RESEARCH LETTER

Trends in Obesity Prevalence Among Adults Aged 18 Through 25 Years, 1976-2018

Emerging adulthood, from ages 18 through 25 years, is a distinct developmental period characterized by exploration and frequent change (eg, from school to work), ultimately leading to the formation of lifelong habits and adult identity.[1,2] Few studies describe obesity in emerging adults; analyses often group these individuals with adolescents (aged 12-19 years) or young adults (aged 20-39 years), limiting opportunities for developmentally informed intervention and treatment.[3,4] We examined the changes in obesity prevalence nationally among emerging adults in the US over the last 4 decades.

Methods | We used nationally representative data from the National Health and Nutrition Examination Survey (NHANES), a series of cross-sectional surveys including interviews and physical examinations with a stratified, multistage sampling design. We drew from NHANES II (1976-1980), NHANES III (1988-1994), and the continuous NHANES cycles from 1999 through 2018 (response rate range, 48.8%-80%). We limited our study population to nonpregnant emerging adults (aged 18-25 years) of non-Hispanic Black or non-Hispanic White race with complete data for variables of interest (89.8% of defined population had complete data). Given the changes in how the NHANES assessed race and ethnicity over time, we were limited to the aforementioned groups.

Our outcome of interest was body mass index (BMI; calculated as weight in kilograms divided by height in meters squared). We categorized BMI into standard groups of underweight (<18.5), normal weight (18.5-24.9), overweight (25-29.9), and obesity (≥30).[5] Covariates included sex (male or female), race and ethnicity (non-Hispanic Black or non-Hispanic White), and household poverty (yes or no). We identified household poverty if the NHANES poverty index (the ratio of family income to the US poverty threshold in NHANES II/III and the ratio of family income to the US

Table. Covariate-Adjusted Mean Body Mass Index (BMI) and Prevalence of BMI Groups Among Non-Hispanic Black and Non-Hispanic White Emerging Adults (Aged 18-25 Years), 1976-2018[a]

	BMI[b]		BMI groups[b]							
			Underweight (<18.5)		Normal weight (18.5-24.9)		Overweight (25.0-29.9)		Obesity (≥30.0)	
Survey year	No.[c]	Mean (95% CI)	No.[c]	Weighted proportion, % (95% CI)[d]	No.[c]	Weighted proportion, % (95% CI)[d]	No.[c]	Weighted proportion, % (95% CI)[d]	No.[c]	Weighted proportion, % (95% CI)[d]
1976-1980	1974	23.1 (22.9-23.4)	127	5.5 (4.4-6.8)	1361	68.7 (66.3-70.9)	351	17.7 (15.9-19.8)	135	6.2 (4.9-7.9)
1988-1994	1396	24.6 (24.2-24.9)	74	4.8 (3.5-6.5)	811	59.5 (56.5-62.5)	281	19.3 (17.0-21.9)	230	14.8 (13.1-16.7)
1999-2000	359	26.5 (25.3-27.8)	14	3.4 (1.3-8.9)	183	47.7 (41.8-53.6)	83	23.9 (17.5-31.9)	79	23.1 (15.6-32.6)
2001-2002	550	26.0 (25.2-26.7)	33	4.6 (2.3-8.9)	293	49.5 (44.3-54.7)	118	24.0 (19.2-29.4)	106	21.3 (17.2-26.1)
2003-2004	608	26.5 (25.7-27.3)	31	4.5 (3.0-6.5)	304	47.2 (42.0-52.4)	130	22.1 (18.1-26.6)	143	24.9 (20.0-30.5)
2005-2006	616	27.1 (26.2-28.0)	23	3.0 (1.9-4.6)	296	45.1 (40.1-50.1)	135	22.8 (18.0-28.4)	162	27.5 (20.6-35.7)
2007-2008	415	26.8 (25.8-27.8)	18	3.8 (2.1-6.8)	200	46.5 (40.7-52.5)	100	22.9 (18.0-28.7)	97	23.3 (17.7-29.9)
2009-2010	484	26.7 (25.7-27.7)	20	2.9 (1.7-4.8)	242	48.7 (39.3-58.2)	98	21.6 (16.6-27.6)	124	24.7 (18.3-32.4)
2011-2012	481	26.9 (25.9-28.0)	25	5.9 (4.0-8.5)	213	44.5 (36.9-52.3)	111	22.3 (17.9-27.5)	132	26.0 (19.9-33.2)
2013-2014	477	27.0 (25.7-28.2)	22	4.3 (2.3-8.1)	223	46.0 (41.4-50.6)	112	23.1 (19.0-27.8)	120	25.8 (20.1-32.4)
2015-2016	337	26.8 (26.1-27.6)	14	4.4 (2.5-7.7)	153	44.3 (39.3-49.5)	85	25.7 (21.9-30.0)	85	25.0 (21.3-29.2)
2017-2018	318	27.7 (26.2-29.1)	22	4.7 (2.3-9.3)	127	37.5 (29.5-46.4)	64	23.6 (18.8-29.4)	105	32.7 (24.7-41.8)
P value[e]		.006		.32		.005		.06		.007
P value for sensitivity analysis[f]		.04		.58		.02		.72		.03

[a] Data are from the National Health and Nutrition Examination Survey (NHANES). All estimates were adjusted for sex, race/ethnicity (non-Hispanic Black vs non-Hispanic White), and poverty index. Race and ethnicity options in NHANES III and the continuous NHANES cycles were defined by the NHANES survey developers and chosen by participants. For NHANES II, the race options were defined by the NHANES survey developers and individuals were classified by observation except in cases when the interviewer was unable to do so, in which case the participant was asked. Ethnicity was not directly assessed. A Hispanic ethnicity variable was constructed based on participant-reported natural origin or ancestry.

[b] Calculated as weight in kilograms divided by height in meters squared.

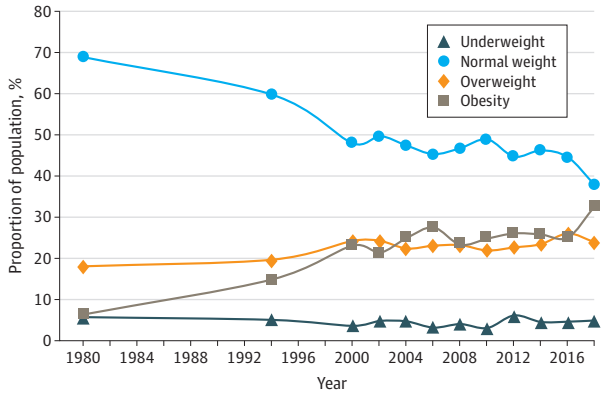
[c] Counts are unweighted.

[d] Examination weights were used to calculate weighted prevalence estimates and 95% CIs. The rare strata with single sampling units in the data were treated as certainty units to perform variance estimation.

[e] Estimated using a nonparametric, Wilcoxon-type test for trend.

[f] Estimated using survey-weighted, adjusted regressions for pooled data from continuous NHANES, 1999-2018.

Figure. Covariate-Adjusted Prevalence of Body Mass Index Groups Among Emerging Adults (Aged 18-25 Years) in the National Health and Nutrition Examination Survey, 1976-2018



Prevalence estimates calculated using survey weights and adjusted for sex, race and ethnicity, and poverty index. Groups were defined using body mass index (calculated as weight in kilograms divided by height in meters squared) as underweight (<18.5), normal weight (18.5-24.9), overweight (25.0-29.9), and obesity (≥30.0).

poverty guidelines in the continuous NHANES) was at or below the poverty threshold or guidelines for that year. We did not include age, given the narrow range of interest.

For each wave, we estimated mean BMI and prevalence of each BMI group along with 95% CIs using NHANES examination weights to account for the complex sampling design and adjusting for all covariates. To test for trend across all years, we used a nonparametric, Wilcoxon-type test given the time differences between surveys.[6] In sensitivity analyses, we combined the continuous NHANES cycles (1999-2018) and conducted a linear or logistic regression, as appropriate, to test for trend over time. Statistical significance was determined by a 2-sided $P < .05$. All analyses were performed using Stata version 15 (StataCorp). The Johns Hopkins institutional review board reviewed this study and determined that it was not human subjects research.

Results | Across all years, 8015 emerging adults were included. Of these, 3965 were female, 3037 were non-Hispanic Black, and 2386 met criteria for household poverty.

Between 1976 and 2018, mean BMI increased from 23.1 (95% CI, 22.9-23.4) in 1976-1980 to 27.7 (95% CI, 26.2-29.1) in 2017-2018 ($P = .006$ for trend using a nonparametric test) (**Table**). The **Figure** shows the adjusted prevalence of BMI groups over time. Between 1976-1980 and 2017-2018, the prevalence of obesity increased from 6.2% (95% CI, 4.9%-7.9%) to 32.7% (95% CI, 24.7%-41.8%; $P = .007$ for trend using a nonparametric test), whereas normal weight decreased from 68.7% (95% CI, 66.3%-70.9%) to 37.5% (95% CI, 29.5%-46.4%; $P = .005$ for trend using a nonparametric test). The sensitivity analyses limited to the continuous NHANES cycles had similar results (Table).

Discussion | This analysis found that from 1976 to 2018, the prevalence of obesity among emerging adults in the US increased significantly. Limitations of this study include the population being limited to non-Hispanic Black and non-Hispanic White individuals, patterns among whom may not be generalizable to other races or ethnicities, as well as a decline in the NHANES response rate over time.

Emerging adulthood may be a key period for preventing and treating obesity given that habits formed during this period often persist through the remainder of the life course. There is an urgent need for research on risk factors contributing to obesity during this developmental stage to inform the design of interventions as well as policies aimed at prevention.

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Concept and design: Ellison-Barnes, Gudzune.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: Ellison-Barnes.
Critical revision of the manuscript for important intellectual content: Johnson, Gudzune.
Statistical analysis: Ellison-Barnes.
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