

# Psychological symptoms in adult Saudi Arabian cancer patients: prevalence and association with self-rated oral health

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**Background:** Although psychological symptoms and oral health status are associated with health management and outcomes among cancer patients, their association has not been assessed in Saudi Arabia. We aimed to assess the symptoms of depression, anxiety, and stress and their association with their oral health status, adjusting for sociodemographic and clinical factors.

**Methods:** A self-reported study included 375 adult cancer patients who received outpatient healthcare services in the Oncology Department, King Abdulaziz Medical City-Riyadh, Saudi Arabia, between April 1 and August 31, 2017. We used the Arabic version of the Depression Anxiety Stress Scale to dichotomize a binary outcome for each. Oral health was evaluated by self-rating from “very good” to “bad”.

**Results:** A high prevalence of subjective depression, anxiety, and stress was found (44.8%, 52.5%, and 42.7%, respectively). Of the sample, 17.9% self-reported “bad” oral health, which is associated with a high risk of anxiety and stress, and its association remains significant after controlling for other factors (adjusted odds ratio=6.48 and 4.73, respectively). Being <60 years old, high level of formal education, low income, breast cancer, and lung cancer were associated with increased psychological symptoms.

**Conclusion:** Every 6 in 10 cancer patients in this study reported at least one psychosocial symptom. The findings suggest that there exists an association between self-reported “bad” oral health and psychosocial symptoms. Being <60 years old, low income, high level of formal education, breast cancer, and lung cancer were associated with psychological symptoms. Routine psychological counseling and oral health screening in outpatient oncology clinics may improve psychological outcomes and cancer management.

**Keywords:** depression, anxiety, stress, dental health, cancer, Saudi

## Introduction

Evidence has shown that psychological distress is increasingly recognized as a major health burden and could impair individual cancer patients and family caregivers.<sup>1,2</sup> Similar attention to poor oral health was also documented among cancer patients.<sup>3,4</sup> The psychological distress and poor oral health were negatively related with time, because of the diagnoses of cancer,<sup>3,5</sup> treatment,<sup>4,6</sup> and poor prognosis in cancer patients.<sup>7,8</sup> In Saudi Arabia, due to a wide array of national screening programs and diagnosis of new cancer cases at an early stage,<sup>9</sup> the survival rate among cancer patients continues to increase.<sup>10</sup> This necessitates routine assessment and intervention among cancer survivors to maintain quality of life<sup>11,12</sup> and better health management and outcomes.<sup>13</sup>

A few studies have documented symptoms of depression and anxiety among cancer patients in Saudi Arabia. The most recent estimated rate of depression<sup>14</sup> was 57.1%

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among patients with colorectal cancer and 10.4% anxiety<sup>15</sup> among patients with breast cancer. Yet, it is not documented in Saudi Arabia if prevalence of anxiety, depression, and stress differ between various cancer sites.

A single study has documented the oral health status among cancer patients in Saudi Arabia,<sup>16</sup> which reported the prevalence of oral health problems. Lack of studies on oral health status among cancer patients in Saudi Arabia has directed the attention of the study authors to explore its relation with anxiety, depression, and stress.

We, therefore, aimed to estimate the prevalence of anxiety, depression, and stress and their contributing factors among cancer survivors in Saudi Arabia. Particularly, we tested the hypothesis of whether perceived oral health and patients with cancer factors independently predict anxiety, depression, and stress in a sample of cancer patients who attended outpatient clinics between April 1 and August 31, 2017, in the Oncology Department, King Abdulaziz Medical City in Riyadh, Saudi Arabia.

## Methods

This is a cross-sectional study of adult cancer patients (age  $\geq 18$  years) receiving routine outpatient healthcare services in the Oncology Department, King Abdulaziz Medical City in Riyadh, Saudi Arabia. The study was conducted between April 1 and August 31, 2017, and recruitment was performed in various outpatient oncology clinics. We did not include seriously ill cancer patients in palliative care services. The study received ethical approval from the Institutional Review Board at the Ministry of National Guard-Health Affairs (MNG-HA), Riyadh, Saudi Arabia (Clearance No RC16/213/R). Written informed consent were obtained to participate and to publish the study findings from all patients who were recruited in the study. We collected data on sociodemographic factors, including gender, age, married (Yes/No), university degree (Yes/No), low income (less than SR 5,000  $\approx$  \$1,333), and being a smoker (Yes/No). Cancer characteristics included type of cancer (breast, lung, colon, and other), cancer stage (I, II, III, IV), number of tumors (single or multiple), and whether patient was newly diagnosed for cancer ( $< 12$  months after cancer diagnosis). Cancer treatment included surgical therapy (Yes/No), chemotherapy (Yes/No), radiation therapy (Yes/No), and immunotherapy (Yes/No). We assessed patients' clinical conditions, and the survey included chronic diseases other than cancer (Yes/No). We assessed patients' activity, and the survey included physical exercise (Yes/No). We evaluated whether patients received full health insurance coverage (Yes/No). We asked

them where they received oral health information (Yes/No) while attending oncology outpatient clinics. The study's cancer patients self-rated their oral health status: "How do you rate your oral or dental health related to gums, teeth, and tongue?" and possible answers included "very good", "good", "acceptable", and "bad".

## Outcome measures

Each patient's perceived psychological distress was measured utilizing the Depression Anxiety Stress Scale (DASS-21).<sup>17</sup> It is a 21-item self-report scale to measure subjective symptoms of depression (7 items), anxiety (7 items), and stress (7 items). The patients rated the degree to which they have encountered a particular symptom over the past week. This was measured on four points ranging from "0" where a symptom "did not apply to me at all – never" to "3" where a symptom "applied to me very much, or most of the time – almost always". The original English DASS-21 version and its culturally adopted Arabic translation version<sup>18</sup> were found to be reliable and valid. The Arabic DASS-21 version is commonly used among Arabic speakers in various outpatient clinics in Saudi Arabia.<sup>18–21</sup> The Arabic version was assessed in our oncology outpatient clinics. Reliability analysis indicated that stress (Cronbach's  $\alpha=0.85$ ), anxiety (Cronbach's  $\alpha=0.83$ ), and depression (Cronbach's  $\alpha=0.81$ ) subscales were reliable in screening for psychological symptoms in our population. The overall Arabic DASS-21 version was also found to be reliable (Cronbach's  $\alpha=0.93$ ). We used the scoring system and cutoff points described in Lovibond and Lovibond<sup>17</sup> to classify each patient according to stress, anxiety, or depression. The total of each psychological symptom scale (0–21) was classified into present or absent. A score  $>4$  was used to classify depression,  $>3$  was used to classify anxiety, and  $>7$  was used to classify stress.<sup>17</sup>

## Sample population

The study recruitment to complete the questionnaire was between April 1 and August 31, 2017, in various outpatient oncology clinics (breast cancer, colon cancer, lung cancer, etc.). Our population comprises adult cancer patients (age  $\geq 18$  years) receiving routine outpatient healthcare services in the Oncology Department, King Abdulaziz Medical City in Riyadh, Saudi Arabia. The minimum required estimated sample for this study was 341 cancer patients based on a proportion of 50%, with a precision of 5% adjusted for a finite population of size 3,000. A total of 500 cancer patients were approached to participate in the study, 375 consented to participate and completed the questionnaire with a response rate of 75%.

## Statistical analysis

Data were analyzed using the SAS version 9.4 (SAS Institute Inc., Cary, NC, USA). Univariate analyses were used to summarize the overall sample characteristics (Table 1). Subgroup analyses or Chi-square tests were used to assess association between sample characteristics and psychological symptoms (Table 1). We evaluated the association between self-rated oral health and psychological symptoms among Saudi patients with cancer. Multivariate Logistic Regression analyses were used to assess the association between self-rated oral health and each psychological symptom (depression, stress, and anxiety) after adjustment for the confounding effects of the factors considered in the univariate analyses (Table 2). An association was considered significant when the *P*-value (*P*) was  $\leq 0.05$ . We evaluated the goodness-of-fit model for each model using the Hosmer–Lemeshow test.

## Results

We analyzed 375 cancer patients in which 125 (33.3%) were diagnosed with breast cancer, 170 (45.3%) with colon cancer, 35 (9.3%) with lung cancer, and 35 (9.3%) with other types of cancer, while 10 (2.7%) chose not to report their cancer type. The mean age of our sample was  $51.79 \pm 14.71$  years with sample ages ranging between 18 and 87 years. More descriptions of the patients' sociodemography and their clinical characteristics are reported in Table 1. Depression symptoms were present in 168 (44.8%; 95% CI, 39.7%–50.0%), anxiety symptoms in 197 (52.5%; 95% CI, 47.3%–57.7%), and stress symptoms in 160 patients (42.7%; 95% CI, 37.6%–47.9%).

According to the subgroup analysis in Table 1, anxiety and stress were negatively associated with “bad” oral health ( $P=0.0146$ ,  $P=0.0070$ , respectively). Anxiety and stress were significantly less frequent among the elderly ( $\geq 60$  years;  $P=0.0053$ ,  $P=0.0007$ , respectively) and were more frequent among the female gender ( $P=0.0025$ ,  $P=0.0339$ , respectively). Depression, anxiety, and stress were highly prevalent in cancer patients with low income (less than SR 5,000  $\approx$  \$1,333;  $P=0.0010$ ,  $P=0.0001$ ,  $P=0.0038$ , respectively). Depression and anxiety were significantly more prevalent in lung cancer patients ( $P=0.0063$ ,  $P=0.0001$ , respectively) and less frequent in cancer patients with health insurance coverage ( $P=0.0445$ ,  $P=0.0024$ , respectively). Depression was highly prevalent in cancer patients who also had other chronic diseases ( $P=0.0184$ ).

Findings of the multivariable logistic models are presented in Table 2. Determinants of depression in cancer patients included university degree (adjusted odds ratio [aOR], 2.06; 95% CI, 1.01–4.25), low income (aOR, 2.3;

95% CI, 1.12–4.72), and lung cancer (aOR, 5.56; 95% CI, 1.31–23.57). Determinants of anxiety in cancer patients included bad oral health (aOR, 6.48; 95% CI, 2.22–18.96), university degree (aOR, 2.71; 95% CI, 1.27–5.80), low income (aOR, 2.68; 95% CI, 1.28–5.59), breast cancer (aOR, 5.20; 95% CI, 1.42–19.10), and lung cancer (aOR, 16.7; 95% CI, 3.39–81.94). Determinants of stress in cancer patients included acceptable oral health (aOR, 2.57; 95% CI, 1.05–6.28) and bad oral health (aOR, 4.73; 95% CI, 1.75–12.76). Elderly patients were less likely to develop stress symptoms (aOR, 0.30; 95% CI, 0.14–0.62). Cancer patients who underwent surgery were less likely to develop anxiety symptoms (aOR, 0.41; 95% CI, 0.20–0.84). The goodness-of-fit test indicates that the three models fit the data well for depression ( $P=0.6274$ ), anxiety ( $P=0.4940$ ), and stress ( $P=0.8114$ ).

## Discussion

This cross-sectional study assessed the psychological symptoms and subjective oral health status of cancer patients who attended outpatient oncology clinics at King Abdulaziz Medical City in Riyadh, Saudi Arabia. We found a significant proportion of cancer patients met the criteria for depression (44.8%), anxiety (52.5%), and stress (42.7%) in our sample. Of the sample, 62.4% reported at least one psychological symptom. This finding supports the result of an earlier Saudi Arabian study that reported the rate of depression at 57.1% among patients with colorectal cancer.<sup>14</sup> According to our knowledge, there is lack of research on self-reported psychological symptoms among cancer patients in Saudi Arabia. The high prevalence of psychological symptoms could alert oncologists to consider psychological needs during cancer treatment and management.

This is the first investigation for subjective oral health status among cancer patients in Saudi Arabia. The study has shown that 17.9% of the cancer patients analyzed perceived their oral health as “bad”. This could be explained by cancer treatment as it may contribute to greater risk of oral health complications.<sup>22</sup> In our sample, “bad” self-rated oral health was a risk indicator for anxiety and stress among cancer patients. This association remains highly significant after adjusting for several factors. For instance, the odds of anxiety were 6.48 times higher among cancer patients with “bad” self-rated oral health. This also has been documented in an earlier study.<sup>23</sup> In our sample, “bad” self-rated oral health was not related to depression.

Graner et al found that older patients tend to show negative expectations concerning the cancer diagnosis.<sup>24</sup> In this

**Table 1** Characteristics of study subjects by psychological symptoms

Characteristic	Category	Total (n=375) N (%)	Depression (n=168) 44.8%		Anxiety (n=197) 52.5%		Stress (n=160) 42.7%	
			n (%)	P-value <sup>a</sup>	n (%)	P-value <sup>a</sup>	n (%)	P-value <sup>a</sup>
<b>Self-rated oral health</b>	Very good	64 (17.1)	22 (34.4)	0.0578	25 (39.1)	0.0146 <sup>b</sup>	19 (29.7)	0.0070 <sup>b</sup>
	Good	131 (34.9)	48 (36.6)		59 (45.0)		48 (36.6)	
	Acceptable	82 (21.9)	40 (48.8)		45 (54.9)		38 (46.3)	
	Bad	67 (17.9)	35 (52.2)		43 (64.2)		38 (56.7)	
	Missing	31 (8.3)	23 (74.2)		25 (80.6)		17 (54.8)	
<b>Elderly (age ≥60 years)</b>	Yes	116 (30.9)	44 (37.9)	0.0672	49 (42.2)	0.0053 <sup>b</sup>	35 (30.2)	0.0007 <sup>b</sup>
	No	247 (65.9)	119 (48.2)		143 (57.9)		121 (49.0)	
	Missing	12 (3.2)	5 (41.7)		5 (41.7)		4 (33.3)	
<b>Gender</b>	Female	216 (57.6)	103 (47.7)	0.1233	127 (58.8)	0.0025 <sup>b</sup>	101 (46.8)	0.0339 <sup>b</sup>
	Male	154 (41.1)	61 (39.6)		66 (42.9)		55 (35.7)	
	Missing	5 (1.3)	4 (80.0)		4 (80.0)		4 (80.0)	
<b>Married</b>	Yes	289 (77.1)	128 (44.3)	0.7417	145 (50.2)	0.0838	123 (42.6)	0.8591
	No	82 (21.9)	38 (46.3)		50 (61.0)		34 (41.5)	
	Missing	4 (1.1)	2 (50.0)		2 (50.0)		3 (75.0)	
<b>University degree</b>	Yes	95 (25.3)	48 (50.5)	0.1173	52 (54.7)	0.4288	45 (47.4)	0.1523
	No	262 (69.9)	108 (41.2)		131 (50.0)		102 (38.9)	
	Missing	18 (4.8)	12 (66.7)		14 (77.8)		13 (72.2)	
<b>Family income</b>	<5,000 SR	139 (37.1)	78 (56.1)	0.0010 <sup>b</sup>	95 (68.3)	<0.0001 <sup>b</sup>	73 (52.5)	0.0038 <sup>b</sup>
	≥5,000 SR	219 (58.4)	84 (38.4)		91 (41.6)		81 (37.0)	
	Missing	17 (4.5)	6 (35.3)		11 (64.7)		6 (35.3)	
<b>Smoke</b>	Yes	98 (26.1)	49 (50.0)	0.2284	51 (52.0)	0.9096	43 (43.9)	0.7779
	No	277 (73.9)	119 (43.0)		146 (52.7)		117 (42.2)	
<b>Type of cancer</b>	Breast	125 (33.3)	62 (49.6)	0.0063 <sup>b</sup>	76 (60.8)	<0.0001 <sup>b</sup>	59 (47.2)	0.2428
	Lung	35 (9.3)	23 (65.7)		28 (80.0)		18 (51.4)	
	Colon	170 (45.3)	66 (38.8)		74 (43.5)		66 (38.8)	
	Other	35 (9.3)	11 (31.4)		13 (37.1)		12 (34.3)	
	Missing	10 (2.7)	6 (60.0)		6 (60.0)		5 (50.0)	
<b>Cancer stage</b>	I	63 (16.8)	27 (42.9)	0.8465	32 (50.8)	0.4002	27 (42.9)	0.7333
	II	81 (21.6)	35 (43.2)		44 (54.3)		35 (43.2)	
	III	63 (16.8)	26 (41.3)		30 (47.6)		22 (34.9)	
	IV	88 (23.5)	40 (45.5)		42 (47.7)		40 (45.5)	
	Unknown	80 (21.3)	40 (50.0)		49 (61.3)		36 (45.0)	
<b>Number of tumors</b>	Single tumor	182 (48.5)	77 (42.3)	0.3529	89 (48.9)	0.2445	75 (41.2)	0.7314
	Two or more	165 (44.0)	78 (47.3)		91 (55.2)		71 (43.0)	
	Missing	28 (7.5)	13 (46.4)		17 (60.7)		14 (50.0)	
<b>Surgical therapy</b>	Yes	211 (56.3)	98 (46.4)	0.4274	111 (52.6)	0.9297	94 (44.5)	0.3647
	No	163 (43.5)	69 (42.3)		85 (52.1)		65 (39.9)	
	Missing	1 (0.3)	1 (100.0)		1 (100.0)		1 (100.0)	
<b>Chemotherapy</b>	Yes	310 (82.7)	138 (44.5)	0.6642	163 (52.6)	0.8282	131 (42.3)	0.5991
	No	61 (16.3)	29 (47.5)		33 (54.1)		28 (45.9)	
	Missing	4 (1.1)	1 (25.0)		1 (25.0)		1 (25.0)	
<b>Radiation therapy</b>	Yes	177 (47.2)	79 (44.6)	0.9532	96 (54.2)	0.4735	77 (43.5)	0.6591
	No	194 (51.7)	86 (44.3)		98 (50.5)		80 (41.2)	
	Missing	4 (1.1)	3 (75.0)		3 (75.0)		3 (75.0)	
<b>Immunotherapy</b>	Yes	226 (60.3)	107 (47.3)	0.2522	125 (55.3)	0.1859	100 (44.2)	0.3352
	No	143 (38.1)	59 (41.3)		69 (48.3)		56 (39.2)	
	Missing	6 (1.6)	2 (33.3)		3 (50.0)		4 (66.7)	
<b>Newly diagnosed</b>	Yes	245 (65.3)	101 (41.2)	0.0748	122 (49.8)	0.1251	99 (40.4)	0.1457
	No	111 (29.6)	57 (51.4)		65 (58.6)		54 (48.6)	
	Missing	19 (5.1)	10 (52.6)		10 (52.6)		7 (36.8)	
<b>Chronic diseases other than cancer</b>	Yes	145 (38.7)	76 (52.4)	0.0184 <sup>b</sup>	83 (57.2)	0.1374	65 (44.8)	0.4984
	No	223 (59.5)	89 (39.9)		110 (49.3)		92 (41.3)	
	Missing	7 (1.9)	3 (42.9)		4 (57.1)		3 (42.9)	
<b>Physical exercise</b>	Yes	115 (30.7)	44 (38.3)	0.0904	63 (54.8)	0.5618	51 (44.3)	0.6616
	No	260 (69.3)	124 (47.7)		134 (51.5)		109 (41.9)	

(Continued)

Table 1 (Continued)

Characteristic	Category	Total (n=375) N (%)	Depression (n=168) 44.8%		Anxiety (n=197) 52.5%		Stress (n=160) 42.7%	
			n (%)	P-value <sup>a</sup>	n (%)	P-value <sup>a</sup>	n (%)	P-value <sup>a</sup>
Health insurance coverage	Yes	179 (47.7)	70 (39.1)	0.0445 <sup>b</sup>	79 (44.1)	0.0024 <sup>b</sup>	68 (38.0)	0.1032
	No	192 (51.2)	95 (49.5)		115 (59.9)		89 (46.4)	
	Missing	4 (1.1)	3 (75.0)		3 (75.0)		3 (75.0)	
Received oral health information	Yes	148 (39.5)	66 (44.6)	0.9020	73 (49.3)	0.3513	62 (41.9)	0.8253
	No	223 (59.5)	98 (43.9)		121 (54.3)		96 (43.0)	
	Missing	4 (1.1)	4 (100.0)		3 (75.0)		2 (50.0)	

Notes: <sup>a</sup>P-values for differences based on chi-squared test for proportions. <sup>b</sup>Differences significant at P≤0.05.

Table 2 aOR and 95% confidence intervals (95% CI) for the relationship between self-rated oral health and psychological conditions, including depression, anxiety, and stress in cancer patients

Characteristic	Category	Depression			Anxiety			Stress		
		aOR	95% CI	P-value	aOR	95% CI	P-value	aOR	95% CI	P-value
Self-rated oral health	Very good	1.00			1.00			1.00		
	Good	1.21	(0.55–2.64)	0.6327	2.26	(1.00–5.10)	0.0494 <sup>a</sup>	1.55	(0.69–3.46)	0.2847
	Acceptable	1.61	(0.68–3.81)	0.2755	2.76	(1.11–6.86)	0.0285 <sup>a</sup>	2.57	(1.05–6.28)	0.0387 <sup>a</sup>
	Bad	2.20	(0.86–5.66)	0.1013	6.48	(2.22–18.96)	0.0006 <sup>a</sup>	4.73	(1.75–12.76)	0.0022 <sup>a</sup>
Elderly (age ≥60 years)	Yes	0.65	(0.33–1.30)	0.2264	0.49	(0.23–1.02)	0.0580	0.30	(0.14–0.62)	0.0013 <sup>a</sup>
	No	1.00			1.00			1.00		
Gender	Female	1.56	(0.64–3.77)	0.3266	1.63	(0.64–4.12)	0.3060	2.02	(0.82–4.99)	0.1273
	Male	1.00			1.00			1.00		
Married	Yes	1.57	(0.76–3.27)	0.2236	0.78	(0.37–1.65)	0.5194	2.07	(0.97–4.44)	0.0602
	No	1.00			1.00			1.00		
University degree	Yes	2.06	(1.01–4.25)	0.0497 <sup>a</sup>	2.71	(1.27–5.80)	0.0100 <sup>a</sup>	1.64	(0.80–3.36)	0.1806
	No	1.00			1.00			1.00		
Family income	<5,000 SR	2.30	(1.12–4.72)	0.0235 <sup>a</sup>	2.68	(1.28–5.59)	0.0088 <sup>a</sup>	1.60	(0.77–3.32)	0.2071
	≥5,000 SR	1.00			1.00			1.00		
Smoke	Yes	1.24	(0.56–2.73)	0.5966	0.83	(0.36–1.92)	0.6605	1.08	(0.47–2.49)	0.8522
	No	1.00			1.00			1.00		
Type of cancer	Breast	2.41	(0.68–8.53)	0.1739	5.20	(1.42–19.10)	0.0129 <sup>a</sup>	1.81	(0.51–6.38)	0.3583
	Lung	5.56	(1.31–23.57)	0.0199 <sup>a</sup>	16.7	(3.39–81.94)	0.0005 <sup>a</sup>	1.28	(0.31–5.30)	0.7346
	Colon	1.93	(0.61–6.11)	0.2628	2.92	(0.92–9.31)	0.0700	1.61	(0.51–5.04)	0.4164
	Other	1.00			1.00			1.00		
Cancer stage	I	1.00			1.00			1.00		
	II	2.95	(0.92–9.49)	0.0689	1.64	(0.48–5.61)	0.4317	4.06	(1.23–13.40)	0.0213 <sup>a</sup>
	III	1.70	(0.64–4.52)	0.2851	1.43	(0.52–3.95)	0.4863	1.85	(0.68–5.04)	0.2267
	IV	1.87	(0.67–5.22)	0.2294	1.53	(0.52–4.50)	0.4414	1.75	(0.62–4.95)	0.2934
	Unknown	0.90	(0.34–2.39)	0.8252	1.28	(0.46–3.58)	0.6337	1.09	(0.40–2.98)	0.8640
Number of tumors	Single tumor	1.21	(0.64–2.31)	0.5526	0.99	(0.50–1.96)	0.9873	1.02	(0.53–1.98)	0.9416
	Two or more	1.00			1.00			1.00		
Surgical therapy	Yes	0.98	(0.51–1.87)	0.9533	0.41	(0.20–0.84)	0.0148 <sup>a</sup>	0.85	(0.44–1.66)	0.6360
	No	1.00			1.00			1.00		
Chemotherapy	Yes	1.00	(0.38–2.67)	0.9935	0.92	(0.34–2.52)	0.8744	0.66	(0.24–1.82)	0.4242
	No	1.00			1.00			1.00		
Radiation therapy	Yes	0.98	(0.54–1.78)	0.9571	1.19	(0.64–2.24)	0.5842	1.19	(0.65–2.17)	0.5747
	No	1.00			1.00			1.00		
Immunotherapy	Yes	1.32	(0.73–2.40)	0.3611	1.21	(0.64–2.29)	0.5478	1.44	(0.77–2.68)	0.2492
	No	1.00			1.00			1.00		
Newly diagnosed	Yes	0.81	(0.44–1.49)	0.4994	0.94	(0.49–1.79)	0.8406	1.06	(0.57–1.97)	0.8503
	No	1.00			1.00			1.00		
Chronic diseases other than cancer	Yes	1.81	(0.99–3.32)	0.0550	1.48	(0.77–2.85)	0.2351	1.36	(0.73–2.54)	0.3326
	No	1.00			1.00			1.00		
Health insurance coverage	Yes	0.63	(0.34–1.17)	0.1422	0.56	(0.29–1.06)	0.0728	0.66	(0.35–1.22)	0.1852
	No	1.00			1.00			1.00		

Note: <sup>a</sup>P-value significant at the significance level 0.05.

Abbreviation: aOR, adjusted odds ratio.

study, the results suggest that age was negatively associated with stress among cancer patients, and the odds of stress tended to reduce 70% among elderly patients (age  $\geq 60$  years) as opposed to patients  $< 60$  years old. A prospective study is needed to monitor psychosocial needs of cancer patients  $< 60$  years old.

As the level of formal education rises, the odds of depression and anxiety increase. This finding contradicts a study conducted on breast cancer outpatients in Turkey, where the educational level is inversely related to depression.<sup>25</sup> In our study, the level of formal education may be translated into a high level of awareness toward cancer and its burden.<sup>26</sup>

In these cancer patients, the odds of depression and anxiety were 2.3 and 2.68 times higher among low-income cancer survivors ( $< SR 5,000 \approx \$1,333$ ) than in cancer survivors with income  $\geq SR 5,000 \approx \$1,333$ . Several earlier reports documented the positive association between low income and psychosocial symptoms.<sup>27–32</sup> The high risk of psychosocial symptoms among low-income cancer survivors could be attributed to economic barriers to cancer treatment and care<sup>33</sup> as well as lack of mental health services.<sup>29</sup>

In this sample, cancer type was a predictor for a high risk of depression and anxiety. Significant increase in psychosocial symptoms was observed in lung and breast cancer patients. Patients who were diagnosed with these cancer sites may need more mentoring and attention or intervention to reduce the burden of psychosocial symptoms.<sup>34</sup>

We noted a number of limitations that should be considered in future studies. The study was based on the self-report of subjective oral health status and psychosocial symptoms and not on clinical examination. Due to the nature of the study design, the results indicate an association rather than causation. Despite the mentioned limitations, the study provides a considerable contribution to the area of oral health and psychosocial symptoms among cancer patients in Saudi Arabia as no such data exist in this population.

## Conclusion

Every six in ten of the cancer patients in this study had at least one psychosocial symptom. The findings suggest that association exists between self-reported “bad” oral health, anxiety, and stress. Being  $< 60$  years old, low income, high level of formal education, breast cancer, and lung cancer were associated with psychological symptoms. Routine psychological counseling and oral health screening in outpatient oncology clinics may improve psychological outcomes and cancer management.

## Availability of data and materials

The dataset is available from the corresponding author who is also the principal investigator of the study.

## Acknowledgments

We would like to thank King Abdullah International Medical Research Center for approving the study. Funding was obtained for open access from King Abdullah International Medical Research Center.

## Author contributions

AEA designed the study and wrote the manuscript. The data analysis was carried out by NY, ANA, ATQ, and ETQ collected the data. ARJ and HALJ reviewed and edited the manuscript. All authors read and approved the final manuscript. All authors contributed toward data analysis, drafting and critically revising the paper, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

## Disclosure

The authors report no conflicts of interest in this work.

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