The association between obesity and self-reported current depression among adult cancer survivors residing in Brazil

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Background: The purpose of the current study was to investigate the association between obesity and self-reported current depression (SRCD) in a population-based sample of adult Brazilian cancer survivors.

Methods: The sample for this study (N=930) was based on the 2013 Brazilian National Health Survey. SRCD was assessed using the 8-item Patient Health Questionnaire (PHQ-8). Obesity was defined as a body mass index ≥ 30 kg/m². Multivariable weighted logistic regression models were conducted to investigate the association between obesity and SRCD among Brazilian adult cancer survivors.

Results: The weighted prevalence of obesity and SRCD among adult cancer survivors was 26.4% (95% confidence interval [CI] 22.5 to 30.3%) and 13.7% (95% CI 10.4 to 17.1%), respectively. Overall there was no significant weighted and adjusted association between obesity and SRCD among cancer survivors (adjusted odds ratio [AOR] 0.99 [95% CI 0.56 to 1.73]). Nevertheless, among cancer survivors of working age (18–59 y), this association was significant (AOR 2.19 [95% CI 1.28 to 3.73]) and therefore obesity is significantly associated with a 119% increase in the odds of SRCD among Brazilian adult cancer survivors of working age.

Conclusions: Since both obesity and depression may lead to worse health and quality of life outcomes in this young and middle-aged population, further investigations are needed in order to establish the causality and directionality of this association.

Keywords: Brazil, cancer survivors, depression, health survey, obesity

Introduction

Depression is among the leading causes of disability worldwide, affecting more than 300 million people, and can lead to significant impairments in an individual's ability to carry out daily responsibilities.¹ According to the World Health Organization (WHO), depression is a mental disorder that involves one or more repeated depressive episodes such as depressed mood, loss of interest or pleasure, decreased energy, feelings of guilt or low self-worth, disturbed sleep or changed appetite and poor concentration.¹ Once these depressive episodes become chronic or repeated, being present for at least 2 weeks, depression can be clinically diagnosed.²

Adverse life events such as unemployment, bereavement and psychological trauma increases the risk for depression, although a complex interaction among psychological, biological and social factors needs to be considered.¹ Furthermore, the association between depression and physical health, such as cardiovascular disease,³ cancer⁴ and obesity,^{5,6} has been previously reported mostly in countries located in North America and Europe.

Obesity in adults, defined as a body mass index (BMI) ≥ 30 kg/m², is another major risk factor for a number of preventable diseases and disability worldwide.¹ The fundamental causes of obesity are linked to the individual's energy imbalance: more calories consumed than calories expended.^{6,7} A range of risk

factors, including social, economic, psychological and genetic vulnerabilities, have all been associated with obesity.^{7–10}

Global estimates show that more than 650 million (13%) adults ≥ 18 y of age were obese in 2016. Overall the prevalence of obesity nearly tripled between 1975 and 2016 worldwide.¹¹ This growing prevalence of obesity is alarming given that obesity is associated with a number of significant chronic diseases, including cardiovascular diseases, musculoskeletal disorders, depression and some types of cancers.^{11,12} Although data from longitudinal studies are lacking, evidence from systematic reviews show that the link between obesity and depression is bidirectional and more strongly associated in American (vs European) adults and in clinically diagnosed depressed adults versus those reporting depressive symptoms.¹³ Longitudinal studies are also lacking in examining the causal link between obesity and cancer; but together with cross-sectional studies, they consistently demonstrate obesity as a risk factor for several cancers, most likely due to inflammatory, hormonal and cell growth regulator mechanisms. Obesity in breast, prostate and colorectal cancer survivors has also been linked to increases in morbidity and mortality.¹² Both obesity and depression may occur in cancer survivors due to a range of physiological and psychological changes. However, the prevalence and strength of associations in cancer survivors are not well known.^{14,15}

Based on estimates provided by the International Agency for Research on Cancer,¹⁶ in 2012 there were 14.1 million new cancer cases and 32.6 million people living with cancer within 5 y of diagnosis worldwide, a large proportion of them living in low- and middle-income countries. It was estimated that in 2018 there would be 18.1 million new cases, 9.6 million cancer deaths and 43.8 million people living with cancer within 5 y of diagnosis worldwide.¹⁷ Due to the growth and aging of the global population, it is estimated that the number of new cancer cases will reach 21.5 and 29.5 million worldwide by 2025 and 2040, respectively.¹⁷ Given the advances in cancer screening and treatment methodology, in the past decade the 5-y net survival of adult cancer has increased significantly.¹⁸ Cancer survivors are exposed to an increased risk of cancer reoccurrence and poor physical and psychosocial outcomes.^{19–21} Roughly 30% of cancer survivors in the US are obese and the obesity rate is increasing faster than in the general population.²² Therefore it is imperative to have a good understanding of the quality of life among cancer survivors across the globe.

The association between obesity and depression among adult cancer survivors needs to be researched as part of the survivorship continuum, especially since depression in this population can lead to reduced quality of life and increased cancer mortality.²³ Unfortunately very limited research has been done in this direction in areas such as South America, including Brazil. In 2018 in Brazil it was estimated that there would be 560 000 newly diagnosed cancer cases and more than 1.3 million 5-y prevalence cases.²⁴ It is also very worrisome to note that in Brazil the overall obesity prevalence has increased dramatically in the last 30 y,²⁵ which has increasingly contributed to the overall burden of cancer.²⁶ A population-based study conducted in Brazil reported a prevalence of depression of 14.2% and 7.5% for those who have and have not been diagnosed with cancer, respectively, with no significant difference in obesity between the two groups.²⁷

Thus this current study adds to the knowledge base by providing new data on the prevalence of co-occurring obesity and depression and its association, controlling for potential confounders, in a recent (2013) nationally representative sample of adult Brazilian cancer survivors. Our hypotheses were that prevalence estimates of both self-reported current depression (SRCD) and obesity in Brazilian adults would generally be lower than in US adult populations and that co-occurring SRCD and obesity in cancer survivors living in Brazil would be significantly associated, after accounting for potential confounders of interest.

Materials and methods

Study sample

The sample for this study was based on a national health survey conducted in Brazil in 2013 called the 'Pesquisa Nacional de Saúde' (PNS). The PNS was carried out by the Brazilian Ministry of Health in partnership with the Brazilian Institute of Geography and Statistics (IBGE) and the Oswaldo Cruz Foundation (Fiocruz). It is a household-based national survey in which the target population was adult residents (≥ 18 y of age). The PNS aimed to produce data about the health status and lifestyles of the population, health care access and surveillance of chronic non-communicable diseases and associated risk factors.²⁸

A three-stage cluster sampling design was conducted to obtain the whole sample of the PNS, having census tracts as the primary unit, households as secondary units and an adult (≥ 18 y of age) randomly selected from each household as a tertiary unit to respond to the individual part of the questionnaire. Initially 81 254 households were selected for sampling. Overall 64 348 household interviews and 60 202 individual interviews were conducted. The response rate was 91.9% and 86.0% for the household interviews and for the individual interviews, respectively. Details on the study design, sampling and complex weighting procedures have been previously described.²⁸ These data are publicly available.

The current study sample consists of 1023 individuals previously diagnosed with cancer, selected from among the 60 202 individuals who responded to the 2013 PNS interview. Pregnant women at the time of the survey ($n=3$) and individuals with <1 y since their initial cancer diagnosis ($n=90$) were excluded. As a result, the final study sample size was 930 adult cancer survivors for >1 y from their initial cancer diagnosis. The median time from the initial cancer diagnosis was 6.1 y, with a quartile 1–quartile 3 range of 2.1–12.5 y. Most of the individuals (80.1% [$n=753$]) reported that nowadays cancer does not or only slightly limits their habitual activities, such as work and house-keeping. Among all the cancer sites inquired about (lung, intestine, stomach, breast [only for women], cervical/cervix, prostate and skin), the most prevalent were breast cancer (22.8% [$n=212$]), skin cancer (18.1% [$n=168$]) and prostate cancer (13.3% [$n=124$]). Other cancer sites different from the seven inquired about, but not specified, were reported by 25.0% ($n=232$) of the sample. Therefore, due to the small subsample sizes, cancer-specific subsample analyses could not be performed.

Outcome of interest: SRCD

SRCD was assessed using the validated 8-item Personal Health Questionnaire (PHQ-8) depression scale.²⁹ The PHQ-8 was developed as a personal depression self-reporting tool based on the physician-administered Primary Care Evaluation of Mental Disorders (PRIME-MD) and incorporates the Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV) criteria for depressive disorders to make a diagnosis. It is a multi-purpose instrument for screening, diagnosing, monitoring and measuring the severity of depression.²⁹

In the PHQ-8, survey participants were asked about how frequently symptoms of depression have bothered them over the past 2 weeks. Response categories were 'not at all' (scored 0), 'several days' (scored 1), 'more than half the days' (scored 2) and 'nearly every day' (scored 3). The sum of the scores defines the five severity categories of depression: none or minimal depression (0–4), mild depression (5–9), moderate depression (10–14), moderately severe depression (15–19) and severe depression (20–24). Also, a score of 0–9 is defined as 'no depression', while a score of 10–24 is defined as 'current depression'.²⁹

Exposure of interest: obesity

Obesity is defined as abnormal body fat accumulation that may impair health and the quality of life of an individual. BMI, calculated as a person's weight in kilograms divided by the square of height in meters (kg/m^2), is the commonly used index to classify obesity status. The cutoff point for the classification of obesity in adults is $\geq 30 \text{ kg/m}^2$.¹¹ The weight and height of each individual were measured by trained interviewers according to a standard protocol using calibrated portable electronic scales and stadiometers.²⁸

Covariates of interest

Sociodemographic variables (age, gender, race, marital status, education and having health insurance or not) were included in the present study. Data were collected by in-person interviews. Race was asked as 'skin colour or race', with the five answer options grouped as white or non-white (black, yellow, brown and indigenous). Marital status grouped individuals as married, separated/divorced/widower or single. Questions about the level of education enabled the computation of years of study to classify interviewees as having less than high school (<12 y of study), completed high school (12 y of study) or more than high school (>12 y of study).

Depression-related comorbidities³⁰ were considered based on how many of the following conditions the respondent indicated as being diagnosed by a doctor: diabetes, heart disease, asthma, arthritis or rheumatism and pulmonary impairment. The PNS survey defined pulmonary impairment as emphysema, chronic bronchitis or chronic obstructive pulmonary disease. The final depression-related comorbidities variable was categorized as 0 (having no comorbidities), 1 (having one comorbidity) or 2 (having two or more comorbidities).

Physical activity (PA) for leisure was assessed through self-reported PA-related questions. According to the World Health

Organization (WHO),³¹ individuals who reported to practice at least 150 min/week of moderately intense PA or at least 75 min/week of intense PA were classified as performing the 'recommended' level of PA for leisure. Otherwise they were classified as performing PA for leisure 'less than recommended'. This measuring instrument for PA for leisure was previously proven valid and reliable for use in Brazil.³²

Statistical analyses

Descriptive analyses were produced for all variables included in the study. The median and interquartile range (IQR) were calculated for age and weighted prevalences and 95% confidence intervals (CIs) were determined for categorical variables.

For basic comparisons between each categorical variable and SRCD, the Rao-Scott χ^2 test was used, which is the survey design adjusted equivalent of the Pearson χ^2 test. Multivariable weighted and adjusted logistic regression models were conducted to investigate the association between obesity and SRCD among adult cancer survivors while adjusting for possible confounders: age, gender, race, marital status, education, health insurance, having one or more depression-related comorbidities and PA for leisure. The multiplicative interaction effect between age groups (working age 18–59 y, retired age ≥ 60 y) and obesity was also investigated and if found significant, subgroup analyses were performed.

Statistical analyses were performed in SAS version 9.4 (SAS Institute, Cary, NC, USA). All analyses were conducted considering the complex survey sampling design. The level of statistical significance was set at 0.05.

Results

Among all the participants in this study, the weighted prevalence of SRCD was 13.7% (95% CI 10.4 to 17.1). The participants median age at the survey was 61.2 y (IQR 51.3–70.0).

SRCD in the white group was 11.5% and in the non-white group was 18.6% ($p=0.027$). Those with less than a high school education had a prevalence of SRCD of 17.8%, four times higher than the 4.4% found for those who received more than a high school education ($p<0.001$). Cancer survivors performing less than the recommended PA for leisure (15.4%) and those with two or more depression-related comorbidities (26.2%) also presented with a higher prevalence of SRCD when compared with their counterparts (Table 1).

In the group of younger individuals of working age (18–59 y), an unadjusted significant association was found between obesity and SRCD, with a higher prevalence of SRCD for the obese (24.8%) compared with the non-obese (12.2%) ($p=0.002$). It is worth noting that education level ($p=0.006$) and the number of depression-related comorbidities ($p=0.002$) were also associated with SRCD in this group. In addition, health insurance ($p=0.046$) and physical activity for leisure ($p=0.020$) were found to be statistically significantly associated with SRCD in this younger group (18–59 y of age) (Table 2).

Conversely, among cancer survivors ≥ 60 y of age, univariable analyses showed that obesity was not statistically significant associated with SRCD ($p=0.136$). For this older group, the

Table 1. Sociodemographic characteristics, PA for leisure, obesity and number of depression-related comorbidities overall and by current depression status among adult cancer survivors, Brazilian National Health Survey 2013

Characteristic	Overall (n=930)			Current depression				p-Value
	Unweighted counts	Weighted		Yes (n=141), weighted		No (n=789), weighted		
		Median	IQR	Median	IQR	Median	IQR	
Age at survey	930	61.2	51.3–70.0	55.3	49.8–68.2	61.7	51.6–70.3	0.382*
		Percent	95% CI	Percent	95% CI	Percent	95% CI	
Age (years)								0.393**
18–59	423	44.3	39.3 to 49.2	15.2	10.6 to 19.9	84.8	80.1 to 89.4	
≥60	507	55.7	50.8 to 60.7	12.5	8.0 to 17.0	87.5	83.0 to 92.0	
Gender								0.218**
Male	316	41.3	36.5 to 46.1	11.6	6.9 to 16.2	88.4	83.8 to 93.1	
Female	614	58.7	53.9 to 63.5	15.3	11.1 to 19.4	84.7	80.6 to 88.9	
Race								0.027**
White	579	68.4	64.6 to 72.3	11.5	7.9 to 15.1	88.5	84.9 to 92.1	
Non-white	351	31.6	27.7 to 35.4	18.6	12.4 to 24.7	81.4	75.3 to 87.6	
Marital status								0.480**
Married	420	57.8	53.4 to 62.3	12.4	8.0 to 16.8	87.6	83.2 to 92.0	
Separated, divorced or widow(er)	306	26.2	22.5 to 29.8	14.7	9.2 to 20.1	85.3	79.9 to 90.8	
Single	204	16.0	12.2 to 19.7	17.0	9.4 to 24.6	83.0	75.4 to 90.6	
Education								<0.001**
Less than high school	522	57.4	52.5 to 62.4	17.8	13.0 to 22.6	82.2	77.4 to 87.0	
Completed high school	181	18.8	15.0 to 22.6	13.1	6.0 to 20.2	86.9	79.8 to 94.0	
More than high school	227	23.8	19.1 to 28.5	4.4	1.2 to 7.6	95.6	92.4 to 98.8	
Health insurance								0.085**
Yes	399	44.4	39.8 to 49.0	10.6	6.0 to 15.2	89.4	84.8 to 94.0	
No	531	55.6	51.0 to 60.2	16.2	11.7 to 20.8	83.8	79.2 to 88.3	
Physical activity for leisure								0.032**
Recommended	182	21.0	16.8 to 25.2	7.3	2.3 to 12.4	92.7	87.6 to 97.7	
Less than recommended	748	79.0	74.8 to 83.2	15.4	11.5 to 19.3	84.6	80.7 to 88.5	
Obesity								0.614**
Yes	236	26.4	22.5 to 30.3	13.3	9.5 to 17.1	86.7	82.9 to 90.5	
No	694	73.6	69.7 to 77.5	14.9	9.3 to 20.4	85.1	79.6 to 90.7	
Number of depression-related comorbidities								0.027**
0	561	62.3	57.9 to 66.7	11.4	7.2 to 15.7	88.6	84.3 to 92.8	
1	266	27.3	23.2 to 31.5	14.2	8.6 to 19.8	85.8	80.2 to 91.4	
≥2	103	10.3	7.6 to 13.1	26.2	13.2 to 39.1	73.8	60.9 to 86.8	

*Based on unadjusted weighted logistic regression.

**Based on the Rao–Scott χ^2 test.

unadjusted risk factors associated with SRCD were race ($p=0.048$), education level ($p=0.003$) and the number of depression-related comorbidities ($p=0.018$) (Table 3).

Overall, among all age groups taken together, univariable and multivariable weighted logistic regression results did not show a significant association between obesity and SRCD among cancer survivors in either unadjusted ($p=0.615$) or adjusted analyses ($p=0.928$). The multiplicative interaction effect between age groups and obesity was found to be statistically significant ($p=0.023$) and therefore age subgroup

analyses were performed. Subgroup analyses showed more than double increased odds for SRCD among obese cancer survivors ages 18–59 y when compared with their non-obese counterparts, in both unadjusted ($p=0.003$) and adjusted analyses ($p=0.004$) (Table 4).

For a better understanding of the association between obesity and SRCD among Brazilian cancer survivors, cancer sites for currently depressed individuals were evaluated. We found that 34.8% ($n=49$) were classified as others and therefore the cancer site could not be identified. The subgroups by cancer site had

Table 2. Sociodemographic characteristics, PA for leisure, obesity and number of depression-related comorbidities by current depression status among adult cancer survivors 18–59 y of age, Brazilian National Health Survey 2013

Characteristic	Current depression				p-Value
	Yes (n=78), weighted		No (n=345), weighted		
	Median	IQR	Median	IQR	
Age (years)	47.4	40.3–54.0	47.1	41.1–55.1	0.852*
	Percent	95% CI	Percent	95% CI	
Obesity					0.002**
Yes	24.8	15.3 to 34.3	75.2	65.7 to 84.7	
No	12.2	8.4 to 16.0	87.8	84.0 to 91.6	
Gender					0.275**
Male	11.7	4.3 to 19.1	88.3	80.9 to 95.7	
Female	16.5	12.1 to 20.9	83.5	79.1 to 87.9	
Race					0.136**
White	13.3	8.4 to 18.2	86.7	81.8 to 91.6	
Non-white	18.7	12.6 to 24.8	81.3	75.2 to 87.4	
Marital status					0.507**
Married	13.7	9.0 to 18.5	86.3	81.5 to 91.0	
Separated, divorced or widow(er)	16.7	10.7 to 22.8	83.3	77.2 to 89.3	
Single	17.9	9.2 to 26.7	82.1	73.3 to 90.8	
Education					0.006**
Less than high school	21.3	14.8 to 27.8	78.7	72.2 to 85.2	
Completed high school	15.7	7.9 to 23.6	84.3	76.4 to 92.1	
More than high school	5.4	0.1 to 10.7	94.6	89.3 to 99.9	
Health insurance					0.046**
Yes	10.9	5.1 to 16.8	89.1	83.2 to 94.9	
No	18.5	13.7 to 23.3	81.5	76.7 to 86.3	
Physical activity for leisure					0.020**
Recommended	8.3	3.2 to 13.5	91.7	86.5 to 96.8	
Less than recommended	17.6	12.6 to 22.7	82.4	77.3 to 87.4	
Number of depression-related comorbidities					0.002**
0	10.8	5.6 to 16.0	89.2	84.0 to 94.4	
1	24.3	13.9 to 34.7	75.7	65.3 to 86.1	
≥2	35.7	19.0 to 52.3	64.3	47.7 to 81.0	

*Based on unadjusted weighted logistic regression.

**Based on the Rao–Scott χ^2 test.

fewer than 30 individuals, therefore, due to the small sample sizes, subset analysis of this association within cancer sites was not feasible.

Discussion

The goals of the current study were to estimate the prevalence of obesity and SRCD in a large, representative population-based sample of adult Brazilian cancer survivors and to investigate the association between obesity and SRCD in this sample while accounting for possible confounders. Primary findings from this study show that obesity is not significantly associated with SRCD among Brazilian cancer survivors of retirement age (≥ 60 y) but is significantly associated with SRCD among adult Brazilian cancer

survivors of working age (18–59 y), although the prevalence of SRCD was similar between the two groups (12.5% and 15.2%, respectively).

Evidence of the association between obesity and SRCD is compelling among non-cancer survivors worldwide.⁵ To our knowledge, there are no previous studies investigating this association in a large nationally representative Brazilian sample of cancer survivors. A large percentage of the scientific evidence worldwide has investigated associations between obesity and specific types of cancer among cancer patients³³ or depression and specific types of cancer.³⁴ According to the National Cancer Institute, the majority of the scientific body of knowledge about obesity in adult cancer survivors comes from people diagnosed with breast, prostate or colorectal cancer.¹⁴ Research shows that obesity may worsen several aspects of cancer survivorship,

Table 3. Sociodemographic characteristics, PA for leisure, obesity and number of depression-related comorbidities by current depression status among adult cancer survivors ≥ 60 y of age, Brazilian National Health Survey 2013

Characteristic	Current depression				p-Value
	Yes (n=63), weighted		No (n=444), weighted		
	Median	IQR	Median	IQR	
Age (years)	68.2	67.7–73.8	68.8	64.4–76.5	0.636*
	Percent	95% CI	Percent	95% CI	
Obesity					0.136**
Yes	8.2	2.3 to 14.1	91.8	85.9 to 97.7	
No	14.2	9.4 to 19.1	85.8	80.9 to 90.6	
Gender					0.533**
Male	11.5	7.5 to 15.5	88.5	84.5 to 92.5	
Female	13.7	7.1 to 20.3	86.3	79.7 to 92.9	
Race					0.048**
White	10.2	6.4 to 14.0	89.8	86.0 to 93.6	
Non-white	18.4	9.1 to 27.7	81.6	72.3 to 90.9	
Marital status					0.637**
Married	11.2	6.0 to 16.4	88.8	83.6 to 94.0	
Separated, divorced or widow(er)	14.1	7.8 to 20.4	85.9	79.6 to 92.2	
Single	14.3	5.4 to 23.3	85.7	76.7 to 94.6	
Education					0.003**
Less than high school	15.9	10.3 to 21.5	84.1	78.5 to 89.7	
Completed high school	9.3	0.9 to 17.8	90.7	82.2 to 99.1	
More than high school	3.2	0.8 to 5.7	96.8	94.3 to 99.2	
Health insurance					0.222**
Yes	10.3	6.4 to 14.2	89.7	85.8 to 93.6	
No	14.4	8.2 to 20.6	85.6	79.4 to 91.8	
Physical activity for leisure					0.168**
Recommended	6.2	0.0 to 13.5	93.8	86.5 to 100.0	
Less than recommended	13.8	9.3 to 18.4	86.2	81.6 to 90.7	
Number of depression-related comorbidities					0.018**
0	12.1	5.9 to 18.2	87.9	81.8 to 94.1	
1	8.4	3.9 to 12.9	91.6	87.1 to 96.1	
≥2	23.2	14.4 to 32.1	76.8	67.9 to 85.6	

*Based on unadjusted weighted logistic regression.

**Based on the Rao-Scott χ^2 test.

including quality of life, cancer reoccurrence and cancer progression.¹⁴ In relation to depression, cancer survivors have in general a higher prevalence of depression than the overall population.³⁴

One possible explanation for the association between obesity and SRCD being significant among cancer survivors of working age (18–59 y) but not significant among cancer survivors of retirement age (≥ 60 y) might be the nature of work in Brazil. The unemployment rate in Brazil was 5.6% in 2013, at the time of the survey.³⁵ It is hard enough for someone without cancer to find and maintain a job in Brazil, let alone a cancer survivor.³⁶ Similar to the USA,³⁷ the return to work for cancer survivors in Brazil has been reported to be problematic due to changes in physical capacity, lack of support and work overload. Therefore younger cancer survivors suffer more from the impact on work

productivity, the choice of occupation and financial hardship—considering employment is essential to ensure a better quality of health care in Brazil.³⁸

The results of the present study reinforce the importance of implementing routine protocols and of warning primary care physicians in Brazil to screen obese cancer survivors for depressive symptoms. Considering the increasing prevalence of obesity, depression and cancer survivors in Brazil during the last 10 y, in addition to the fact that obesity is a preventable and modifiable factor,^{1,11} our study suggests that weight and height measurements should be collected by the most appropriate health professional working in the care setting and BMI should be calculated during the survivorship continuum. After identifying if the patient is obese, in addition to standard recommendations for dietary and physical activity patterns, a clinical depression

Table 4. Current depression among Brazilian adults according to obesity status: univariable and multivariable weighted logistic regression results, Brazilian National Health Survey 2013

Exposure of interest	Unweighted counts	Weighted percent (95% CI)	Current depression	
			UOR (95% CI)	AOR* (95% CI)
Obesity among adult cancer survivors ≥18 y of age				
Yes	236	26.4 (22.5 to 30.3)	1.14 (0.69 to 1.89)	0.99 (0.56 to 1.73)
No	694	73.6 (69.7 to 77.5)	Ref.	Ref.
Obesity among adult cancer survivors 18–59 y of age				
Yes	108	24.1 (18.7 to 29.5)	2.37 (1.35 to 4.17)	2.19 (1.28 to 3.73)
No	315	75.9 (70.5 to 81.3)	Ref.	Ref.
Obesity among adult cancer survivors ≥60 y of age				
Yes	128	28.3 (22.6 to 33.9)	0.54 (0.23 to 1.24)	0.41 (0.15 to 1.08)
No	379	71.7 (66.1 to 77.4)	Ref.	Ref.

UOR: unadjusted odds ratio; AOR: adjusted odds ratio; Ref.: Reference.

*Adjustment was made for gender, age, race, marital status, education, insurance, PA for leisure and number of depression-related comorbidities.

assessment should be conducted by the most appropriate health care professional available in the care setting. Studies have shown that prevention strategies managed by the primary care doctor are one of the strongest predictors of compliance during the survivorship continuum.^{39,40}

Our present findings should be considered in the context of certain limitations. First, current results are based on a cross-sectional design. This type of study is limited in its ability to draw causality conclusions because it relies on risk factors and outcomes measured simultaneously through the survey. Second, due to the nature of the survey, the answers for some of the questions may be subject to recall bias. Even though self-reported questionnaires are a common methodology in behavior science, researchers rely heavily on the ability and honesty of their participants. Third, although we performed a cross-tabulation, we did not have enough power (a small number of individuals with the outcome of interest) to perform cancer site-specific analyses and therefore the results are presented for all cancer sites collected by the survey combined.

Despite these limitations, our study has also several strengths. First, to our knowledge this is the first study to investigate the association between obesity and depression/SRCD among cancer survivors in a very large, representative sample of the entire Brazilian adult population. Second, the final study sample was large, providing a good representation of cancer survivors in Brazil. Third, the information collected from the national survey followed a rigorous process of sampling, data collection and validation.²⁸ Fourth, the measurements for height and weight were collected using calibrated and validated tools and measurements were performed by trained interviewers. Fifth, validated measures of PA for leisure and SRCD were applied to minimize discrepancies.

In summary, the present study extends the body of existing literature and focuses attention on an important work-related aspect that can play an essential role on the impact that

obesity may have on the psychological well-being of Brazilian cancer survivors. Additionally, findings from this study provide direction for a holistic health assessment among cancer survivors.

More studies, especially longitudinal ones, will need to be performed to better understand this association and its causality and directionality and to develop effective interventions with long-term benefits among Brazilian cancer survivors.

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