


ORIGINAL RESEARCH ARTICLE

Impact of COVID-19 stay-at-home orders on weight-related behaviours among patients with obesity

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Summary

How the impact of the COVID-19 stay-at-home orders is influencing physical, mental and financial health among vulnerable populations, including those with obesity is unknown. The aim of the current study was to explore the health implications of COVID-19 among a sample of adults with obesity. A retrospective medical chart review identified patients with obesity from an obesity medicine clinic and a bariatric surgery (MBS) practice. Patients completed an online survey from April 15, 2020 to May 31, 2020 to assess COVID-19 status and health behaviours during stay-at-home orders. Logistic regression models examined the impact of these orders on anxiety and depression by ethnic group. A total of 123 patients (87% female, mean age 51.2 years [SD 13.0]), mean BMI 40.2 [SD 6.7], 49.2% non-Hispanic white (NHW), 28.7% non-Hispanic black, 16.4% Hispanic, 7% other ethnicity and 33.1% completed MBS were included. Two patients tested positive for severe acute respiratory syndrome coronavirus 2 and 14.6% reported symptoms. Then, 72.8% reported increased anxiety and 83.6% increased depression since stay-at-home orders were initiated. Also 69.6% reported more difficulty in achieving weight loss goals, less exercise time (47.9%) and intensity (55.8%), increased stockpiling of food (49.6%) and stress eating (61.2%). Hispanics were less likely to report anxiety vs NHWs (adjusted odds ratios 0.16; 95% CI, 0.05-0.49; $P = .009$). Results here showed the COVID-19 pandemic is having a significant impact on patients with obesity regardless of infection status. These results can inform clinicians and healthcare professionals about effective strategies to minimize COVID-19 negative outcomes for this vulnerable population now and in post-COVID-19 recovery efforts.

KEYWORDS

behaviour, bariatric surgery, COVID-19, severe obesity, weight loss

1 | INTRODUCTION

The spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which is responsible for the novel corona virus disease 2019 (COVID-19) pandemic, has so far resulted in over 6.2 million

known infections, almost 375 000 deaths and tremendous impact on world economies in a relatively short amount of time.¹ COVID-19 morbidity and mortality statistics have disproportionately affected vulnerable populations, which include those with pre-existing medical conditions such as diabetes, heart disease, obesity and severe

obesity.² Specifically, those with obesity have an elevated risk of hospitalization, serious illness and mortality.² Moreover, both the United States and United Kingdom have noted that non-Hispanic black (NHB) populations, who tend to have disproportionately greater rates of obesity and related chronic conditions, are more likely to die from COVID-19.^{3,4} The impact of COVID-19 in those with obesity is not surprising given the impact of obesity on pulmonary function and inflammation.^{5,6} Obesity is associated with decreased expiratory reserve volume, functional capacity and respiratory system compliance.⁶ In patients with increased abdominal obesity, pulmonary function is further compromised in supine patients by decreased diaphragmatic excursion, making ventilation more difficult.⁵ Furthermore, increased inflammatory cytokines associated with obesity may contribute to the increased morbidity associated with obesity in COVID-19 infections.⁷

However, what is not known is how the COVID-19 social orders such as self-quarantine, lockdown and/or mandatory stay-at-home orders are impacting of the are impacting mental and financial health, in addition to physical health, in vulnerable populations, such as those with obesity. The stay-at-home orders forced the cancellation of elective surgeries, including metabolic and bariatric surgery (MBS),⁸ and nothing is known about how this has impacted patients' decisions to move forward with those plans, especially since many have lost employment and health insurance coverage (given this study took place in the United States where universal health care does not exist). Indeed, social crises such as the current pandemic, have the potential to influence and drive maladaptive behaviours among individuals who are vulnerable (eg, those with chronic health conditions, unemployed, uninsured etc.) in particular.^{9,10}

It is unknown how the COVID-19 pandemic is impacting weight management, health behaviours and psychosocial health in particular among people with obesity. Thus, it is critically important to document, in real time, how socio-ecological determinants of health¹¹ are impacting behaviours among those with obesity. Given that obesity is a prevalent, serious, complex, chronic and relapsing disease, and severe obesity is a deepening crisis, it is important to pay special attention to these challenges during the COVID-19 pandemic. This will avoid placing an even greater burden on individuals, health systems and society in the post-COVID-19 recovery phase. Quarantine and isolation may increase psychosocial distress in many ways, influenced by duration, the provision of information, fear of infection, social and familial isolation, loneliness, the availability of supplies, financial hardship and stigmatization.^{9,12}

The aim of the current study was to: (a) provide an in depth understanding of the psychosocial health implications of COVID-19 among a local clinical sample of adult patients with obesity and (b) obtain information that can inform clinicians and other health professionals about effective strategies to minimize the physical and psychosocial health impact from COVID-19 among adults with obesity as we enter post-pandemic recovery efforts. It was hypothesized that adults with obesity would report a deterioration in psychosocial health since the stay-at-home orders were mandated.

2 | METHODS

2.1 | Design

A retrospective medical chart review identified patients with obesity from an academic healthcare system-based clinic specializing in obesity medicine and a community-based MBS practice. Patients with obesity were identified through these two clinics that serve patients with obesity, including those preparing for, or who have completed MBS.

2.2 | Procedure

An online survey format (non-anonymous) to obtain information about the COVID-19 pandemic's impact on patients with obesity was implemented starting April 15, 2020. This was approximately 2 weeks after the Governor of Texas mandated stay-at-home orders (March 31, 2020). The University of Texas Health System Institutional Review Board approved the study. Patients were asked to respond to a 10 to 15 minutes survey about their experiences during the COVID-19 pandemic as it pertains to their health and lifestyle behaviours. Those that agreed to participate signed an online consent and authorized researchers to contact them for follow-up information. Study data were collected and managed using Research Electronic Data Capture (REDCap)^{13,14} electronic data capture tools hosted at the UT Southwestern Medical Center. REDCap is a secure, HIPAA compliant, web-based software platform designed to support data capture for research studies, providing (a) an intuitive interface for validated data capture; (b) audit trails for tracking data manipulation and export procedures; (c) automated export procedures for seamless data downloads to common statistical packages and (d) procedures for data integration and interoperability with external sources.

2.3 | Measures

Survey respondents were queried on a variety of areas including demographics, lifestyle behaviours and the impact of COVID-19 on their physical and mental health.

2.4 | Demographics

Demographic questions were based on the validated instrument, Behavioral Risk Factor Surveillance System.¹⁵ Respondents were asked their gender, race/ethnicity, age, marital status and basic anthropometrics (height/weight). Household information was collected, including a breakdown of the number of adults (older than 18), teenagers (ages 13-18), children (ages 5-12) and infants/toddlers (ages 0-4) living at home. Socioeconomic factors such as annual household income and highest level of education were asked. To cross reference

publicly available COVID-19 infection rates with geographic location, participants' home ZIP code and county were gathered.

2.5 | Employment

COVID-19 has had a significant impact on the US economy and employment rates.¹ The survey addressed if participants experienced any changes in employment as a result of the pandemic. This included unemployment or underemployment. Respondents identified if they had undergone a job loss (Have you lost your job because of COVID-19?) or had a decrease in working hours (Have you had a reduction in job hours because of COVID-19?). Questions also asked if they were considered essential employees and were required to physically go into work during the stay-at-home order (Are you considered an essential employee and required to physically go to work? You are NOT allowed to work remotely from home.) or if they were working remotely from home (Are you CURRENTLY working remotely from home?).

2.6 | COVID-19

COVID-19-related questions focused on if they or their family members were infected with the virus (Have any of your family members tested positive for COVID-19?). Whether infected or not, participants were asked if they were tested (Have you been tested for COVID-19?), had experienced difficulty in receiving a test if desired (Have you wanted to get tested for COVID-19 but found it difficult to do so?), or had symptoms (Have you had any symptoms associated with COVID-19?). Follow-up questions required respondents to select which symptoms (fever, cough, shortness of breath or difficult breathing, tiredness, aches, runny nose, sore throat, loss of smell, loss of taste, rash, nausea/vomiting, diarrhoea other) they had and the level of severity (no symptoms/asymptomatic, very mild, moderate, severe or very severe). All participants were asked if they had any existing chronic medical conditions (active cancer treatment, asthma/other pulmonary disease, autoimmune disease, diabetes, heart disease, high blood pressure, high cholesterol/hyperlipidaemia, kidney disease, metabolic syndrome, osteoarthritis, polycystic ovarian syndrome, sleep apnoea other), which in addition to their obesity, would put them at greater risk for COVID-19-related complications.

2.7 | Lifestyle behaviours

In addition to employment and health, COVID-19 has resulted in considerable changes to everyday life. Survey respondents were inquired about these changes (Have you been staying at home because of COVID-19?) (Since the stay-at-home orders have been lifted, has there been a change in how often you go out? Include routine activities [eg, work, shopping] and social activities [eg, eat-in restaurants].) and how they were coping with the stay-at-home order (activities

with family in my house, alcohol, cooking, counsellor/therapist/medical provider, eating, exercise, going online/social media, medication, meditation, reading, recreational drugs, sleeping less, sleeping more, smoking/vaping, walking outside, watching TV/streaming, other). Follow-up questions asked about their level of quarantine (not going outside at all, Going outside for walks or exercise, going outside for necessities [groceries/medications/fuel], visiting close family/friends, going to work, attending religious services, attending parties/large social functions, going about as normal, other), which ranged from staying completely isolated at home to attending large social gatherings. A variety of Likert-scale questions required respondents to compare their lifestyle behaviours before COVID-19 and since COVID-19 (How often do you go out to the grocery store to shop for food?) (Do you stockpile food?). Questions related to their health (Has COVID-19 made you think more about your own health?) included changes to exercise (How has COVID-19 affected your weight loss goals?) (Has the time you dedicated to exercise changed?) (Has the intensity of your exercise changed?), healthy habits (Have you increased the use of any recreational substances, including alcohol and tobacco?) (As a result of COVID-19, do you find it is easier or more difficult to stick to healthy diet menus and plans?) and food consumption (both quality and quantity) (Has it been more challenging to stick with your healthy eating pattern due to the available food options in your local grocery store?) (Since COVID-19, has your consumption of the following foods [fast foods, fresh fruits, pizza, processed meats, red meat, restaurant foods, snacks/potato chips, soda/sugar sweetened beverages vegetables] changed?) (Do you COOK more or less due to COVID-19?) (Do you BAKE more or less due to COVID-19?) (Have you increased ordering restaurant to-go/delivery foods to avoid going to the grocery store?). Additionally, food security was evaluated using the validated 6-item US Adult Food Security Survey Module.¹⁶

2.8 | Depression

Depressive symptoms were assessed in survey respondents with the validated 16-item Quick Inventory of Depressive Symptomatology (QIDS-SR₁₆).¹⁷ They were queried on variety of elements, such as sleep, appetite, anxiety and so forth and how these had changed over the last 7 days.

2.9 | Statistical analysis

Descriptive analysis was performed for baseline characteristics including age, sex, race/ethnicities (non-Hispanic white [NHW], NHB, Hispanic and other) education, household incomes, BMI and chronic medical conditions. COVID-19-related information including test results (positive or negative), severity of symptom (from asymptomatic to very severe) and level of quarantine. A comparison of the change of weight-loss goal, exercise habits, food shopping and eating habits since COVID-19 stay-at-home order between four different ethnicities was performed using Fisher's exact tests. Crude odds ratios and

adjusted odds ratios (aOR) were calculated for depression (Y/N) and anxiety (Y/N), respectively, using race/ethnicities (NHW, NHB, Hispanic and other) as the primary independent variable, and NHW is the reference group. Adjusted logistic regression models controlled for age, gender, race/ethnicity, education, BMI, prior MBS (Y/N) and COVID-19 infection. All statistical analyses were performed using SAS v9.4 (SAS Institute, Cary, North Carolina). Two-sided *P*-value <.05 is considered significant.

3 | RESULTS

By May 31, 2020, we had 128 participants started the survey, after excluding patients who did not complete the demographic questionnaire (*n* = 5), a total of 123 patients (87% female, mean age 51.2 years, SD 13.0) were included in the final analytical sample. Two patients (1.7%) had tested positive for SARS-CoV-2. However, more patients (14.6%) reported COVID-19 symptoms. About half (49.2%) were NHW, 28.7% were NHB, 16.4% were Hispanic and 5.7% identified as "other" (multiracial, Asian etc.). The majority (56.1%) were college graduated, and an additional third had some education beyond high school. Most of the sample (53.6%) had an annual household income \geq \$75 000. Mean BMI was 40.2 kg/m² (SD 6.7) and 33.1% (*n* = 39) had completed MBS. Two-third of these patients (*n* = 26) had MBS after 2010 with 14 (35.9%) had MBS in the last year (2019). Only three (7.7%) patients had MBS before 2000 (Data not shown on tables.). Self-reported chronic medical conditions were highly prevalent; having high blood pressure (67.0%), sleep apnoea (51.0%), diabetes (30.0%), hyperlipidaemia (25.0%), asthma (23.0%), heart disease (15.0%) and active cancer treatment (4.0%) (Table 1).

Almost the entire sample (91.5%) had been on stay-at-home orders, with most (87.0%) reporting only leaving their homes for necessities, followed by 47.2% who went outside for walks or exercise. Almost 10 % of the sample had lost their job since the beginning of the pandemic.

The majority (69.6%) of the sample reported that it has been more difficult to achieve their weight loss goals since the stay-at-home orders, while 22.4% reported no impact. Almost half (47.9%) reported a decreased amount of time for exercise, and 55.8% reported a decrease in intensity of exercise (Table 2). None of these reported changes were significantly different by ethnic group.

Slightly more than a third (39.6%) of the sample reported grocery shopping once a week, while just less than a third (31.5%) reported shopping one to two times a month. Half of the sample reported an increase in stockpiling food. Well over half (61.2%) reported healthy eating was more challenging, and 61.2% reported stress eating. Well over half reported general cooking more often (63.8%). The majority (78.3%) of the sample was not food insecure but did skip meals (12.1%). None of these reported behaviour changes were significantly different by ethnic group (Table 3).

A majority of the sample reported anxiety (72.8%) and depression (83.6%). Ethnic groups differences were significant for anxiety (NHW 40.3%, NHB 21.1%, Hispanic 7% and other 4.4%, *P* = .011), but not

TABLE 1 Patient demographic and medical information (*n* = 123), COVID-19 and obesity study

Variables	Total (<i>n</i> = 123)
Male, <i>n</i> (%)	16 (13.0)
Age, mean (SD), y	51.2 (13.0)
Race, <i>n</i> (%)	
NHW	60 (49.2)
NHB	35 (28.7)
Hispanic	20 (16.4)
Other	7 (5.7)
Education, <i>n</i> (%)	
Some high school	3 (2.4)
High school graduate	10 (8.1)
Some college of technical school	41 (33.3)
College graduate	69 (56.1)
Annual household income, <i>n</i> (%)	
<\$25 000	15 (12.2)
\$25000-49 999	21 (17.1)
\$50000-74 999	21 (17.1)
\geq 75 000	66 (53.6)
BMI, mean (SD)	40.2 (6.7)
Completed MBS, <i>n</i> (%)	39 (33.1)
Chronic Medical conditions, <i>n</i> (%)	
Active cancer treatment	4 (4.0)
Asthma	23 (23.0)
Diabetes	30 (30.0)
Heart disease	15 (15.0)
High blood pressure	67 (67.0)
High cholesterol/hyperlipidaemia	25 (25.0)
Sleep apnoea	51 (51.0)
Test positive for SARS-CoV-2, <i>n</i> (%)	2 (1.7)
COVID-19 symptoms, <i>n</i> (%)	
Asymptomatic	2 (11.1)
Very mild	6 (33.3)
Moderate	4 (25.0)
Severe	3 (16.7)
Very severe	1 (5.6)
Total	18 (14.6)
Staying at home since COVID-19, <i>n</i> (%)	108 (91.5)
Level of quarantine, <i>n</i> (%)	
Not going outside at all	9 (8.3)
Going outside for walks or exercise	51 (47.2)
Going outside for necessities (food, medications)	94 (87.0)
Visiting close family/friends	15 (13.9)
Going to work	17 (15.7)
Attending religious services	1 (0.9)
Attending parties/large social functions	0 (0)
Lost job since COVID-19, <i>n</i> (%)	11 (9.6)

Abbreviations: MBS, metabolic and bariatric surgery; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

TABLE 2 Change of weight loss goal and exercise habits since COVID-19 stay-at-home orders took effect, COVID-19 and obesity study

		N (%)					P-value ^a
		Total	NHW	NHB	Hispanic	Other	
Weight loss goal ^b	Easier to achieve	9 (7.8)	2 (1.7)	3 (2.6)	2 (1.7)	2 (1.7)	.266
	Not affect	26 (22.4)	15 (12.9)	5 (4.3)	5 (4.3)	1 (0.9)	
	Harder to achieve	81 (69.6)	40 (34.5)	25 (21.6)	12 (10.3)	4 (3.5)	
Exercise time ^c	Decreased	56 (47.9)	25 (21.4)	18 (15.4)	8 (6.8)	5 (4.3)	.873
	Unchanged	28 (23.9)	17 (14.5)	5 (4.3)	5 (4.3)	1 (0.8)	
	Increased	20 (17.1)	9 (7.7)	6 (5.1)	4 (3.4)	1 (0.8)	
	Do not exercise	13 (11.1)	6 (5.1)	5 (4.3)	2 (1.7)	0 (0)	
Exercise intensity ^d	Decreased	58 (55.8)	24 (23.1)	19 (18.3)	9 (8.6)	6 (5.8)	.096
	Unchanged	40 (38.5)	25 (24.0)	8 (7.7)	7 (6.7)	0 (0)	
	Increased	6 (5.8)	2 (1.9)	2 (1.9)	1 (1.0)	1 (1.0)	

Abbreviations: NHB, non-Hispanic black; NHW, non-Hispanic white.

^aFisher's exact tests.

^bN_{missing} = 7.

^cN_{missing} = 6.

^dN_{missing} = 17.

TABLE 3 Change of food shopping and eating habits since COVID-19 stay-at-home orders, COVID-19 and obesity study

		N (%)					P-value ^a
		Total	NHW	NHB	Hispanic	Other	
Food shopping frequency ^b	Never/home delivery	17 (15.3)	10 (9.0)	5 (4.5)	1 (0.9)	1 (0.9)	.925
	1-2 times/mo	35 (31.5)	16 (14.4)	10 (9.0)	6 (5.4)	3 (2.7)	
	1 time/wk	44 (39.6)	20 (18.0)	13 (11.7)	8 (7.2)	3 (2.7)	
	≥2 times/wk	15 (13.5)	8 (7.2)	3 (2.7)	4 (3.6)	0 (0)	
Stockpile food ^b	Less	4 (3.5)	1 (0.9)	2 (1.7)	1 (0.9)	0 (0)	.818
	Unchanged	54 (47.0)	27 (23.5)	17 (14.8)	7 (6.1)	3 (2.6)	
	More	57 (49.6)	27 (23.5)	15 (13.0)	11 (9.6)	4 (3.5)	
Follow healthy diet plans ^c	Easier	16 (13.8)	5 (4.3)	5 (4.3)	4 (3.5)	2 (1.7)	.157
	Unchanged	29 (25.0)	15 (12.9)	5 (4.3)	6 (5.2)	3 (2.6)	
	More challenging	71 (61.2)	36 (31.0)	24 (20.7)	9 (7.8)	2 (1.7)	
Stress eat more ^c	Yes	71 (61.2)	35 (30.2)	22 (19.0)	9 (7.8)	5 (4.3)	.590
	No	45 (38.8)	21 (18.1)	12 (10.3)	10 (8.6)	2 (1.7)	
Cooking activity ^c	Less	12 (10.3)	7 (6.0)	3 (2.6)	2 (1.7)	0 (0)	.956
	Unchanged	30 (25.9)	16 (13.8)	7 (6.0)	5 (4.3)	2 (1.7)	
	More	74 (63.8)	33 (28.4)	24 (20.7)	12 (10.3)	5 (4.3)	
Baking activity ^b	Less	8 (7.0)	3 (2.6)	3 (2.6)	1 (0.9)	1 (0.9)	.085
	Unchanged	75 (65.8)	32 (28.1)	27 (23.7)	12 (10.5)	4 (3.5)	
	More	31 (27.2)	20 (17.5)	3 (2.6)	6 (5.3)	2 (1.8)	
Cannot afford to eat balanced meals ^c	Often	8 (7.0)	4 (3.5)	3 (2.6)	1 (0.9)	0 (0)	.924
	Sometimes	15 (13.0)	6 (5.2)	5 (4.4)	2 (1.7)	2 (1.7)	
	Never	90 (78.3)	43 (37.4)	26 (22.6)	16 (13.9)	5 (4.3)	
Skip meals ^c	Yes	14 (12.1)	6 (5.2)	5 (4.3)	2 (1.7)	1 (0.9)	.985
	No	101 (87.1)	49 (42.2)	29 (25.0)	17 (14.7)	6 (5.2)	

Abbreviations: NHB, non-Hispanic black; NHW, non-Hispanic white.

^aFisher's exact tests (n < 5) or chi-square tests (n > 5).

^bN_{missing} = 9.

^cN_{missing} = 7.

TABLE 4 Comparison of self-reported anxiety and depression since COVID-19 stay-at-home orders, by ethnic group

		N (%)					P-value ^a
		Total	NHW	NHB	Hispanic	Other	
Anxiety ^b	Yes	83 (72.8)	46 (40.3)	24 (21.1)	8 (7.0)	5 (4.4)	.011
	No	31 (27.2)	10 (8.8)	8 (7.0)	11 (9.6)	2 (1.8)	
Depression ^c	Yes	92 (83.6)	46 (41.8)	28 (25.4)	12 (10.9)	6 (5.5)	.346
	No	18 (16.4)	9 (8.2)	4 (3.6)	5 (4.6)	0 (0)	

Abbreviations: NHB, non-Hispanic black; NHW, non-Hispanic white.

^aFisher's exact test.

^bN_{missing} = 9.

^cN_{missing} = 13.

TABLE 5 Odds of anxiety and depression among different races/ethnicities

	Anxiety				Depression			
	Crude odds (95% CI) ^a	P-value ^a	Adjusted odds (95% CI) ^a	P-value ^b	Crude odds (95% CI) ^a	P-value ^a	Adjusted odds (95% CI) ^a	P-value ^b
NHW	1.0 (ref)	—	1.0 (ref)	—	1.0 (ref)	—	1.0 (ref)	—
NHB	0.65 (0.23-1.87)	.462	0.51 (0.16-1.61)	.662	1.37 (0.39-4.86)	.957	1.30 (0.32-5.21)	.956
Hispanic	0.16 (0.05-0.49)	.009	0.14 (0.04-0.50)	.020	0.47 (0.13-1.66)	.935	0.44 (0.11-1.77)	.934
Other	0.54 (0.09-3.21)	.865	0.44 (0.07-3.03)	.939	—	—	—	—

Abbreviations: NHB, non-Hispanic black; NHW, non-Hispanic white.

^aCrude logistic regression.

^bMultiple logistic regression adjusted for age, gender, race/ethnicities, education, BMI, prior metabolic bariatric surgery (yes or no) and COVID-19 infection.

for depression (41.8% for NHW, 25.4% for NHB, 10.9% for Hispanic and 5.5% for other, $P = .346$) (Table 4).

After controlling for key demographics, BMI and COVID-19 infection, Hispanics were significantly less likely to report anxiety compared with NHWs (aOR 0.16; 95% CI, 0.05-0.49; $P = .009$) (Table 5). In addition, a post hoc power analysis (calculated via PROC POWER procedure in SAS v9.4) with depression and anxiety as the primary outcomes showed ample power (>0.99) in the logistic regression models.

4 | DISCUSSION

It may seem counterintuitive that an infectious disease such as COVID-19 should have a strong relationship with obesity, which is a chronic, non-communicable disease. However, the stay-at-home orders mandated in many states plus efforts to isolate vulnerable populations and people with diagnosed or suspected COVID-19 have had serious effects on health behaviours and well-being for our sample of patients with obesity. Results here showed that COVID-19 is having a substantial impact on the health of patients with obesity regardless of infection status. Almost the entire sample (91.5%) reported following stay-at-home orders and as a result, 87.0% left their homes only for necessities. This impacted several obesity-related health behaviours negatively; overall, 69.6% of patients reported their

weight loss goals were harder to achieve. Other findings specific to obesity-related health behaviours included substantial decreases in both physical activity duration and intensity (47.9%, 55.8%, respectively). Food access and consumption behaviours were also affected as 49.6% reported stockpiling food more than usual. Despite more patients (63.8%) cooking at home, 61.2% found healthy eating patterns to be more challenging as 27.2% of patients baked more and 61.2% stress ate more than usual. Even more troubling, an increase in anxiety (72.8%) and depression (83.6%) were highly reported while (9.6%) reported job loss. These results have implications for clinical practice and management of patients with obesity as we now move into post-COVID-19 relief efforts.

People with obesity already have a 25% increased risk of developing mood and anxiety disorders.¹⁸ Public health strategies to control the outbreak that focused on social distancing have led to an increase in loneliness and social isolation, which play a significant role in behaviours that influence body weight. Specifically, in an email survey conducted by SocialPro, an organization led by psychologists and experts on social interaction, one in three US respondents reported feeling lonelier since the pandemic.¹⁹ Previous research has demonstrated that dieters experiencing loneliness have less dietary restraint and that loneliness is predictive of physical inactivity.^{20,21} This was consistent with our findings that almost half of respondents reported reduced exercise time and intensity. Physical activity is a key component of maintaining weight loss, and it is recommended that patients

complete ≥ 300 minutes of physical activity for weight maintenance.²² Therefore, disruptions in physical activity could have negative implications for those trying to lose or maintain it. Loneliness not only affects mental health and behavioural changes, but also has been associated with a 26% increased likelihood of mortality.²³ This issue could be amplified in patients with obesity given research has shown the lifespan of patients with class III obesity, which was the average in our sample, is already reduced by 6.5 to 13.7 years.²⁴

According to the US Bureau of Labor and Statistics, the percent of job losses as a percent of the civilian labour force increased from 2.4% in March to 13.2% in April 2020,²⁵ which is comparable to our analysis (9.6%). It is likely that the implications on food access, health behaviours and emotional stress may be higher in the general population as greater numbers are experiencing financial stress. However, even though only about 10% of the sample here reported job loss, twice that (20.0%) reported that they could not afford a balanced meal. These findings suggest that there may be challenges with food quality food consumption at baseline even without the added hardship of job loss, and despite the majority (53.6%) of patients reporting an annual income $\geq \$75\ 000$. It is likely that the implications on food access, health behaviours and emotional stress may be higher in the general population as even more are experiencing financial stress.

Prior to the pandemic, it has been reported that Americans consume 20% of their calories from restaurants and that there are worsening disparities in fast food meal quality by race/ethnicity, education and income.²⁶ Due to recent economic challenges, patients may be more likely to select cheaper foods, which are often energy dense and nutrient poor.²⁷ Therefore, even though more patients are cooking at home, the type of foods that are being stockpiled are likely to be processed foods due to their longer shelf life. These are associated with greater intake of fat, carbohydrate and calories, which facilitate greater weight gain when compared to more balanced diets.²⁸ It is possible Americans may be trading one pattern of low-quality consumption for another by choosing cheaper processed foods instead of eating out.

Due to the increase in obesogenic behaviours related to the COVID-19 pandemic that were found here, it is paramount that healthcare access is not disrupted for patients with obesity. Maintaining these vital services will prevent exacerbating the negative health and economic consequences of excess body weight. This includes access to primary care providers, Obesity Medicine specialists and MBS programs. In addition to asking about diet and exercise patterns, screening for indicators of mental health, loneliness, financial stressors and behaviours that may influence body weight should be implemented by healthcare teams to combat this problem. Telemedicine has been shown to be non-inferior in terms of appointment adherence, BMI and psychosocial outcomes as method of care for post-bariatric surgery patients should be embraced during this time when face-to-face encounters are limited.²⁹ Xenaki et al showed that enrolling patients in a stress management program led to significant reductions in BMI and improved depression and anxiety scores.³⁰ Although this was a small study, larger systemic reviews have also shown benefits of psychosocial interventions on eating pathology of

binge eating/uncontrolled eating, uncontrolled eating, emotional eating and quality of life.³¹ These types of interventions may help mitigate the increase in behaviours promoting weight gain during this stressful time. Focusing on these management strategies is especially important during the pandemic as obesity is a risk factor for hospitalization from COVID-19,³² and it is unclear how long the pandemic will continue. Not only are hospitalized COVID-19 patients more likely to have obesity, but obesity has also been associated with the need for ICU admission and mechanical ventilation.^{5,32}

4.1 | Study limitations and strengths

There are several limitations to this study that should be mentioned. First, this was a sample of convenience which can produce selection bias. Respondents were enrolled from an Academic Medical Center's Weight Management Program and were primarily white women with an average age of 51 years, average BMI of 40.6 kg/m², and most had a college education and an annual income of $\geq \$75\ 000$. This study may not be generalizable to a clinic, or general population with healthy weight. It may also not be generalizable to other populations and as a result may not accurately assess the burden of COVID-19 on obesity-related health and behaviours in lower socioeconomic status and/or ethnic minority populations who are disproportionately more affected by obesity and COVID-19.⁴ Participants were established weight management patients with secured health insurance, which is not representative of the average American challenged with obesity in which $<2\%$ receive anti-obesity medications³³ and $<1\%$ undergo MBS.³⁴ In addition, the sample size of ethnic minority groups is relatively small in this study, although we used robust statistical methods to ensure the accuracy of our results, the type II error may increase due to possibly insufficient power. With increased sample size, future studies may be able to detect more ethnic group differences aside from the one observed here which showed Hispanics were significantly less likely to report anxiety compared with NHWs. Another limitation is that behavioural changes were based on the patient's own perception at the time of the survey rather than on quantifying these behaviours (such as exercise time decreased from 100 to 50 minutes/week). It also did not capture information on attitudes about health and psychosocial health in particular. Furthermore, we are inferring that an increase in behaviours that favour weight gain during COVID-19 would lead to worsening obesity but do not present longitudinal causal effect data on changes in weight. Strengths of the study include the capture of important information to inform comprehensive, future health care for patients with obesity. Certainly health care access should be maintained in some way during these periods moving forward especially if the pandemic should cause future stay-at-home orders as there are implications for long-term health as shown from this stay-at-home situation.

Finally, as most elective surgeries have been postponed to allow for allocation of PPE, ventilators, hospital beds and medical personnel to those critically ill with COVID-19, it will be crucial to document how this is affecting health outcomes in patients awaiting MBS and

determine the safest way to resume procedures.³⁵ As MBS operations restart, prioritization strategies need to be implemented to prevent harm. Fortunately, the Diabetes Surgery Summit has developed criteria for this that emphasizes the medical acuity of obesity over BMI.³⁶ However, the dynamic changes affecting the finances of patients, insurance providers and the healthcare system as a whole may ultimately influence the population that has access to these services. In addition, as bariatric surgery requires specialized training, and many surgeons have had prolonged periods of time without operating due to COVID-19, ensuring best practices such as ongoing video webinar training, enhanced “time-outs” during procedures, or the addition of another senior consultant to scrub in during resumption of procedures may be prudent to prevent increased rates of complications.³⁶

5 | CONCLUSIONS

COVID-19, the infectious disease caused by the coronavirus SARS-CoV-2, was declared a pandemic by the World Health Organization on March 12, 2020. In a relatively short period, our results show that there have been substantial perceptions in changes in health behaviours among patients with obesity. Our sample described decreases in positive health behaviours, increases in deleterious behaviours and associated deterioration in mental health. Even though, actual COVID-19 disease burden was low (1.7% tested positive for COVID-19 and another 14.6% reported symptoms), the pandemic is having a significant impact on those without infections. The major strength of this study is that it is the first snapshot into how the COVID-19 pandemic has influenced health behaviours for patients with obesity. The results of 69.6% of respondents feeling their weight loss goals were harder to achieve with 47.9% decreasing exercise, 49.6% increasing stockpiling food and 61.2% stress eating as well as increased anxiety (72.8%) and depression (83.6%) during this time can inform clinicians and public health officials about how best to prevent negative outcomes for this vulnerable population now and in post-COVID-19 recovery efforts.

CONFLICTS OF INTEREST

No conflict of interest was declared.

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