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Impact of the COVID-19 pandemic lockdown on weight status and factors associated with weight gain among adults in Massachusetts

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Summary

The study aims to examine the impact of the coronavirus disease-2019 (COVID-19) pandemic lockdown on weight, overweight and obesity, and identify factors associated with weight gain. At a safety net health system in Massachusetts, 11 534 adults were retrospectively followed within 3 months of the COVID-19 lockdown. Chi-square and 95% confidence intervals (CI) were reported for categorical and continues variables, respectively. Multivariate analyses were performed to identify factors associated with weight gain (≥0.01 kg and 5%). During the lockdown period, greater proportion of women gained weight compared to men (46.1% vs 40.6%, $P < .01$). The obesity rate after the lockdown increased among women (40.7%-41.7, $P < .01$) but decreased among men (39.6%-38.6, $P < .01$) compared to before the lockdown. Post-lockdown obesity rates increased among Haitian (51.2%-55.0%, $P < .01$) and Hispanic women (50.7%-51.8%, $P < .01$). More than 5% weight gain was associated with 18 to 39 vs ≥60 years of age (OR = 1.45, 95% CI = 1.07, 1.97), food and housing insecurity (OR = 1.44, 95% CI = 1.05, 1.97) and tobacco use (OR = 1.38, 95% CI = 1.07, 1.78) among men; and 18 to 39 vs ≥60 years of age (OR = 1.55, 95% CI = 1.25, 1.91), Hispanics (OR = 1.25, 95% CI = 1.01, 1.54), Brazilians (OR = 1.22, 95% CI = 1.03, 1.45), and tobacco use (OR = 1.36, 95% CI = 1.10, 1.69) among women. During the COVID-19 lockdown, significant proportion of participants gained weight, but subgroup variations existed. Our study can inform healthcare professionals about the impact of the lockdown on unhealthy weight gain and identify vulnerable populations. Strategies are needed to combat unhealthy weight gain during and beyond the pandemic.

KEYWORDS
COVID-19 lockdown, obesity, overweight, weight gain

1 | INTRODUCTION

Since the novel corona virus disease 2019 (COVID-19) began in Wuhan, China in December 2019, more than 113 million cases and 28 million deaths have been reported worldwide as of March 2021. The United States has been hit hardest with more than 25 million cases and 506 000 deaths byMarch 2021.[1] In the United States,

Abbreviations: AOR, adjusted odds ratio; BMI, body mass index; CHA, Cambridge Health Alliance; CI, confidence intervals; COVID-19, corona virus disease 2019; EMR, electronic medical records; ICD, International Statistical Classification of Diseases and Related Health Problems; Kg, kilogram; M, meter squared; SD, SD.

ethnic and racial minorities have been disproportionately affected by COVID-19.[2] Obesity, which is also more prevalent among minorities, has been identified as one of the strongest risk factors for severe complications of COVID-19.[3-6]

To combat the spread of the pandemic, local and national governments have been imposing lockdowns. The state of emergency was declared in Massachusetts, USA on 10 March 2020, and most businesses, parks, recreational facilities were not allowed to reopen until 25 May 2020, in a gradual phase-based approach.[7] The pandemic and the subsequent restrictions have had significant impact on the lives, livelihoods, lifestyle and activities of individuals. A large study of 2766 participants found considerable psychological impact during the national COVD-19 quarantine period in Italy.[8,9]

Since the pandemic and the stay-at-home orders, studies have reported individuals suffering from increased anxiety and depression along with more stress eating patterns.[10] Unhealthy behaviour such as binge eating and increased night eating episodes during the lockdown has been linked to weight gain.[11] Less physical activities and more unhealthy dietary choices have also been reported during the lockdowns, which have negative impact on maintaining healthy weight.[12-14] A recent large study among Chinese youth found increased weight and body mass index during the lockdown period.[14] However, to our knowledge, the impact of the pandemic lockdown on weight status and obesity among adults in the United States has not been reported. To fill this gap the study examines the impact of the COVID-19 lockdown on weight, overweight and obesity, and identify factors associated with any and at least 5% weight gain.

What is already known about this subject

- Obesity is associated with severe complications of COVID-19
- The COVID-19 lockdown has been linked to behavioural patterns of less physical activity and more unhealthy dietary choices
- Increase in body mass index, overweight and obesity has been reported among Chinese youth during the COVID-19 lockdown.

What this study adds

- To our knowledge, this is one of the first studies to report the impact of the COVID-19 lockdown on weight, overweight and obesity among adults in the United States.
- During the COVID-19 lockdown in Massachusetts, significant proportion of adults had increase in weight, overweight and obesity.
- The study found subgroup variations in the burden and increase of overweight and obesity during the COVID-19 lockdown.

2 | MATERIALS AND METHODS

A retrospective study of patients was conducted using electronic medical records (EMR) at Cambridge Health Alliance (CHA) in Massachusetts. CHA is a large safety net health system serving >140 000 patients in Cambridge and Boston's metro-north region, mostly immigrants, ethnic minorities, and underserved communities. Data were analysed within 3 months before and after the COVID-19 pandemic lockdown period in Massachusetts. The state of emergency was declared in the state of Massachusetts on 10 March 2020 and most business, parks, recreational facilities were not allowed to reopen, until 25 May 2020 in a phase-based approach.[7] For ease of data collection, the first lockdown period was approximated to be between 01 March 2020 and 31 May 2020.

2.1 | Study population

All CHA patients who had weight and body mass index (BMI) before 01 March 2020 and after 31 May 2020 were included. Initially, 32 425 participants were identified. A total of 1467 were excluded because of pregnancy. Children (n = 3312) were excluded from this study. Additional 16 112 patients were excluded as their initial or follow-up measures were longer than 3 months of the lockdown period in Massachusetts, leaving 11 534 adults in the final analyses. The study was exempted by the Institutional Review Board of the CHA.

2.2 | Measures

Anthropometric data obtained during medical visits at CHA were used. BMI was determined by dividing weight in kilograms (kg) over the square of height in meters (m). Obesity was defined as BMI ≥30 kg/m^2 and overweight was defined as BMI ≥25 kg/m^2. Any weight gain was defined as ≥0.01 kg. Clinically meaningful weight gain of ≥5% was determined as at least 5% weight increase in pounds from their corresponding baseline weight. Weight gain cut-off of ≥5% is used as it has been reported to be a clinically meaningful weight change.[15]

Demographic information of age and sex were obtained from the electronic medical record. Primary languages patients chose for communications were used as more accurate approximation of ethnic/racial categories based on information collected routinely during registration. The main categories were: English, Spanish, Brazilian Portuguese, Haitian creole and others. Housing and food insecurity information were collected and documented in the EMR based on routine screenings for social determinants of health during patient encounters. The conditions of hypertension, diabetes, hyperlipidemia, mental illness, COVID-19 and tobacco use were defined based on carrying the corresponding International Statistical Classification of

Diseases and Related Health Problems (ICD) code 10 diagnoses in the EMR.

2.3 | Statistical analysis

The prevalence of obesity and overweight were compared for all and subgroups of participants who gained weight stratified by sex. Chi-square tests was used for categorical variables. The mean weight and BMI changes were calculated within 3 months before and after the lockdown among those who gained weight. The mean changes in weight and BMI were significant if their 95% CI did not include 0.

Multivariate logistic regression analyses were computed with any and ≥ 5% weight gain as outcome variables after adjusting for confounding factors and other covariates. Potential confounders were identified based on priori and our conceptual framework. Confounders included in the final models were age, initial weight, and duration of follow-up stratified by sex. Two-tailed statistical significance was assessed at $\alpha < 0.05$. Data analyses were conducted using SAS, version 9.4. Data were collected and analysed in November 2020 to December 2020.

3 | RESULTS

Basic characteristics of the study population are shown in Table 1. Women accounted for 66.6% of participants. Overall, 30.2%, 39.6%, and 30.2% of the study population were 18 to 39, 40 to 59, and > 60 years of age, respectively. Majority (54.4%) were English speakers, followed by Brazilian Portuguese speakers at 19.5%, Spanish speakers at 11.2% and 6.2% of Haitian Creole speakers (Table 1). Housing or food insecurity were reported by 9.1% of participants, and 14.5% had COVID-19.

Figure 1 shows greater proportion of women gained weight compared to men (46.1% vs 40.6%, $P < .01$). In comparison to older women, greater proportion (50.2%) of younger (18 to 39 years of age) women gained weight ($P < .01$). Among women, greater proportion of Spanish speakers (51.0%) gained weight compared to other language speakers ($P = .03$). Among those who gained weight, greater proportion of women gained at least 5% of their initial weight compared to men (29.5% vs 26.8%, $P < .01$). Across age categories, greater proportion (31.2%) of younger (18 to 39 years of age) men gained at least 5% of their initial weight compared to older men ($P = .01$). Similarly, in

TABLE 1 Basic characteristics of participants during the COVID-19 pandemic lockdown at a safety-net health system in Massachusetts

Variables, n (%)	All	Men	Women
All participants	11 534 (100.0)	3853 (33.4)	7681 (66.6)
Age			
18–39 y	3486 (30.2)	974 (25.3)	2512 (32.7)
40–59 y	4569 (39.6)	1540 (39.9)	3029 (39.4)
≥60 y	3479 (30.2)	1339 (34.8)	2140 (27.9)
Language			
English	6278 (54.4)	2344 (60.8)	3934 (51.2)
Spanish	1292 (11.2)	355 (9.2)	937 (12.2)
Brazilian Portuguese	2243 (19.5)	610 (15.8)	1633 (21.3)
Haitian Creole	716 (6.2)	185 (4.8)	531 (6.9)
Others	1005 (8.7)	359 (9.3)	646 (8.4)
City of residence			
Cambridge	1668 (14.5)	561 (14.6)	1107 (14.4)
Somerville	1918 (16.6)	669 (17.4)	1249 (16.3)
Everett	1682 (14.6)	543 (14.1)	1139 (14.8)
Malden	1319 (11.4)	432 (11.2)	887 (11.6)
Revere	901 (7.8)	323 (8.4)	578 (7.5)
Chelsea	385 (3.3)	152 (3.9)	233 (3.0)
Others	3661 (31.7)	1173 (30.4)	2488 (32.4)
Hypertension	3546 (30.7)	1454 (37.7)	2092 (27.2)
Diabetes	2359 (20.5)	1016 (26.4)	1343 (17.5)
Hyperlipidemia	3465 (30.0)	1456 (37.8)	2009 (26.2)
Mental illness	4834 (41.9)	1496 (38.8)	3338 (43.5)
COVID-19	1669 (14.5)	502 (13.0)	1167 (15.2)
Tobacco use	1530 (13.3)	725 (18.8)	805 (10.5)
Housing or food insecurity	1050 (9.1)	398 (10.3)	652 (8.5)

Abbreviations: COVID-19, coronavirus disease 2019; y, years of age.

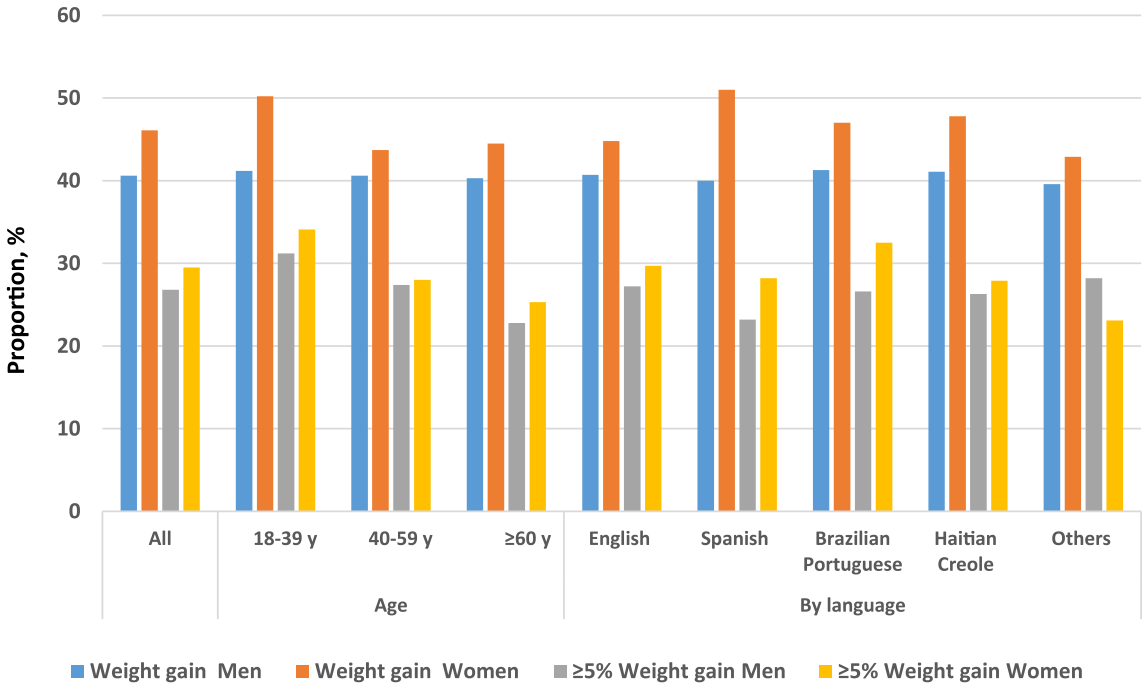

FIGURE 1 Proportions (%) of adults with weight gain and ≥ 5% weight gain during the COVID-19 lockdown

TABLE 2 Changes in weight and body mass index before and after the COVID-19 pandemic lockdown among all participants at a Safety-net Health System in Massachusetts

	Weight change in kg, (95% CI)		BMI change in kg/m^2, (95% CI)	
Variables	Men	Women	Men	Women
All	−0.81 (−1.14, −0.46)	0.51 (0.31, 0.72)	−0.15 (−0.20, −0.09)	0.09 (0.06, 0.13)
Language				
English	−0.85 (−1.32, −0.37)	0.16 (−0.15, 0.48)	−0.15 (−0.22, −0.08)	0.02 (−0.4, 0.07)
Spanish	−1.06 (−2.07, −0.04)	1.16 (0.70, 1.62)	−0.22 (−0.41, −0.04)	0.20 (0.10, 0.31)
Brazilian Portuguese	−0.40 (−1.12, 0.33)	1.10 (0.71, 1.49)	−0.06 (−0.19, 0.06)	0.21 (0.12, 0.29)
Haitian Creole	−0.93 (−2.28, 0.41)	0.86 (0.02, 1.69)	−0.21 (−0.43, 0.02)	0.25 (0.08, 0.41)
Others	−0.92 (−1.73, −0.10)	−0.07 (−0.61, 0.49)	−0.13 (−0.28, 0.02)	−0.00 (−0.12, 0.11)

Abbreviations: BMI, body mass index; CI, confidence interval; kg, kilogram; m, meter.

comparison to older women, greater proportion (34.1%) of younger women gained at least 5% of their baseline weight ($P < .01$) (Figure 1).

Table 2 shows the overall mean weight increased by 0.51 (SD = 9.08; 95% CI = 0.31, 0.72) kilograms (kg) among women and decreased by −0.81 (SD = 10.81; 95% CI = −1.14, −0.46) kg among men (Table 2). Their mean BMI increased by 0.09 (SD = 1.73; 95% CI = 0.06, 0.13) kg/m^2 among women and decreased by −0.15 (SD = 1.74; 95% CI = -0.22, 0.08) kg/m^2 among men (Table 2).

Among those who gained weight, the mean weight increased by 3.41 (SD = 3.54; 95% CI = 3.29, 3.58) kilograms (kg) among men and 3.09 (SD = 3.08; 95% CI = 2.98, 3.19) kg among women (Table 3). Their mean BMI increased by 1.12 (SD = 1.33; 95% CI = 1.05, 1.18) kg/m^2 among men and 1.19 (SD = 1.36; 95% CI = 1.15, 1.24) kg/m^2 among women (Table 3).

Table 4 shows the overall obesity rate after the pandemic lockdown increased among women (40.7%-41.7%, $P < .01$) but it decreased among men (39.6%-38.6%, $P < .01$) compared to before the pandemic lockdown period. The corresponding overall overweight rates also increased among women (72.1%-72.8%, $P < .01$) but decreased among men (77.6%-76.3%, $P < .01$) before and after the pandemic lockdown period. Post-lockdown obesity rates increased among Haitian (51.2%-55.0%, $P < .01$) and Hispanic women (50.7%-51.8%, $P < .01$).

Table 5 shows obesity increased before and after the pandemic lockdown period in both men (37.5%-45.5%, $P < .01$) and women (39.5%-46.6%, $P < .001$) among those who gained weight. Overall overweight rates also increased in both men (75.0%-81.4%, $P < .01$) and women (71.4%-78.1%, $P < .01$) before and after the pandemic

TABLE 3 Changes in weight and body mass index before and after the COVID-19 pandemic lockdown among participants who gained weight at a Safety-net Health System in Massachusetts

	Weight change in kg, (95% CI)		BMI change in kg/m^2, (95% CI)	
Variables	Men	Women	Men	Women
All	3.41 (3.29, 3.58)	3.09 (2.98, 3.19)	1.12 (1.05, 1.18)	1.19 (1.15, 1.24)
Language				
English	3.69 (3.43, 3.95)	3.27 (3.11, 3.42)	1.16 (1.07, 1.25)	1.21 (1.14, 1.28)
Spanish	2.83 (2.47, 3.20)	2.72 (2.52, 2.93)	0.94 (0.74, 1.15)	1.12 (1.01, 1.23)
Brazilian Portuguese	3.18 (2.83, 3.52)	3.06 (2.87, 3.25)	1.12 (0.96, 1.28)	1.21 (1.12, 1.29)
Haitian Creole	3.18 (2.59, 3.78)	3.36 (2.90, 3.82)	0.99 (0.72, 1.27)	1.38 (1.17, 1.58)
Others	2.60 (2.28, 2.93)	2.42 (2.15, 2.70)	1.05 (0.89, 1.22)	1.01 (0.87, 1.15)

Abbreviations: BMI, body mass index; CI, confidence interval; kg, kilogram; m, meter.

TABLE 4 Changes in obesity and overweight before and after the COVID-19 pandemic lockdown among all participants at a Safety-net Health System in Massachusetts

	Men		Women	
Variables	Before	After	Before	After
Obesity, all, %	39.6	38.6	40.7	41.7
Obesity by language,%				
English	42.8	41.6	41.5	41.9
Spanish	43.1	41.7	50.7	51.8
Brazilian Portuguese	39.0	37.9	32.0	33.8
Haitian Creole	30.8	30.8	51.2	55.0
Others	21.2	20.9	34.4	34.7
Overweight, all, %	77.6	76.3	72.1	72.8
Overweight by language, %				
English	77.4	76.2	69.2	69.4
Spanish	85.4	84.2	86.1	86.5
Brazilian Portuguese	80.5	79.7	68.4	70.5
Haitian Creole	74.6	72.4	83.8	84.8
Others	67.7	66.0	69.4	69.8

TABLE 5 Changes in obesity and overweight before and after the COVID-19 pandemic lockdown among participants who gained weight at a Safety-net Health System in Massachusetts

	Men		Women	
Variables	Before	After	Before	After
Obesity, all, %	37.5	45.5	39.5	46.6
Obesity by language, %				
English	42.0	49.5	41.0	46.7
Spanish	38.7	48.6	46.2	53.6
Brazilian Portuguese	36.5	44.8	28.8	36.9
Haitian Creole	28.9	38.2	51.2	63.8
Others	11.9	20.4	36.8	44.4
Overweight, all, %	75.0	81.4	71.4	78.1
Overweight by language, %				
English	74.8	80.2	69.4	75.6
Spanish	83.8	91.6	83.4	89.3
Brazilian Portuguese	79.8	86.9	64.4	73.3
Haitian Creole	69.7	76.3	86.2	90.6
Others	61.3	72.5	68.9	76.5

lockdown period. Overweight rates increased among Hispanic men (83.8%-91.6%, $P < .01$) and Haitian women (86.2%-90.6%, $P < .01$).

Table 6 shows factors associated with any weight gain and at least 5% weight gain during the COVID-19 lockdown period. After adjusting for baseline weight and duration of follow-up, men with hypertension had 18% (OR = 1.18, 95% CI = 1.01, 1.37) higher odds of weight gain compared with men without hypertension, while women with hyperlipidemia had 14% (OR = 1.14, 95% CI = 1.01, 1.29) higher odds of weight gain compared with women without hyperlipidemia. Compared with non-Hispanic men aged ≥60 years, younger (18-39 years of age) women (OR = 1.37, 95% CI = 1.18, 1.58) had higher odds of weight gain. Among women, Spanish (OR = 1.34, 95% CI = 1.15, 1.55) and Haitian creole (OR = 1.22, 95% CI = 1.01, 1.29) speakers had greater odds of weight gain than English speakers (Table 6). At least 5% weight gain was associated with younger age of 18 to 39 years compared to ≥60 years (OR = 1.45, 95% CI = 1.07, 1.97), food and housing insecurity (OR = 1.44, 95% CI = 1.05, 1.97) and tobacco use (OR = 1.38, 95% CI = 1.07, 1.78) among men; and with younger age of 18-39 years compared to ≥60 years (OR = 1.55, 95% CI = 1.25, 1.91), Spanish vs English speakers (OR = 1.25, 95% CI = 1.01, 1.54), Brazilians Portuguese vs English speakers (OR = 1.22, 95% CI = 1.03, 1.45), and tobacco use (OR = 1.36, 95% CI = 1.10, 1.69) among women.

4 | DISCUSSION

Given the high prevalence of obesity in the United States and severe complications of COVID-19 associated with obesity, understanding the impact of the lockdown on unhealthy weight gain and obesity is

TABLE 6 Factors associated with any weight gain and 5% weight gain during the COVID-19 pandemic lockdown at a Safety-net Health System in Massachusetts

	Weight gain		≥ 5% weight gain	
Variable	Men AOR (95% CI)	Women AOR (95% CI)	Men AOR (95% CI)	Women AOR (95% CI)
Age				
18–39 y	1.14 (0.94, 1.38)	1.37 (1.18, 1.58)	1.45 (1.07, 1.97)	1.55 (1.25, 1.91)
40–59 y	1.06 (0.91, 1.24)	1.00 (0.89, 1.14)	1.30 (1.00, 1.68)	1.05 (0.87, 1.27)
≥60 y	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Language				
English	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Spanish	0.96 (0.76, 1.21)	1.34 (1.15, 1.55)	0.82 (0.56, 1.21)	1.25 (1.01, 1.54)
Brazilian Portuguese	1.04 (0.86, 1.25)	1.11 (0.98, 1.25)	1.01 (0.75, 1.36)	1.22 (1.03, 1.45)
Haitian Creole	0.98 (0.71, 1.33)	1.22 (1.01, 1.47)	1.03 (0.62, 1.69)	1.22 (0.93, 1.62)
Others	0.90 (0.71,1.14)	0.97 (0.82, 1.16)	0.93 (0.64, 1.34)	0.81 (0.61, 1.08)
Hypertension	1.18 (1.01,1.37)	1.05 (0.93, 1.18)	1.08 (0.85, 1.38)	1.03 (0.86, 1.23)
Diabetes	1.07 (0.91, 1.25)	0.93 (0.81, 1.18)	1.00 (0.77, 1.31)	1.02 (0.83, 1.25)
Hyperlipidemia	0.99 (0.86, 1.16)	1.14 (1.01, 1.29)	0.82 (0.64, 1.05)	0.86 (0.72, 1.04)
Mental illness	1.07 (0.93, 1.22)	0.99 (0.91, 1.09)	1.04 (0.84, 1.30)	1.10 (0.96, 1.26)
COVID-19	0.90 (0.74, 1.09)	1.07 (0.95, 1.22)	0.91 (0.66, 1.25)	1.01 (0.84, 1.21)
Tobacco use	1.06 (0.89, 1.26)	1.04 (0.89, 1.21)	1.38 (1.07, 1.78)	1.36 (1.10, 1.69)
Housing or food insecurity	1.17 (0.94, 1.46)	1.05 (0.89, 1.24)	1.44 (1.05, 1.97)	1.25 (0.99, 1.57)

Note: Using logistic regressions. Adjusting for baseline weight and duration of follow up.
Abbreviations: AOR: adjusted odds ratio; COVID-19, coronavirus disease 2019; Ref: reference; y, years of age.

of significant public health importance. The study found nearly half of patients gained weight during the first lockdown in Massachusetts, women more than men. Of these, nearly a third gained more than 5% of their baseline weight. Overall obesity and overweight rates also significantly increased post-lockdown among women but not men. Overweight rates were highest among Hispanic men and Haitian women. Among men, ≥5% weight gain was associated with younger age, food and housing insecurity and tobacco use. Similarly, younger age and tobacco use were associated with ≥5% weight gain among women, along with Spanish and Brazilian Portuguese speaker women.

During the first COVID-19 lockdown in the state of Massachusetts, 40.6% of men and 46.1% of women gained weight. Of these, 26.8% of men and 29.5% of women gained clinically meaningful weight of more than 5% of their baseline weight. Although weight gain during the COVID-19 pandemic among adults have not yet been reported, a large study among Chinese youth found significant increase in body mass index as well as in overweight and obesity rates.[14,16] The increase in unhealthy weight during the pandemic correlates with reported increase in sedentary lifestyle as well as decreased physical activity and exercise.[14,17] Increased anxiety, stress and related problematic eating behaviours, such as stress eating and night time eating could also be contributing for such findings of unhealthy weight gain.[10,11,13]

Our study found significant subgroup differences in weight gain, obesity and overweight during the lockdown period. During the lockdown period, greater proportion of women gained weight, and the obesity rates among women also increased compared to men. This is likely due to the disproportionate impact of the COVID-19 shutdowns on women. The US Department of Labor report indicates female-dominated job sectors, such as hospitality, retail and restaurants have been hit hardest by the pandemic lockdown.[18] Furthermore, school and daycare closures impact mothers more as primary childcare givers.[18] This in turn could have a disproportionately negative impact on the financial, emotional and physical wellbeing of women since the pandemic lockdown.

Among women, Spanish and Brazilian Portuguese speakers had 25% and 22% more odds of ≥5% weight gain, respectively, compared to English speakers. Overweight rates were highest among Hispanic men and Haitian women. Although there is paucity of research since the pandemic, these findings are in line with prior studies, which have shown significant burden of obesity and weight gain among immigrants and ethnic minorities.[3,19] Similar to other studies, our study did not find associations between COVID-19 status and weight gain.[10] This is likely due to the similar behavioural and lifestyle changes during the lockdown regardless of COVID-19 infection status.[10]

The study found food and housing insecurity was associated with at least 5% weight gain among men. This finding concurs with prior studies where social determinants of health, such as food insecurity have been linked to higher BMI and obesity.[20,21] The pandemic and the subsequent lockdowns have led to significant job losses and economic crisis.[22] Such economic hardships have been linked to food insecurity, poor dietary quality and obesity as people may buy and

consume high-carbohydrate, non-perishable meals, rather than healthy fresh foods.[23]

Interestingly, younger adults in our study had greater odds of gaining clinically meaningful weight than older individuals. This finding likely reflects the consequences of decreased physical activities among younger individuals as gyms and fitness centers were closed and sporting activities were restricted during the pandemic.[24] Prior longitudinal studies conducted before the COVID-19 pandemic have found most of the weight gains tend to occur during early adulthood.[25,26] In addition to changes in obesogenic environments, basal metabolic factors as well as differences in lean muscle mass and distribution of body fat could be contributing for the more weight gain observed in younger age groups.[15] The pandemic lockdown might have exacerbated and accelerated these findings.

The study has several limitations. First, the study's generalizability can be limited since it was conducted in a patient population in the state of Massachusetts, USA. Second, as the study is based on medical records, demographic and anthropometric information obtained during routine clinical encounters may not have been complete and consistent. Furthermore, the inclusion and analysis of additional confounders and independent variables can be limited by data available through the medical record. Finally, BMI could underestimate body fat and risk of disease outcomes among particular subgroups.[27] Therefore, caution needs to be taken when interpreting the study findings.

Notwithstanding these limitations, the study has several strengths. One of the strengths of this study is the large and diverse sample size, which allows for subgroup analyses. The study contributes to the substantial gap in the current body of literature about the impact of COVID-19 pandemic lockdown on weight and obesity in the U.S. Another strength of this study is the use of actual clinical diagnoses and measurements from the EMR, such as weight and BMI, rather than relying solely on self-reported data. Further investigations are needed to ascertain and better understand underlying reasons behind subgroup differences to inform developments of targeted strategies to prevent and treat obesity during and beyond the COVID-19 lockdowns.[28]

5 | CONCLUSION

To our knowledge, this is one of the first studies to report the impact of the COVID-19 lockdown on weight, overweight and obesity among adults in the US. The study found significant proportion of participants gained weight, but there are subgroup variations. Our study can inform clinicians, policy makers and healthcare professionals about the impact of the lockdown and identify high risk vulnerable populations. Further studies are needed along with tailored prevention and treatment strategies to counteract the impact of the lockdown on unhealthy weight gain during and beyond the pandemic.

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CONFLICT OF INTEREST

No conflict of interest was declared.

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