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RESEARCH BRIEF

Obesity Prevalence Among U.S. Adults During the COVID-19 Pandemic

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Introduction: As the COVID-19 pandemic unfolded, several studies collected small and relatively homogenous samples to track U.S. adult obesity rates and obesity-related risk factors. In this study, a much larger sample from a nationally representative survey was used to investigate changes in average BMI, obesity prevalence rates, and 4 obesity-related risk factors in the U.S. adult population during the COVID-19 pandemic.

Methods: Using a large nationally representative sample of U.S. adults aged ≥20 years from the 2011−2020 Behavioral Risk Factor Surveillance System, linear regression models estimated intra-pandemic changes in average BMI and obesity prevalence rates as well as 4 obesity-related risk factors.

Results: Relative to the 2019 to prepandemic 2020 period, significantly higher average BMI (+0.6%, $p<0.05$, N=3,555,865) and obesity prevalence rates (+3%, $p<0.05$, N=3,555,865) were observed among U.S. adults during the COVID-19 pandemic. Significantly higher rates of any exercise participation (+4.4%, $p<0.01$, N=3,607,272), average sleep hours in a 24-hour period (+1.5%, $p<0.01$, N=1,907,798), average alcoholic drink days in the past month (+2.7%, $p<0.05$, N=3,577,090), and lower rates of smoking at least some days (−4%, $p<0.01$, N=3,625,180) were also observed.

Conclusions: During the COVID-19 pandemic, U.S. adult obesity rates were higher and worsened the pre-existing epidemic of adult obesity in the U.S. Higher rates of alcohol consumption and lower smoking rates may have contributed to the higher rates of adult obesity in the U.S during the COVID-19 pandemic.

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INTRODUCTION

In 2017−2018, obesity prevalence among U.S. adults was estimated to be 42.4%.[1] As the coronavirus disease 2019 (COVID-19) pandemic unfolded, weight gain in the adult population was reported by several studies, suggesting that intra-pandemic behavior changes caused a positive energy balance that exacerbated the adult obesity epidemic. An online survey conducted in April 2020−May 2020 indicated that weight gain was reported by almost 1 in 3 participants overall and by more than one-third of participants who had obesity.[2] In February 2020−June 2020, analysis of repeated weight measures from adult participants of the Health eHeart Study revealed an average gain of 1.5 pounds per month after local and state shelter-in-place orders were implemented.[3] Similarly, in an online survey of adults during May 2020−August 2020, the average weight gain reported across all participants amounted to 1.3 pounds, with 1 in 4 participants who had obesity reporting an average weight gain >3 times higher (4.4 pounds).[4] Given the rapidity with which adults gained weight, it is likely that intra-pandemic changes in risky dietary or other health-related behaviors contributed to the rise in body weight during the pandemic. Indeed,

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studies using online survey data found that adult participants who reported that they gained weight during the pandemic also reported more frequent snacking and alcohol intake[5]; increased eating in response to sight, smell, and stress[6]; and decreased physical activity.[2]

Though prior studies provide insights into how obesity prevalence changed during the pandemic, it is unclear whether results from nonrepresentative samples generalize to the broader adult population. This study contributes to the literature by using nationally representative data on adults aged ≥20 years from the 2011–2020 Behavioral Risk Factor Surveillance System (BRFSS) to analyze changes in average BMI and obesity prevalence rates during the pandemic. Several behaviors that can influence obesity risk—exercise, sleep duration, alcohol use, and smoking—are also examined to help explain observed changes in average BMI and obesity prevalence rates.

METHODS

The BRFSS collects data about U.S. residents from all 50 states, the District of Columbia, and 3 U.S. territories regarding health-related risk behaviors and chronic health conditions. This study used only public-use deidentified BRFSS data. To estimate intra-pandemic changes in average BMI, obesity prevalence rates, and 4 obesity-related risk measures—participation in any physical activity in the past month, average sleep hours in a 24-hour period, number of days in the past month when any amount of alcohol was consumed, and cigarette smoking every day or on some days—among adults aged ≥20 years in the 2011–2020 BRFSS, the following linear regression model was estimated by ordinary least squares:

$$Y_{it} = \alpha + X'_{it}\beta + \gamma_j \sum_{j=2011}^{2018} Interview\ Year_{it} + \delta COVID\ Pandemic_{it} + \varepsilon_{it}, \quad (1)$$

where Y_{it} is either a body weight measure or an obesity-related risk factor for individual i at time t; X_{it} is a vector of individual characteristics—age, sex, race/ethnicity, education, income, marital status, and number of children—that account for changing demographic characteristics over time that could affect body weight or obesity risk as well as the survey respondent's location; $\sum$ *Interview Year* represents 8 indicator variables equal to 1 if the survey respondent was interviewed in a prepandemic year 2011, 2012, . . ., 2018 and 0 otherwise; *COVID Pandemic* is an indicator variable equal to 1 if the survey respondent was interviewed after the President of the U.S. declared the spread of the novel coronavirus a pandemic (March 13, 2020) and 0 otherwise; and ε_{it} is a random error term. All interview period coefficient estimates are estimated relative to the (omitted) 2019 to March 12, 2020 period.

The primary dependent variable of interest, BMI, is derived from self-reported height and weight. As these measures are often misreported, they were adjusted for measurement error using a percentile-based approach with data from the 2011 to March 2020 National Health and Nutrition Examination Survey.[7] The adjusted height and weight data were used to compute an adjusted BMI measure and an adjusted obesity indicator (BMI ≥30). Table 1 contains the summary statistics for the dependent and independent variables used in the analysis. For BMI/obesity, the analysis involved 3,555,865 respondents (3,311,457 before the pandemic and 244,408 during the pandemic). Consistent with BRFSS respondents overestimating height and underestimating weight, adjusted BMI and obesity are higher than unadjusted BMI and obesity (Table 1).

There was significant skewness in the continuous dependent variables (BMI, sleep hours, and alcoholic drink days); therefore, they were log-transformed in the regression analysis. The primary independent variable of interest (*COVID Pandemic*) is a binary variable, so in linear regressions involving logged continuous dependent variables, percentage changes relative to the 2019 to March 12, 2020 period were obtained by applying the formula 100 × exp (linear coefficient estimate)−100. In linear regressions involving binary dependent variables, coefficient estimates were divided by sample means to obtain percentage changes relative to the 2019 to March 12, 2020 period.

All analyses were conducted using Stata, version 17. To account for the complex survey design of the BRFSS and produce nationally representative estimates, BRFSS sampling weights, strata, and primary sampling units were applied using Stata's estimation commands for survey data.

RESULTS

Figure 1 shows the linear regression coefficient estimates associated with the indicator for the COVID-19 pandemic period. The analysis reveals that, relative to the 2019 to March 12, 2020 period, average BMI was higher by 0.6% ($p<0.05$) and obesity prevalence rates were higher by 1.1 percentage points or 3% relative to the sample mean ($p<0.05$). Exercise participation rates were higher by 3.3 percentage points (or 4.4%) ($p<0.01$), average sleep hours were higher by 1.5% ($p<0.01$), average alcoholic drink days were higher by 2.7% ($p<0.05$), and smoking rates were lower by 0.7 percentage points (or 4%) ($p<0.01$).

DISCUSSION

Relative to the 2019 to March 12, 2020 period, significantly higher average BMI and obesity prevalence rates during the COVID-19 pandemic were observed among adults. Significant changes in several obesity-related risk indicators were also observed. Higher rates of alcohol consumption and lower smoking rates may have contributed to higher obesity prevalence rates. Indeed, higher alcohol intake has been shown to be a risk factor for obesity in some adults, particularly when it is not compensated for through reductions in intake of other calorie-dense foods and beverages.[8] Quitting smoking has also been shown to lead to weight gain, both in the short and longer term.[9] Higher exercise participation and average sleep duration can reduce obesity risk.[10] However, given

Table 1. Summary Statistics for the Overall Sample, 2011–2020 Behavioral Risk Factor Surveillance System

Variables	Mean or %	SD
BMI (unadjusted)	28.139	6.315
Obese (unadjusted)	30.8%	
BMI (adjusted)	29.051	6.620
Obese (adjusted)	36.7%	
Any physical activity in past month[a]	75.6%	
Average hours of sleep in a 24-hour period[b]	6.958	1.469
Number of days in the past month alcohol was consumed[c]	5.079	8.071
Currently, smoking some days or every day[d]	17.6%	
Age in years	48.093	16.914
Sex		
Female	49.5%	
Male	50.5%	
Racial/ethnic group		
Non-Hispanic White	65.4%	
Non-Hispanic Black	11.7%	
Hispanic	15.3%	
Other	7.7%	
Educational attainment		
Never attended school or only kindergarten	0.2%	
Grades 1 through 8 (elementary)	3.8%	
Grades 9 to 11 (some high school)	8.2%	
Grade 12 or GED (high school graduate)	26.8%	
College 1 year to 3 years (some college)	31.5%	
College 4 years or more (college graduate)	29.5%	
Household income, $		
<10,000	5.8%	
10,000 to <15,000	5.3%	
15,000 to <20,000	7.5%	
20,000 to <25,000	9.1%	
25,000 to <35,000	10.5%	
35,000 to <50,000	13.6%	
50,000 to <75,000	15.3%	
>75,000	33.0%	
Marital status		
Married or a member of an unmarried couple	58.1%	
Divorced	11.6%	
Widowed	6.6%	
Separated	2.6%	
Never married	21.1%	
Number of children under 18 years of age in the household		
0	63.0%	
1	14.9%	
2	13.4%	
3	5.8%	
4	2.0%	
≥5	1.0%	
Time period		
Year 2011	9.9%	
Year 2012	10.2%	
Year 2013	10.1%	
Year 2014	10.0%	
Year 2015	9.7%	
Year 2016	10.1%	
Year 2017	10.2%	
Year 2018	9.8%	
Year 2019–March 12, 2020	11.7%	
March 13, 2020–March 18, 2021	8.2%	

Note: These are summary statistics corresponding to the regression sample involving BMI/obesity as a dependent variable: the overall N=3,555,865, the prepandemic *n*=3,311,457, and intra-pandemic *n*=244,408. To produce nationally representative estimates, the appropriate BRFSS sampling weights, strata, and primary sampling units were applied in computing these summary statistics. Because of missing information on the other dependent variables used in the regression analyses summarized in Figure 1, the sample sizes are smaller and are as follows:

[a]The overall N=3,607,272. The prepandemic *n*=3,349,482 and intra-pandemic *n*=257,790.

[b]The overall N=1,907,798. The prepandemic *n*=1,652,408 and intra-pandemic *n*=255,390.

[c]The overall N=3,577,090. The prepandemic *n*=3,328,705 and intra-pandemic *n*=248,385.

[d]The overall N=3,625,180. The prepandemic *n*=3,374,039 and intra-pandemic *n*=251,141.

the observed higher obesity prevalence rates, higher exercise participation rates and average hours of sleep were not enough to offset behavior changes that increased obesity risk. Given that >40% of adults currently have obesity, which raises annual medical costs by approximately $3,632 (2020 dollars),[11] continued surveillance of obesity prevalence rates and obesity-related risk factors can help to inform policy that is designed to mitigate the health and economic burdens of obesity.[12]

A major strength of this study is its ability to estimate intra-pandemic obesity prevalence rates and obesity-related risk factors using a large nationally representative survey. The BRFSS is, however, a cross-sectional data set. Future work exploiting longitudinal data to explore the dynamics of weight status among the same individuals during the pandemic would be useful. Another important limitation is that BRFSS respondents were not asked whether they had COVID-19, which may have affected obesity-related risk factors. Moreover, obesity is a

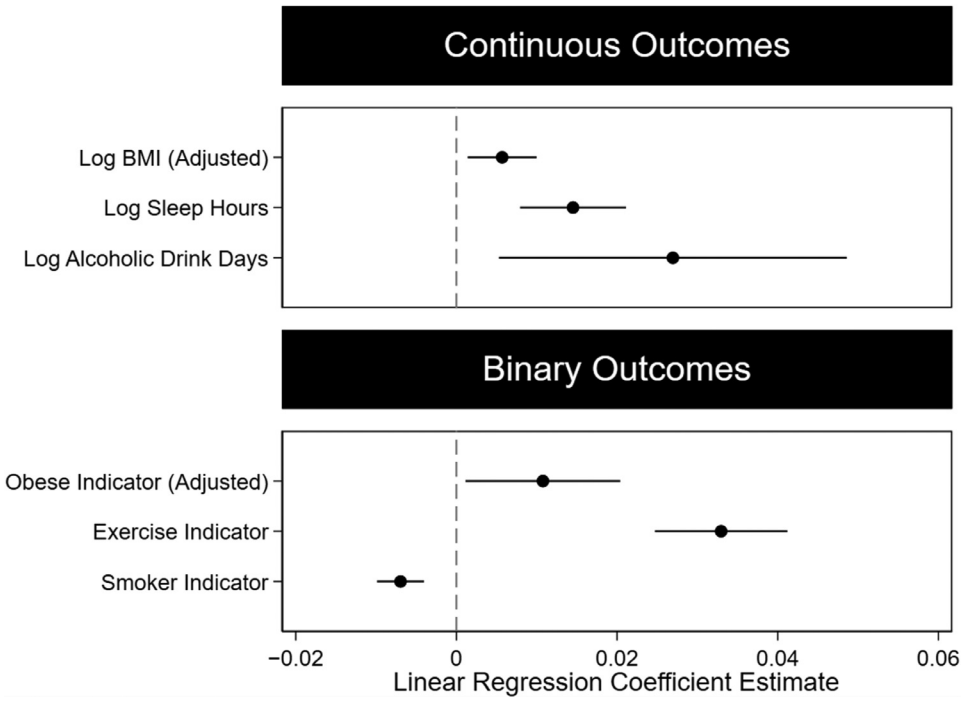

Figure 1. Changes in average BMI, obesity prevalence rates, and obesity-related risk factors during the COVID-19 pandemic.
Note: Each marker shows the linear regression coefficient estimate—relative to the 2019 to March 12, 2020, period—associated with an indicator for the COVID-19 pandemic period from a separate linear regression model estimated by Ordinary Least Squares along with the corresponding 95% confidence band. To compute nationally representative estimates, the appropriate BRFSS sampling weights, strata, and primary sampling units were used in all regressions. Each coefficient estimate shown is statistically significant at the 5% level or better. Please see the notes in Table 1 for the sample sizes for the 6 separate regression models. For the continuous dependent variables, to obtain percentage changes, the formula 100 × exp (linear regression coefficient estimate) − 100 must be applied. To obtain percentage changes for the binary dependent variables, the linear regression coefficient estimate must be divided by the sample mean. Regressors included but not shown: age and its square, male dummy, race/ethnicity dummies, educational attainment dummies, annual household income dummies, marital status dummies, number of children under 18 years of age in the household dummies, indicators for survey years 2011, 2012, . . ., 2018, and indicators for the survey respondent's state of residence.
Source: 2011–2020 Behavioral Risk Factor Surveillance System.

complex disease, and there are many risky behaviors that could have contributed to the higher obesity prevalence rates documented here, including changes in dietary intake that are unmeasured in the BRFSS data. An important direction for future research is to examine whether adults shifted toward more calorie-dense eating patterns during the pandemic. These results may prove to be useful inputs in policymaking decisions regarding potential actions to combat the exacerbated adult obesity epidemic as the COVID-19 pandemic subsides.

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CREDIT AUTHOR STATEMENT

Brandon J. Restrepo: Conceptualization; Data Curation; Formal Analysis; Investigation; Methodology; Validation; Visualization; Writing - Original Draft; Writing - Review and Editing.

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