robinson *et al.*, 2022; Daly and Robinson 2021; Bartels *et al.*, 2022;

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Daly and Robinson 2022), with longitudinal studies conducted at this site noting a minimal impact of the COVID-19 pandemic on anxiety symptoms over time in cohorts of patients with mental health disorders (Hennigan *et al.*, 2021; Rainford *et al.*, 2022; McLoughlin *et al.*, 2023).

Diabetes mellitus (DM) was one of the conditions noted to be 'a high risk disorder' for sequelae of COVID-19, with individuals with DM thus advised to be particularly careful about adherence to public health measures (www.diabetes.ie/what-is-covid19), with concerns expressed internationally that individuals would be at risk of experiencing more severe symptoms (American Diabetes Association, 2020). Such concern was subsequently supported with higher levels of respiratory complications and renal dysfunction noted for individuals who contracted COVID-19 and had a pre-existing diagnosis of DM (Zhou *et al.*, 2023). Mental health disorders are over-represented in individuals with a diagnosis of DM with recurrent depressive disorder (Kershaw *et al.*, 2023) and generalised anxiety disorder particularly prevalent (Wimberley *et al.*, 2022).

There has been conflicting data pertaining to the psychological impact of the COVID-19 pandemic for individuals with DM to date. Initial data suggested that individuals diagnosed with DM experienced high rates of 'minor psychiatric disorders' as measured utilising a self-report 20 item questionnaire (Self-Report Questionnaire-20 (SRQ-20)) with high levels of psychological distress amongst individuals with both Type 1 (33%) and Type 2 DM (53%) (Alessi *et al.*, 2020) reported. However, these findings have not been universally demonstrated (Nachimuthu *et al.*, 2020). A recent systematic literature review suggested that individuals with DM had 'impaired mental health' with high rates of depressive (11.5–60.7%) and anxiety symptoms (7.0–27.5%). However, in addition to the wide range for the presence of symptoms, the authors noted that half of the published studies were of low methodological quality (Troncone *et al.*, 2023).

Thus, the impact of the COVID-19 pandemic on individuals' psychological well-being who have an established diagnosis of DM remains has yet to be elucidated. We hypothesised that participants with DM will experience significant anxiety symptoms with an impact on their ability to self-manage their DM and global functioning. We additionally sought to evaluate if anxiety symptoms were inversely correlated with their self-management of their DM.

Methods

Participants

All participants attending a DM clinic were invited to participate in this study. Inclusion criteria included a diagnosis of either type 1 or 2 DM and a capacity to make an informed decision to participate in the study. Exclusion criteria included been under 18 years of age, having an intellectual disability (intelligence quotient <70), a diagnosis of dementia, and an inability to provide written informed consent. Research interviews were undertaken initially by physicians with several years of clinical practice (GF, AL), with training in study procedures provided by the lead physician (AL). Subsequently, participants were contacted to ascertain if they were willing to have a clinical interview with an experienced psychiatrist (AR, KS) with training in study procedures provided by the principal investigator (BH). All responses were anonymised and all data stored securely and handled in accordance with the Data Protection Act, 2018. Ethical approval was attained prior to study commencement from the Galway University Hospitals Research Ethics Committee (C.A. 2542).

Procedure

All individuals provided written informed consent after a detailed explanation of study procedures. Clinical case notes were reviewed to ascertain DM diagnosis and demographic data where participants described uncertainty pertaining to their treatment regimen.

Assessments

A semi-structured interview was conducted in person in between March 20th and 27th 2021 with psychiatric interviews conducted between April 15th and October 10th 2021, and occurred at a time when governmental mandated social restrictions were in place.

Categorical data pertaining to the effect of COVID-19 on participants' mental health status overall and severity of anxiety symptoms (better, no change, worse) was attained. Participants' subjective experience of the impact of COVID-19 pandemic was measured utilising the same Likert scales (0-10) to measure: 1) anxiety symptoms, 2) mood symptoms 3) social functioning, 4) occupational functioning and 5) quality of life; with 0 indicating no adverse impact and 10 indicating a very severe impact due to restrictions imposed because of the COVID-19 pandemic.

Established psychometric instruments with known high reliability and validity indices were employed to measure current symptomatology and included the: 1) Beck Anxiety Inventory (BAI, Beck & Steer, 1993), 2) Hamilton Anxiety Rating Scale (HAM-A, Hamilton 1959), 3) Global Assessment of Function (GAF, Hall 1978), 4) Diabetes Treatment Satisfaction Questionnaire (DTSQ, Bradley, 1994) and 5) Diabetes Self-Management Questionnaire (DSMQ, Schmitt *et al.*, 2013). Nine of the 16 items on the DSMQ are negatively worded, and thus these item scores were inverted prior to attaining a total score for this instrument. Sub-optimal care is suggested if the score for any of the four sub-scales is <6.

Statistical analysis

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) 27.0 for Windows (SPSS Inc., IBM, New York, USA). Descriptive analyses (frequencies, percentages, means and standard deviation) on key demographic and clinical data were performed for both categorical and continuous variables, as appropriate. We utilised the student *t*-test to compare psychometric data between individuals diagnosed with Type 1 or 2 DM. Correlation analysis was conducted to examine the interaction between the different psychometric scales employed, with correction for multiple testing applied by utilising the family wise error (FWE) (Holm 1979).

Results

Demographic and clinical data

Of the 43 participants invited to participate 31 (72.1%) consented to engage in all study procedures. Of note 16 (51.6%) participants were male and 28 (93.3%) had a diagnosis of type 2 DM. Nine individuals had a prior diagnosis of a mental health disorder (29.0%), with eight individuals having a diagnosis of a depressive disorder, six individuals (19.4%) in receipt of antidepressant medications at the time of interview and three individuals (9.7%) attending a community mental health team (see Table 1). No individuals had a history of psycho-active substance misuse or current alcohol use disorder.

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Table 1. Demographic and clinical variable of all participants

Variable	*n* (%)
Gender	
Male	16 (51.6)
Female	15 (48.4)
Marital Status*	
Single	4 (12.9)
Married/Civil Partnership	17 (54.8)
Separated/Divorced	3 (9.7)
Employment Status*	
Unemployment	5 (16.1)
Employed	6 (19.4)
Retired	16 (51.6)
Mental Health Disorder	
Anxiety Disorder	1 (3.2)
Mood Disorder	8 (25.8)
Smoker	
Yes	3 (9.7)
No	19 (61.3)
Co-morbid Psychiatric Disorder	
EUPD of Borderline Type	3 (15.0)
Schizophrenia	3 (15.0)
Other Disorders***	3 (15.0)
Diabetes Mellitus	
Type 1	2 (6.5)
Type 2	29 (93.5)

Table 2. Psychometric data of all participants

Variables	*n* (%)
Effect on Mental Health	
Improvement	0 (0.0)
No change	9 (29.0)
Disimprovement	22 (71.0)
Effect on Anxiety Symptoms	
Improvement	0 (0.0)
No change	20 (64.5)
Disimprovement	11 (35.5)
	Mean (SD)
Psychometric Data: Anxiety	
BAI	9.9 (11.0)
HAM-A	7.8 (6.8)
Psychometric Data: Functioning	
GAF	77.5 (12.57)
Psychometric Data: Diabetes	
DSMQ	
Total*	39.6 (6.3)
Glucose Management	12.6 (2.9)
Dietary Control	8.5 (2.5)
Physical Activity	7.0 (2.0)
Health Care Use	8.6 (0.8)
DTSQ	35.3 (4.0)
Likert Scales	
Anxiety	2.7 (2.9)
Mood	3.0 (3.1)
Social Functioning	5.5 (3.7)
Occupational Functioning	1.1 (2.8)
Quality of Life	4.1 (3.1)

BAI = Beck Anxiety Inventory, DSMQ = Diabetes Self-Management Questionnaire, DTSQ = Diabetes Treatment Satisfaction Questionnaire, HAM-A = Hamilton Anxiety Rating Scale, GAF = Global Assessment of Function.
*The total score is derived from 16 items, with one of these items not included in any of the sub-categories.

Symptomatology

As demonstrated in Table 2, Likert data noted that social functioning (mean = 5.5, SD = 3.7) and quality of life (mean = 4.1, SD = 3.1) were most impacted by the COVID-19 pandemic. Anxiety symptoms were prevalent with mean scores noted in the mild range for both the BAI (mean = 9.9, SD = 11.0) and HAM-A (mean = 7.8, SD = 6.8) (see Table 2). Thirteen individuals (41.9%) utilising the BAI (>7) and 4 individuals (12.9%) utilising the HAM-A (>17) scoring above standardised cut-off scores indicating anxiety symptoms.

Good self-care was evident with the DSMQ across the four sub-scales and total instrument score with high levels of treatment satisfaction additionally demonstrated (DTSQ).

As demonstrated in Table 3, the HAM-A was significantly correlated with a deleterious impact of COVID-19 as measured utilising Likert scales for anxiety ($r = 0.58$, $p < 0.001$), depressive symptoms ($r = 0.69$, $p < 0.001$) and quality of life ($r = 0.75$, $p < 0.001$) and inversely correlated with global functioning ($r = -0.84$, $p < 0.001$). The DSMQ was significantly correlated with functioning (GAF, $r = 0.51$, $p = 0.006$) and inversely correlated with anxiety symptoms utilising both the HAM-A and Likert scales ($r = -0.51$, $p = 0.007$) but not with the BAI.

The presence of a prior history of a depressive or anxiety disorder was associated with significant differences in symptomatology (see Table 4), with anxiety symptoms [BAI ($t = 5.46$, $p < 0.001$), HAM-A ($t = 5.014.87$, $p < 0.001$), Likert scale ($t = 2.95$, $p = 0.006$)] and global functioning impairment ($t = 5.93$, $p < 0.001$), higher. A greater negative impact on overall mental well-being (66.7% v 15%, $\chi^2 = 5.39$, $p = 0.04$), poorer self-care of diabetes (DSMQ, $t = 5.49$, $p = 0.014$) (Fig. 1) and satisfaction with diabetes treatment (DTSQ, $t = 2.39$, $p = 0.025$) was also demonstrated where a prior history of a depressive or anxiety disorder was present. These findings however did not impact correlation data.

For individuals showing evidence of anxiety symptoms ($n = 13$) utilising the BAI (>7), increased depressive symptoms, reduced social functioning, quality of life and global functioning were demonstrated ($p < 0.002$, see Table 4), however there was no impact on self-care of diabetes or satisfaction with diabetes treatment.

Discussion

Participants with DM, experienced anxiety symptoms, with these at least in part related to a deleterious impact of the COVID-19

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Table 3. Correlation data

	Anxiety (Likert)	Mood (Likert)	Soc. Ftn. (Likert)	Occ. Ftn. (Likert)	QoL (Likert)	BAI	HAM-A	GAF	DSMQ	DTSQ
	r, *p*	*r*, *p*	*r*, *p*	*r*, *p*	*r*, *p*	*r*, *p*	*r*, *p*	*r*, *p*	*r*, *p*	*r*, *p*
Anxiety (Likert)	–	**0.80, <0.001**	**0.50, 0.004**	0.23, 0.224	**0.56, 0.001**	**0.43, 0.016**	**0.67, <0.001**	**−0.66, <0.001**	**−0.51, 0.007**	−0.28, 0.161
Mood (Likert)	**0.80, <0.001**	–	0.35, 0.050	0.02, 0.906	**0.60, <0.001**	**0.47, 0.008**	**0.70, <0.001**	**−0.70, <0.001**	−0.40, 0.038	0.13, 0.947
Soc. Ftn. (Likert)	**0.50, 0.004**	0.35, 0.005	–	0.14, 0.459	**0.65, <0.001**	0.32, 0.078	**0.54, 0.002**	**−0.46, 0.009**	−0.31, 0.115	−0.16, 0.436
Occ. Ftn (Likert)	0.23, 0.224	0.02, 0.906	0.14, 0.459	–	0.19, 0.303	−0.06, 0.743	−0.02, 0.909	−0.17, 0.375	0.06, 0.754	0.01, 0.979
QoL (Likert)	**0.56, 0.001**	**0.60, <0.001**	**0.65, <0.001**	0.19, 0.303	–	**0.51, 0.003**	**0.75, <0.001**	**−0.67, <0.001**	−0.14, 0.490	−0.06, 0.772
BAI	**0.43, 0.016**	**0.47, 0.008**	0.32, 0.078	−0.06, 0.743	**0.51, 0.003**	–	**0.70, <0.001**	**−0.75, <0.001**	−0.33, 0.094	−0.05, 0.801
HAM-A	**0.67, 0.001**	**0.70, <0.001**	**0.54, 0.002**	−0.02, 0.909	**0.75, <0.001**	**0.70, <0.001**	–	**−0.84, <0.001**	**−0.51, 0.007**	−0.16, 0.434
GAF	**−0.66, <0.001**	**−0.70, <0.001**	**−0.46, 0.009**	−0.17, 0.375	**−0.67, <0.001**	**-0.75, <0.001**	**−0.84, <0.001**	–	**0.51, 0.006**	0.20, 0.304
DSMQ	**−0.51, 0.007**	−0.40, 0.038	−0.31, 0.115	0.06, 0.754	−0.14, 0.490	−0.33, 0.094	**−0.51, 0.007**	**0.51, 0.006**	–	0.42, 0.028
DTSQ	−0.28, 0.161	0.01, 0.947	−0.16, 0.436	0.01, 0.979	−0.06, 0.772	−0.05, 0.801	−0.16, 0.434	0.21, 0.304	0.42, 0.028	–

BAI = Beck Anxiety Inventory, DSMQ = Diabetes Self-Management Questionnaire, DTSQ = Diabetes Treatment Satisfaction Questionnaire, HAM-A = Hamilton Anxiety Rating Scale, GAF = Global Assessment of Function, Occ. Ftn. = Occupational Functioning, Soc. Ftn = Social Functioning, QoL = Quality of Life.
Correction for multiple testing was applied by utilising the family wise error (FWE).

pandemic. Anxiety symptoms were associated with lower functioning and poorer diabetes self-care. A prior history of a depressive or anxiety disorder was additionally associated with greater levels of anxiety symptoms, lower levels of functioning and poorer diabetes self-care.

This study noted an increase in anxiety symptoms for individuals both with and without a prior history of anxiety disorders. Data from this study is consistent with previous studies noting an exacerbation of anxiety symptoms for individuals both with and without a prior history of mental illness (Li *et al.*, 2020; Plunkett *et al.*, 2021), and confirms the negative impact of COVID-19 for individuals with DM noted in some previous studies (Troncone *et al.*, 2023). It was notable that individuals with a prior history of anxiety or depressive disorders had greater levels of symptomatology and that this additionally impacted their quality of life and diabetes self-management.

For individuals who have a prior history of an anxiety or depressive disorder attending a DM clinic, the evaluation of anxiety symptoms could enable an earlier development of treatment strategies (i.e. pharmacotherapy, psychotherapy or a combination of both) and if required referral on to a community mental health team. Only one-third of participants who had a prior psychiatric history were under the care of a community mental health team at the time this study was conducted. The introduction of strategies to manage anxiety symptoms would hopefully also ameliorate participants' diabetes self-management, given the inverse correlation between anxiety symptoms and diabetes self-management.

The COVID-19 pandemic for many people had a deleterious impact on anxiety symptoms, functioning and quality of life. It is likely that this is particularly significant for individuals with physical health difficulties and for those with co-morbid physical and mental health disorders, this deleterious impact is further increased. Thus, whilst some individuals demonstrated a minimal impact from the COVID-19 pandemic, identifying those with ongoing symptoms or distress, and providing multidisciplinary tailored interventions is suggested with tele-medicine a potential option to consider if future restrictions secondary to COVID-19 or other epidemics or pandemics arise.

There are a number of limitations with this study, the most significant of which were a modest sample size of 31 participants and the absence of a control group. Consequently, caution is required in relation to the generalisability of these findings, particularly as participants were attending one hospital site for their diabetes management, which may not be fully reflective of other services with differential resources or co-morbid disorders. Additionally, there were insufficient numbers to compare findings for individuals with different types of DM. Hard outcomes for diabetic control, (i.e. HbA1c or change in glycaemic control over time), were not evaluated in this cross-sectional study, and therefore despite an association between poor diabetes self-care and anxiety symptoms, caution is required in inferring that anxiety symptoms were associated with an overall deleterious impact on diabetes management. Operational criteria (International Classification of Diseases or Diagnostic Statistical Manual), were not utilised for diagnostic clarification of anxiety disorders and thus only an increase in symptomatology rather than an increase in the incidence of anxiety disorders, can be inferred from this study's methodology. The increase in anxiety symptoms noted could potentially be related to an adjustment to a change in life circumstances in the context of the global pandemic, or a deterioration in individuals' physical health.

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Table 4. Impact of psychiatric history or anxiety disorder on symptomatology

Variable	Psychiatric history ($n = 9$) *n* (%)	No psychiatric history ($n = 21$) *n* (%)	Statistics $\chi 2$ *p*
Effect on Mental Health			
Improvement	0 (0.0)	0 (0.0)	**4.33, 0.037***
No change	18 (81.8)	4 (44.4)	
Disimprovement	4 (18.2)	5 (55.5)	
Effect on Anxiety Symptoms			
Improvement	0 (0.0)	0 (0.0)	**5.39, 0.038***
No change	3 (33.3)	17 (85.0)	
Disimprovement	6 (66.7)	5 (15.0)	
	Mean (SD)	**Mean (SD)**	***t, p***
Psychometric Data			
BAI	21.9 (11.6)	5.0 (5.7)	**5.46, <0.001**
HAM-A	15.0 (6.0)	4.9 (4.7)	**5.01, <0.001**
GAF	63.2 (4.3)	83.6 (9.7)	**5.93, <0.001**
DSMQ	34.7 (8.3)	41.3 (4.5)	**5.49, 0.014**
DTSQ	32.4 (4.8)	36.3 (3.3)	**2.39, 0.025**
Likert Scales			
Anxiety	4.9 (2.8)	1.9 (2.5)	**2.95, 0.006**
Mood	5.1 (2.2)	2.2 (2.8)	**2.56, 0.016**
Social Functioning	7.1 (3.2)	4.8 (3.8)	1.63, 0.114
Occupational Functioning	0.7 (2.0)	1.3 (3.1)	0.58, 0.566
Quality of Life	6.1 (1.8)	3.2 (3.2)	**2.56, 0.016**
	BAI > 7 ($n = 13$) *n* (%)	BAI ≤ 7 ($n = 18$) *n* (%)	Statistics $\chi 2$ *p*
Effect on Mental Health			
Improvement	0 (0.0)	0 (0.0)	2.85, 0.123*
No change	7 (53.8)	14 (82.4)	
Disimprovement	6 (46.2)	3 (17.6)	
Effect on Anxiety Symptoms			
Improvement	0 (0.0)	0 (0.0)	2.92, 0.132*
No change	6 (46.2)	13 (76.5)	
Disimprovement	7 (53.8)	4 (23.5)	
	Mean (SD)	**Mean (SD)**	***t, p***
Psychometric Data			
HAM-A	14.2 (5.2)	3.2 (3.1)	**7.51, <0.001**
GAF	65.5 (7.4)	86.2 (6.9)	**8.00, <0.001**
DSMQ	37.5 (7.7)	40.9 (4.9)	1.41, 0.171
DTSQ	34.5 (5.1)	35.9 (3.1)	0.90, 0.424
Likert Scales			
Anxiety	4.4 (3.0)	1.6 (2.4)	**3.00, 0.005**
Mood	5.0 (3.0)	1.6 (2.5)	**3.46, 0.002**
Social Functioning	7.8 (2.9)	3.8 (3.4)	**3.44, 0.002**
Occupational Functioning	1.4 (2.9)	0.9 (2.8)	0.43, 0.673
Quality of Life	6.4 (1.9)	2.4 (2.7)	**4.36, <0.001**

*Fisher's exact test utilised for p value.

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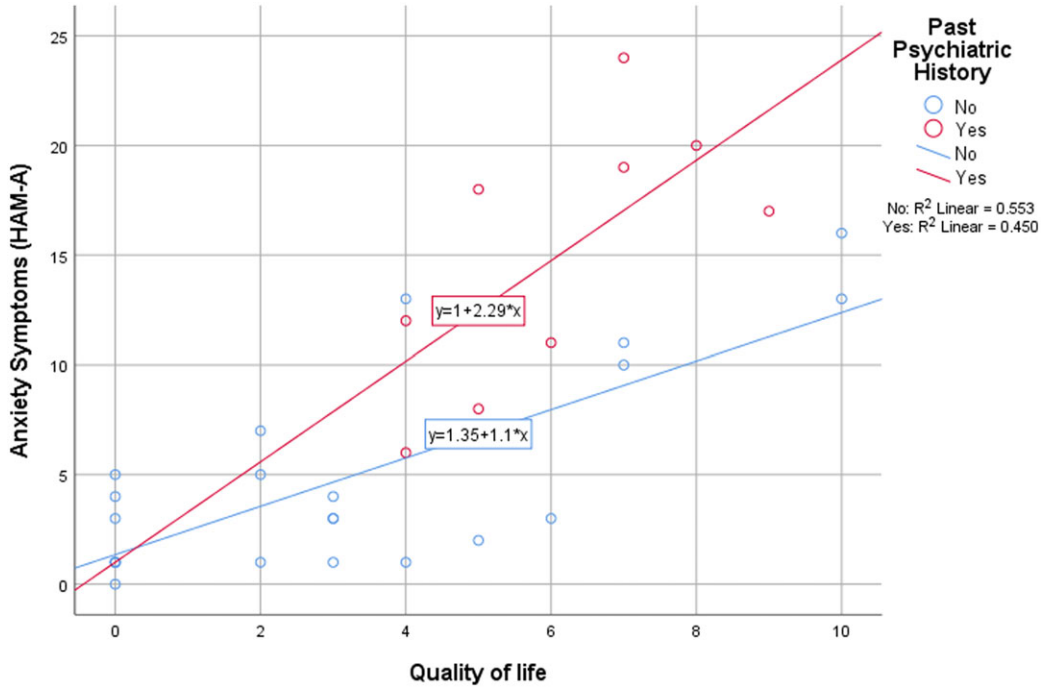

Figure 1. Correlation of anxiety symptoms with quality of life.

Conclusion

Twelve to eighteen months after the COVID-19 pandemic and its' associated restrictions commenced, individuals with DM demonstrated anxiety symptoms, with these symptoms adversely correlated with their diabetes self-management.

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Competing interests. The authors declare that they have no conflict of interest. All authors have seen and approved the final version of the manuscript and believe that the manuscript represents work completed.

Ethical standards. Ethical approval was obtained from the Galway University Hospitals Research Ethics Committee (C.A. 2542). The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committee on human experimentation with the Helsinki Declaration of 1975, as revised in 2008.

Contributions. All authors participated in the design of the study, data attainment and critical review of the manuscript.

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