

BMJ Open Factors associated with anxiety and depression among type 2 diabetes outpatients in Malaysia: a descriptive cross-sectional single-centre study

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ABSTRACT

Objective: To determine the prevalence and factors associated with anxiety and depression among type 2 diabetes outpatients in Malaysia.

Design: Descriptive, cross-sectional single-centre study with universal sampling of all patients with type 2 diabetes.

Setting: Endocrinology clinic of medical outpatient department in a Malaysian public hospital.

Participants: All 169 patients with type 2 diabetes (men, n=99; women, n=70) aged between 18 and 90 years who acquired follow-up treatment from the endocrinology clinic in the month of September 2013.

Main outcome measures: The validated Hospital Anxiety and Depression Scale (HADS), sociodemographic characteristics and clinical health information from patient records.

Results: Of the total 169 patients surveyed, anxiety and depression were found in 53 (31.4%) and 68 (40.3%), respectively. In multivariate analysis, age, ethnicity and ischaemic heart disease were significantly associated with anxiety, while age, ethnicity and monthly household income were significantly associated with depression.

Conclusions: Sociodemographics and clinical health factors were important correlates of anxiety and depression among patients with diabetes. Integrated psychological and medical care to boost self-determination and confidence in the management of diabetes would catalyse optimal health outcomes among patients with diabetes.

INTRODUCTION

Type 2 diabetes is a chronic metabolic disorder characterised by hyperglycaemia due to insulin deficiency.¹ The global prevalence of diabetes is currently estimated to be 285 million and projection rates are expected to rise to over 438 million by the year 2030,² with Asia suffering the bulk of the total diabetes epidemic.³ The Malaysian scenario is more debilitating when figures confirmed that the

Strengths and limitations of this study

- Malaysia suffers the highest rate of diabetes in the Asian region. People with diabetes are twice more likely to develop anxiety and depression, causing poor health outcomes and increased mortality.
- This study aimed to assess the prevalence and factors associated with anxiety and depression among type 2 diabetes outpatients in Malaysia.
- Integrated psychological and medical care to boost self-determination and confidence in the management of diabetes would catalyse optimal health outcomes among patients with diabetes.
- The absence of a control group and a relatively small sample size from one hospital might limit the generalisability of the study findings. The cross-sectional design of the study limits our ability to make causal inferences.

country suffers the highest rate of diabetes in the Asian region, with prevalence rates rising from 14.9% in 2006 to 20.8% in 2011.⁴

The complex mechanism to cope with chronic diseases requires self-determination to overcome the emotional shock of the diagnoses and proper assimilation of information regarding self-care to prevent disease complications.⁵ The collapse of these coping strategies over time due to low psychological, emotional and social support renders significant comorbid anxiety and depression, exacerbating disease complications and poor prognosis.⁵ People with diabetes were twice at risks to suffer from pre-morbid anxiety and depression as the general population.^{2, 6} The coexistence of anxiety and depression in people with diabetes catalyses serious disease comorbidities, complications, poor quality of life and escalated healthcare expenditures.⁷

Anxious and depressed people with diabetes are less likely to comply with diabetes



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self-care recommendations.⁶ The diagnosis of diabetes is a life-threatening stressor that demands high mental and physical accommodations due to elevated feelings of fear.⁸ Depression among people with diabetes adds an increased burden to patient adherence, compliance and poor prognosis for quality health outcomes.⁹ Depression in the diabetes population has been associated with potential sociodemographic and clinical factors.⁷ Ageing,² ethnicity,⁸ socioeconomic status,¹⁰ education level¹¹ and unemployment¹² were important correlates for depression among people with diabetes.

Common diabetes vascular complications like ischaemic heart disease (IHD), cerebrovascular accidents (CVAs) and diabetic nephropathy had caused significant rates of mortality and poor quality of life.^{2 11} Malaysia topped the world in diabetic nephropathy, with almost 15 000 patients requiring dialysis and 2000 acquiring kidney transplants.¹³ Diabetes-related complications and associated comorbidities have been proven to amplify psychiatric conditions.²

Numerous studies from developed and developing countries assessed factors affecting anxiety and depression among people with diabetes.^{2 6 14} Irish and Mexican studies concluded that the prevalence of anxiety and depression was considerably higher among people with diabetes in comparison to the general population.^{6 9} A Malaysian study recommended that early psychiatric screening was required owing to elevated risks for anxiety and depression among people with diabetes.⁸ This study aimed to determine the prevalence and factors associated with anxiety and depression among outpatients with diabetes in a Malaysian public hospital.

METHODS

Study setting and population

This cross-sectional single-centre study was conducted in the month of September 2013 among all 169 patients with type 2 diabetes aged between 18 and 90 years who acquired follow-up treatment from the Endocrinology Clinic at the Medical Outpatient Department of Tengku Ampuan Rahimah Hospital (HTAR), Selangor, Malaysia. Objectives and benefits of the study were explained in verbal and written form attached to the questionnaires. Patients were assured that their participation was confidential and would not affect their medical treatment outcomes. A written consent was obtained from those who agreed to participate. Patients with type 1 and gestational diabetes were excluded from the study.

Ethical issues

This study complied with the guidelines convened in the Declaration of Helsinki. The study was conducted as part of a larger study that explored anxiety and depression among outpatients in Malaysia.

Study instruments

A self-administered questionnaire consisting of three parts was used in this study:

The first part included items on sociodemographics (gender, age, ethnicity, marital status, education level, residence, monthly household income and employment status).

The second part assessed anxiety and depression among patients with diabetes. Anxiety is defined as subjective experience of fear and its' physical manifestations while depression is defined as anhedonia (reduced positive affect).¹⁵ To explore anxiety and depression among patients with diabetes, we used the Hospital Anxiety and Depression Scale (HADS), originally developed by Zigmond and Snaith,¹⁶ and validated among the Malaysian population.¹⁷ This widely used self-assessment tool measures the level of emotional distress (anxiety and depression) in various clinical settings, including diabetes population.^{2 6 18} HADS is comprised of 14 items, 7 of which measures anxiety (HADS-A) and another 7 measures depression (HADS-D). These items are scored on a four-point Likert scale ranging from 0 (not present) to 3 (considerable). Item scores were summed to provide subscaled scores of anxiety and depression, ranged between 0 and 21, and total summed score ranged from 0 to 42. A higher score represents higher anxiety or depression.¹⁸ The scores are categorised as follows: normal (0–7) and caseness which includes mild distress (8–10), moderate distress (11–14) and severe distress (15–21).¹⁸ The questionnaire was administered in English.

The third part included clinical health information of the patients derived from medical records.

Baseline data definitions

Type 2 diabetes

The presence of diabetes diagnosed by a physician with a fasting plasma glucose value of 7 mmol/L (126 mg/dL) or higher,¹⁹ and patients currently being administered with oral hypoglycaemic drugs or insulin therapy as documented in medical records were included in this study.

Diabetes vascular complications

Vascular complications in diabetes were considered when patients were diagnosed with CVA, IHD or nephropathies. Patients diagnosed with either one vascular complication over the past year were included in this study. CVA was defined as hemiparesis cases proven by medical and CT scan records.²⁰ IHD was considered to exist with a history of angina or acute coronary syndromes elicited among patients with diabetes and documented in medical records.² Nephropathy is defined by proteinuria >500 mg in 24 h among patients with diabetes from medical records.¹

Diabetes comorbid conditions

Patients with diabetes were classified as hypertensive if they were previously diagnosed and were currently on antihypertensive medications² as documented in medical records. Dyslipidaemia was defined as high plasma triglyceride concentration, low high-density

lipoprotein cholesterol concentration and increased concentration of low-density lipoprotein cholesterol²¹ with patients currently on statin medications as documented in medical records.

The Malaysian healthcare system

Public healthcare providers across the nation are mainly entrusted by the Ministry of Health Malaysia with the commitment of 'healthcare access to all'.⁴ The public healthcare is highly subsidised through general revenue and taxation collected by the federal government, and with a minimal registration fee of US\$0.33 or MYR1. Malaysians are granted free access to clinical consultations, treatment and medications both as outpatients or inpatients in all public health facilities within the country.⁴ HTAR is the second busiest public health facility in terms of patient admissions and outpatient services in Malaysia at the time of this study.⁴

Statistical analysis

Analysis was performed using Statistical Package for Social Sciences (SPSS) (V.16.0, IBM, Armonk, New York, USA). Descriptive analysis was performed for all variables in this study. To check for the validity of the HADS among Malaysian population, an exploratory factor analysis was performed using principal component method with varimax rotation and Cronbach's α was used to test the internal consistency of the scale. Anxiety and depression scores were expressed as mean and SDs. Test of normality was performed for total anxiety and depression subscale scores. T test and analysis of variance (ANOVA) test were applied to compare anxiety and depression across sociodemographic and clinical health variables. In case of ANOVA, post hoc test was used to determine where the significant difference was. Multiple linear regression analysis using 'Enter' technique was employed to obtain significant factors associated with anxiety and depression among patients with diabetes. The accepted level of significance was set below 0.05 ($p < 0.05$). Multicollinearity was checked between independent variables.

RESULTS

Sociodemographic characteristics and clinical health information of the respondents

One hundred sixty-nine patients were included in this study. Of the total, 99 (58.6%) were men and 70 (41.4%) were women. The mean (\pm SD) age of the patients was 36.9 (\pm 15.9) years and the majority aged less than 50 years, 137 (81.1%; [table 1](#)).

Baseline clinical data of the patients are summarised in [table 2](#). Of the total patients, 53 (31.4%) were diagnosed for diabetes vascular complications. Twelve patients (7.1%) were diagnosed for CVA, 24 (14.2%) were diagnosed for IHD and 17 (10.1%) developed nephropathy. Forty-four (26.0%) patients developed at least one comorbid condition, while 21 (12.4%) had two

Table 1 Sociodemographic characteristics of the respondents (n=169)

Characteristics	N	Percentage
Gender		
Male	99	58.6
Female	70	41.4
Age (years)		
<50	137	81.1
\geq 50	32	18.9
Ethnicity		
Malay	53	31.3
Chinese	88	52.1
Indian	28	16.6
Marital status		
Single	63	37.3
Married	106	62.7
Highest education level		
High school	75	44.4
Tertiary education	94	55.6
Residence		
Urban	132	78.1
Rural	37	21.9
Monthly household income (MYR)		
<3000	56	33.1
\geq 3000	113	66.9
Current employment status		
Employed	119	70.4
Unemployed	50	29.6

MYR1 is equivalent to US\$0.33 at the time of study.

comorbid conditions. Cronbach's α coefficient for HADS-A subscale was 0.83, while Cronbach's α coefficient for HADS-D subscale was 0.71. Mild anxiety and depression were found in 33 (19.5%) and 49 (29.0%) of the patients, respectively. Moderate anxiety and depression were found in 16 (9.5%) patients respectively. Severe anxiety and depressive symptoms were detected in four (2.4%) and three (1.8%) of the patients, respectively.

Association between anxiety and depression and sociodemographics of the respondents

[Table 3](#) shows the association between anxiety and depression with sociodemographic characteristics. Patients aged 50 years or older had higher anxiety score (9.1 ± 4.6) compared with those aged less than 50 years (6.4 ± 2.7 , $p < 0.001$). Significant associations were observed between anxiety and ethnicity ($p < 0.001$); post hoc tests showed that Indians exhibited higher anxiety score (8.4 ± 4.2) in comparison to Chinese (6.6 ± 2.4 , $p = 0.044$). Patients graduated from high school exhibited higher anxiety score (7.5 ± 4.0) in comparison to those with a tertiary degree (6.4 ± 2.5 , $p = 0.037$). In addition, patients aged 50 years or older were more depressed (9.2 ± 4.0) in comparison to those aged less than 50 years (6.3 ± 2.9 , $p < 0.001$). Significant associations were observed between depression and ethnicity ($p < 0.001$);

Table 2 Clinical health information of the respondents (n=169)

Characteristics	N	Percentage
<i>Diabetes vascular complications</i>		
Cerebrovascular accident		
Yes	12	7.1
No	157	92.9
Ischaemic heart disease		
Yes	24	14.2
No	145	85.8
Diabetic nephropathy		
Yes	17	10.1
No	152	89.9
<i>Comorbidities</i>		
Diabetes alone	104	61.6
Diabetes with hypertension or dyslipidaemia	44	26.0
Diabetes with hypertension and dyslipidaemia	21	12.4
<i>Anxiety</i>		
Normal	116	68.6
Mild	33	19.5
Moderate	16	9.5
Severe	4	2.4
<i>Depression</i>		
Normal	101	59.7
Mild	49	29.0
Moderate	16	9.5
Severe	3	1.8

post hoc tests revealed that Indians exhibited higher depression (9.8 ± 3.5) in comparison to Malays (6.9 ± 3.1) and Chinese (5.9 ± 2.9 , $p<0.001$, respectively). Similarly, patients who graduated from high school exhibited greater depression (7.7 ± 3.7) in comparison to tertiary graduates (6.2 ± 2.9 , $p=0.006$). Patients with a monthly household income of less than MYR3000 have higher depression score (8.7 ± 3.6) compared to those with higher income (6.0 ± 2.8 , $p<0.001$). Similarly, unemployed patients portrayed higher depression score (7.9 ± 3.2) in comparison to those employed (6.4 ± 3.3 , $p=0.007$).

Association between anxiety and depression and clinical health information of the respondents

Patients diagnosed for IHD exhibited higher anxiety score (8.7 ± 4.2) in comparison to those without such complication (6.6 ± 3.1 , $p=0.004$). In addition, significant associations were observed between depression and disease comorbidities ($p=0.010$); post hoc tests showed that patients with associated hypertension or dyslipidaemia had higher depression score (7.5 ± 3.2) in comparison to those without comorbid conditions (6.3 ± 3.4 , $p=0.009$; table 4).

Factors associated with anxiety among patients with diabetes by multiple linear regression

Table 5 exhibits the factors associated with anxiety among patients with diabetes. Patients aged ≥ 50 years had on

Table 3 Association between anxiety and depression with sociodemographic characteristics of the respondents (n=169)

Characteristics	Anxiety		Depression	
	Mean (SD)	p Value	Mean (SD)	p Value
Gender				
Male	7.0 (3.5)		7.1 (3.5)	
Female	6.8 (3.0)	0.737	6.6 (3.1)	0.345
Age (years)				
<50	6.4 (2.7)		6.3 (2.9)	
≥ 50	9.1 (4.6)	<0.001	9.2 (4.0)	<0.001
Ethnicity				
Malay	6.5 (3.8)		6.9 (3.1)	
Chinese	6.6 (2.4)		5.9 (2.9)	
Indian	8.4 (4.2)	0.035	9.8 (3.5)	<0.001
Marital status				
Single	6.7 (2.7)		6.9 (2.9)	
Married	7.0 (3.6)	0.601	6.8 (3.6)	0.894
Highest education level				
High school	7.5 (4.0)		7.7 (3.7)	
Tertiary education	6.4 (2.5)	0.037	6.2 (2.9)	0.006
Residence				
Urban	6.8 (2.9)		6.7 (3.1)	
Rural	7.2 (4.5)	0.569	7.6 (3.9)	0.125
Monthly household income (MYR)				
<3000	7.5 (4.4)		8.7 (3.6)	
≥ 3000	6.6 (2.6)	0.090	6.0 (2.8)	<0.001
Current employment status				
Employed	6.6 (3.2)		6.4 (3.3)	
Unemployed	7.6 (3.4)	0.078	7.9 (3.2)	0.007

the average 2.3 (95% CI 0.9 to 3.6) higher anxiety score in comparison to those aged less than 50 years ($p=0.001$). Indians had on an average 1.7 (95% CI 0.3 to 3.2) higher anxiety score compared with Malays ($p=0.018$). Patients diagnosed with IHD had on an average 1.5 (95% CI 0.1 to 2.9) higher anxiety score in comparison to those without such a condition ($p=0.039$).

Factors associated with depression among patients with diabetes by multiple linear regression

Table 6 shows the factors associated with depression among patients with diabetes. Patients aged ≥ 50 years had on the average 1.4 (95% CI 0.2 to 2.7) higher depression score in comparison to those aged less than 50 years ($p=0.027$). Indians had on the average 2.7 (95% CI 1.4 to 4.0) higher depression score compared with Chinese ($p<0.001$). Patients with a monthly household income of less than MYR3000 had on an average 1.9 (95% CI 0.8 to 3.0) higher depression score compared to those with a higher income ($p=0.001$).

DISCUSSION

This study aimed to determine the prevalence and factors associated with anxiety and depression among

Table 4 Association between anxiety and depression with clinical health information of the respondents (n=169)

Characteristics	Anxiety		Depression	
	Mean (SD)	p Value	Mean (SD)	p Value
<i>Diabetes vascular complications</i>				
Cerebrovascular accident				
Yes	6.6 (4.1)	0.742	6.7 (4.8)	0.823
No	6.9 (3.3)		6.9 (3.2)	
Ischaemic heart disease				
Yes	8.7 (4.2)	0.004	7.8 (4.1)	0.131
No	6.6 (3.1)		6.7 (3.2)	
Diabetic nephropathy				
Yes	7.4 (2.2)	0.492	6.4 (3.0)	0.548
No	6.8 (3.4)		6.9 (3.4)	
Comorbidities				
Diabetes alone	6.6 (3.3)	0.289	6.3 (3.4)	0.010
Diabetes with hypertension or dyslipidaemia	7.2 (3.4)		7.5 (3.2)	
Diabetes with hypertension and dyslipidaemia	7.7 (3.0)		8.4 (2.9)	

diabetes outpatients in Malaysia. Of the 169 patients with diabetes surveyed, 31.4% perceived anxious states while 40.3% exhibited depressive symptoms. The estimated rate of anxiety reported in this study was similar to an Irish sample (32%),⁶ but relatively lower than that found in Mexican (52.9%)⁹ and Pakistani (57.9%) participants.² In contrary, self-reported depression rates reported in this study were similar than that found in Mexican (47.7%)⁹ and Pakistani (43.5%) samples,² but comparatively higher than that found in Irish participants (22.4%).⁶ In the final model, age, ethnicity and history of IHD were significantly associated with anxiety, while factors significantly associated with depression were age, ethnicity and monthly household income.

Ageing appears to accelerate diabetes vascular complications and hyperglycaemic crisis, causing poor functional status and high mortality rates.²² Dysregulation of the hypothalamic-pituitary-adrenal axis and overactivation of the sympathetic nervous system due to fear of hypoglycaemia, complications or mortality are immediate physiological processes that prompt higher anxiety states

among older population.⁵ This study found a significantly higher anxious state among older patients compared with younger ones. Collins *et al*⁶ reported otherwise.

The development of vascular complications is a predictive factor for psychological morbidity among people with diabetes.²³ This study found a significantly higher anxiety level among patients with IHD. Khuwaja *et al*² reported similar associations.

The increased susceptibility to various diseases, disabilities and social isolation among older population causes serious psychological repercussions.²⁴ This study found a significantly higher depression score among older patients in comparison to younger ones. Similar findings were found among patients with diabetes in other countries.^{2 25}

Latest statistics revealed by the Ministry of Health Malaysia reported that the prevalence of diabetes was the highest among Indian ethnic (24.9%), followed by Malay ethnic (17%) and Chinese ethnic (13.9%).⁴ Minority ethnic groups have been known to experience higher anxiety and depression rates.^{26 27} This study found a

Table 5 Factors associated with anxiety among patients with diabetes by multiple linear regression (n=169)

Predictors	B	SE	β	p Value	95% CI	
					Lower	Upper
Age (years)						
<50	Ref	Ref	Ref	Ref	Ref	Ref
≥50	2.3	0.7	0.3	0.001	0.9	3.6
Ethnicity						
Malay	Ref	Ref	Ref	Ref	Ref	Ref
Chinese	0.7	0.6	0.1	0.194	-0.4	1.8
Indian	1.7	0.7	0.2	0.018	0.3	3.2
Highest education level						
High school	0.1	0.5	0.0	0.871	-1.0	1.1
Tertiary educated	Ref	Ref	Ref	Ref	Ref	Ref
Having ischaemic heart disease						
Yes	1.5	0.7	0.2	0.039	0.1	2.9
No	Ref	Ref	Ref	Ref	Ref	Ref

Table 6 Factors associated with depression among patients with diabetes by multiple linear regression (n=169)

Predictors	B	SE	β	p Value	95% CI	
					Lower	Upper
Age (years)						
<50	Ref	Ref	Ref	Ref	Ref	Ref
≥50	1.4	0.6	0.2	0.027	0.2	2.7
Ethnicity						
Malay	0.4	0.5	0.1	0.458	-0.7	1.4
Indian	2.7	0.7	0.3	<0.001	1.4	4.0
Chinese	Ref	Ref	Ref	Ref	Ref	Ref
Highest education level						
High school	-0.3	0.5	-0.1	0.548	-1.4	0.7
Tertiary educated	Ref	Ref	Ref	Ref	Ref	Ref
Monthly household income (MYR)						
<3000	1.9	0.6	0.3	0.001	0.8	3.0
≥3000	Ref	Ref	Ref	Ref	Ref	Ref
Current employment status						
Employed	Ref	Ref	Ref	Ref	Ref	Ref
Unemployed	-1.7	1.5	-0.2	0.265	-4.7	1.3
Comorbidities						
Diabetes alone	Ref	Ref	Ref	Ref	Ref	Ref
Diabetes with hypertension or dyslipidaemia	-2.6	1.5	-0.4	0.080	-5.5	0.3
Diabetes with hypertension and dyslipidaemia	-2.3	1.7	-0.2	0.189	-5.7	1.1

significantly higher anxiety and depression level among Indian patients in comparison to other ethnicities. A recent Malaysian study which reported similar associations postulated that minority ethnic Indians experienced extensive psychological comorbidities due to triadic stressors of socioeconomic constraints, poor education level and perceived discrimination.⁸

Higher depression states in unemployment is caused by reduced sociological functions such as status identity, social contacts, participation in collective purposes and regular activities.¹² This study found a significantly higher depression status among unemployed patients in comparison to those being employed. Kaur *et al*⁸ reported similar consistencies. In addition, this study found a significantly higher depression level in lower income patients. Similar findings were reported in a Malaysian study.⁸ Reduced confidence due to economic instability and increased healthcare expenditures for routine diabetes screening complications, comorbid conditions and adherence to treatment pose substantial psychological illness among people with diabetes.⁹

Diabetes comorbid conditions like hypertension and dyslipidaemia has been known to amplify disease complications and poor treatment outcomes.^{21 28} Increased rates of depression have been found in diabetes patients with hypertension.²⁸ An exponential rise of mortality rates due to serious cardiovascular disease complications in dyslipidaemia would contribute to high depression rates among patients with diabetes due to reduced quality of life and poor prognosis.^{7 21} This study found a significantly higher depression score among patients with diabetes and hypertension or dyslipidaemia. Khuwaja *et al*² found similar findings.

Higher education attainment has been linked to be a protective factor against anxiety and depression among people with diabetes.^{6 11 29} Education drives individuals towards proper understanding of disease mechanisms and complications, prompting increased compliance and adherence towards disease treatment for better health outcomes. Our study found a significantly lower anxiety and depression level among tertiary educated patients in comparison to high school graduates.

LIMITATIONS

The absence of a control group and a small sample size from a single hospital might limit the generalisability of the study findings. In addition, the heterogeneity of the sample in this study caused by the wide range of age affects the prevalence rates and may limit the exploration of anxiety and depression in the youngest age groups. The cross-sectional design of the study limits our ability to make causal inferences. Further research is needed to address these limitations.

CONCLUSION

Sociodemographics and clinical factors were important correlates of anxiety and depression among patients with diabetes. Age, ethnicity and IHD were significantly associated with anxiety. Factors significantly associated with depression were age, ethnicity and monthly household income.

RECOMMENDATIONS

Early recognition of vulnerable factors associated with anxiety and depression in people with diabetes is

necessary to promote patient adherence and compliance to diabetes control. Collaborative teamwork between healthcare providers and patients through a compassionate and holistic approach in recognising early neurotic features is essential to prevent disease comorbidities and mortalities. Rejuvenating primary healthcare policies from an essentially 'reactive-based system' (responding only when individuals are sick) to a 'proactive-based system' (focus on overall mental and physical health well-being) needs to be drafted immediately and amalgamated in all public health facilities within Malaysia. Increasing patient awareness to boost self-determination and confidence through integrated psychological and medical care in the management of diabetes would catalyse optimal health outcomes, as mused Osler (1961):

Care more for the individual patient than for the special features of the disease...Put yourself in his place...The kindly word, the cheerful greeting, the sympathetic look—these the patient understands. Sir William Osler (Aphorisms from his bedside teachings and writings, 1961)

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Contributors KG had the original idea, designed the study, drafted the first version of the manuscript and is responsible for the final version. PR and RAM assisted with the study design, data collection, the literature research and editing of the manuscript. KG and SARA-D contributed to the study coordination, data analysis and preparation of the manuscript. SARA-D revised the final draft critically for important intellectual content. All authors have contributed to and approved the final version of the manuscript.

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