



Identifying modifiable obesogenic behaviors among Latino adolescents in primary pediatric care

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ABSTRACT

Latino adolescents engage in more obesogenic behaviors, including sedentary behaviors and sugary drink consumption, than White adolescents. However, it is unclear whether engagement in obesogenic behaviors differs within the Latino population. Cross-sectional data were examined from Latino adolescents ages 13–17 with a well-child visit (2016–2019) in an integrated healthcare system. Adolescents self-reported on four daily obesogenic behaviors: 1) consuming < 5 servings of fruits/vegetables; 2) drinking > 1 juice/soda; 3) exercising/playing sports < 60 min; and 4) > 2 h screen time. A composite variable of ≥ 3 self-reported behaviors was constructed. Multivariable logistic regression was used to examine associations between obesogenic behaviors with age category (13–15 or 16–17 years), sex, household language preference (English/Spanish), neighborhood deprivation index (NDI quartiles), and body mass index (BMI). Among 77,514 Latino adolescents (mean age 14.7 \pm 1.4; 50 % female), 23 % lived in Spanish-speaking households, 43 % resided in census tracts with the highest (most deprived) NDI quartile, and 45 % had an overweight or obese BMI. Older (vs younger) adolescents had higher odds of insufficient fruit/vegetable intake (OR 1.20; CI 1.17–1.24), greater sedentary behavior (OR 1.51; 1.46–1.56), and reporting > 2 h screen time (OR 1.07; 1.03–1.11). Adolescents in the 4th (vs 1st) NDI quartile (OR 1.34; 1.26–1.42) and those with obesity (vs healthy weight) (OR 1.55; 1.42–1.70 for class 3 obesity) had higher odds of ≥ 3 obesogenic behaviors. In conclusion, among Latino adolescents, older age, obesity, and living in more deprived neighborhoods were associated with greater obesogenic behaviors. Identifying adolescents more likely to engage in obesogenic behaviors can inform targeted lifestyle interventions.

1. Introduction

Obesogenic behaviors during adolescence, including consumption of sugary drinks and sedentary activity, contribute to the growing incidence of chronic diseases and adverse cardiometabolic outcomes. (Cote et al., 2013; Mayne et al., 2020; Nyberg et al., 2011) Healthy diet and exercise behaviors develop during adolescence and can continue into adulthood. Adolescence is therefore a critical time window to establish healthy behaviors crucial for promoting lifelong health. (Merlo et al., 2020) In the United States, however, few adolescents meet national dietary or physical activity guidelines. (Merlo et al., 2020) In a 2019 national study, only 23 % of high-school students met the recommended ≥ 60 min/day of exercise, and though trends of sugary drinks

consumption have decreased over the past two decades, about 25 % of high-school students continued to drink sugary drinks ≥ 1 time/day. (Merlo et al., 2020) In addition, these obesogenic behaviors disproportionately affect Latino adolescents. (Mayne et al., 2020; Nyberg et al., 2011; Merlo et al., 2020; Kann et al., 2018; Bender et al., 2013; Russo et al., 2020; Ford et al., 2016; Hanson and Chen, 2007) In particular fewer Latino adolescents report eating vegetables ≥ 1 time/day (35 % vs 47 % among White adolescents), and more Latino adolescents report drinking sugary drinks ≥ 1 time/day (about 28 % vs 24 % among White adolescents). (Merlo et al., 2020) Similarly, fewer Latino adolescents report engaging in ≥ 60 min/day of exercise (21 % vs 26 % among White adolescents). (Merlo et al., 2020) Prior studies found that environmental and socioeconomic factors such as transportation issues, poor sidewalks,

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limited playgrounds and safety concerns act as barriers for Latino adolescents to engage in physical activity. (Nyberg et al., 2011) Similarly, Latino adolescents have more access to unhealthy foods than their White peers, (Kann et al., 2018) promoting an unhealthy diet. The fact that Latino adolescents engage in more obesogenic behaviors (Mayne et al., 2020; Nyberg et al., 2011; Merlo et al., 2020) is concerning given the high burden of obesity-linked metabolic conditions within this population. (Nyberg et al., 2011) Identifying and addressing obesogenic behaviors within primary care settings present opportunities for interventions targeting overweight and obesity (Sargent et al., 2011) and can support efforts to promote lifelong health and reduce health disparities.

Prior studies evaluating obesogenic behaviors conducted in clinical settings found Latino adolescents to be disproportionately affected compared to White adolescents, but were not large enough to examine obesogenic behaviors within the Latino subgroup. (Bender et al., 2013; Patrick et al., 2004; SanGiovanni et al., 2018; Doymaz and Neuspiel, 2009) By contrast, prior studies that have examined these behaviors within Latino subgroups have primarily relied on population surveys. (Nyberg et al., 2011; Russo et al., 2020) Although these prior population studies captured detailed lifestyle information (e.g., 24-hour diet recalls) necessary to identify multiple facets of lifestyle behaviors, their length and complexity in administration make them impractical to replicate in most routine clinical settings. In this study, we leveraged self-reported data on four obesogenic behaviors collected in the context of pediatric primary care from a large, contemporary population of Latino adolescents in northern California and examined how these behaviors differ by patient demographic characteristics and by weight status. Identifying Latino adolescents more likely to engage in obesogenic behaviors can inform targeted lifestyle interventions for chronic disease prevention.

2. Research Design and Methods.

1.1. Study design, setting and population

This retrospective cross-sectional study utilized electronic health record (EHR) data from Kaiser Permanente Northern California (KPNC), a large integrated healthcare delivery system providing comprehensive care for a racially and ethnically diverse population of 4.3 million members. KPNC provides both primary and specialty care in inpatient and outpatient settings, with data linked through an integrated EHR, and its membership is largely representative of the northern California population. A central focus of pediatric primary care is preventive health care visits, (Academy, 2021) referred to as well-child care visits. (Coker et al., 2013) In this study, we identified 77,514 Latino adolescents ages 13–17 years who had a well-child visit during 2016–2019 and completed a well-check questionnaire. For adolescents who had more than one well-child visit during the 4-year study window, only data from the first qualifying visit was used. The study was approved by the KPNC Institutional Review Board and a waiver of informed consent was obtained due to the nature of the study.

1.2. Lifestyle risk factor measurements

Information on lifestyle risk factors came from an intake questionnaire completed by adolescents during registration for the well-child visit and entered into the EHR. The form included the following four binary questions relating to daily nutrition and activity: 1) consuming at least 5 servings of fruits/vegetables; 2) drinking >12 oz (1 can) of soda, juice or sweetened beverage; 3) exercising or playing sports for at least 60 min; and 4) spending >2 h on screen time.

1.3. Demographic, socioeconomic status and anthropometric measurements

EHR databases were used to derive sex, race and ethnicity, and primary or preferred household language (English or Spanish). The

Neighborhood Deprivation Index (NDI) was used as a proxy of neighborhood socioeconomic status, based on geocoded place of residence, and was derived from US Census tract level data pertaining to the following socioeconomic indicators: income and poverty, education, housing, employment and occupation. (Messer et al., 2006) Body mass index (BMI) was calculated from well-child visit measured height and weight, with BMI percentiles based on Centers for Disease Control and Prevention (CDC) reference data. (Program, 2019) Weight status was classified as underweight (BMI < 5th age- and sex-specific percentile), healthy weight (BMI 5th to < 85th percentile), overweight (BMI 85th to < 95th percentile), and obesity (BMI ≥ 95th percentile), and obesity was further categorized as Class I, II, and III obesity (BMI 100 % to < 120 %, 120 % to < 140 %, and ≥ 140 % of the 95th percentile, respectively). (Program, 2019) Adolescents with biologically implausible values (0.03 %) for height, weight, or BMI, (Program, 2019) underweight adolescents (1.8 %), and those with primary language other than English or Spanish (0.3 %) were excluded.

1.4. Statistical analysis

Variables for each of the four daily obesogenic behaviors were reported as: 1) consuming < 5 servings of fruits/vegetables; 2) drinking > 1 juice/soda (12 oz); 3) exercising/playing sports < 60 min; or 4) > 2 h of screen time. Given that the majority of adolescents had at least 1 or 2 of these reported behaviors, a composite outcome of ≥ 3 obesogenic behaviors was created as an outcome of interest. Standard descriptive statistics were used to examine the proportions within demographic and clinical subgroups reporting obesogenic behaviors or ≥ 3 behaviors combined. Multivariable logistic regression was used to examine associations between each obesogenic behavior and the composite outcome (≥3 obesogenic behaviors) with age category, sex, language preference, NDI, and weight status. All analyses were performed using SAS 9.4 (SAS Institute, Cary NC), in 2021.

2. Results

A total of 77,514 Latino adolescents (mean age 14.7 ± 1.4 years, 50 % female) had a well-child visit and completed a well-check questionnaire. Nearly-one-fourth (23 %) lived in Spanish-speaking households, 43 % lived in neighborhoods at the highest (most deprived) NDI quartile, and 45 % had overweight or obesity. Over one-fourth (27 %) engaged in ≥ 3 obesogenic behaviors (Table 1). Older adolescents (age 16–17) had higher odds of insufficient fruit/vegetable intake (OR 1.20; 95 % CI: 1.17–1.24), being more sedentary (OR 1.51; 1.46–1.56), and reporting > 2 h of screen time (OR 1.07; 1.03–1.11) compared to younger adolescents (age 13–15), but juice/soda consumption was similar (OR 1.03; 0.99–1.06). Boys had higher odds of insufficient fruit/vegetable intake (OR 1.17; 1.13–1.20) and excess juice/soda consumption (OR 1.29; 1.25–1.33) than girls, but lower odds of being sedentary (OR 0.73; 0.70–0.75) and reporting > 2 h of screen time (0.92; 0.89–0.95). Adolescents in Spanish-speaking households had lower odds of insufficient fruit/vegetable intake (OR 0.87; 0.84–0.90) and reporting > 2 h of screen time (OR 0.93; 0.90–0.97), but higher odds of being more sedentary (OR 1.12; 1.08–1.16) than adolescents in English-speaking households.

Differences in the odds of the composite outcome, ≥3 obesogenic behaviors, are shown in Fig. 1. Higher NDI quartile was associated with a graded increase in obesogenic behaviors (p -trend < 0.01); adolescents living in the fourth NDI quartile had 1.3-fold higher odds of reporting ≥ 3 obesogenic behaviors (OR 1.34; 1.26–1.42) than adolescents in the first NDI quartile. Likewise, higher BMI level was associated with a graded increase in obesogenic behaviors (p -trend < 0.001); adolescents with class 3 obesity had 1.6-fold higher odds of reporting ≥ 3 obesogenic behaviors (OR 1.55; 1.42–1.70) than adolescents in the normal weight category.

Table 1
Daily obesogenic behaviors reported by Latino adolescents at a well-child visit during 2016–2019.

Characteristic	Total, n	< 5 servings of fruits/vegetables	> 1 juice or soda	Exercise/play sports for < 60 min	Screen time > 2 h	≥ 3 obesogenic behaviors
Combined sample	77,514	48 %	30 %	27 %	73 %	27 %
Age category, years						
13 to 15	53,806	47 %	30 %	24 %	72 %	25 %
16 to 17	23,708	52 %	30 %	32 %	74 %	31 %
Sex						
Girls	38,865	46 %	27 %	30 %	74 %	27 %
Boys	38,649	50 %	33 %	24 %	72 %	27 %
Language preference						
English	59,664	49 %	29 %	26 %	73 %	27 %
Spanish	17,850	46 %	31 %	28 %	72 %	27 %
NDI, quartile						
First (least deprived)	7,864	47 %	24 %	24 %	72 %	23 %
Second	14,328	48 %	27 %	25 %	73 %	24 %
Third	22,140	48 %	29 %	26 %	72 %	26 %
Fourth (most deprived)	32,954	49 %	33 %	28 %	73 %	29 %
Missing	228	48 %	30 %	31 %	74 %	27 %
BMI category						
5th to < 85th percentile	42,211	47 %	31 %	24 %	72 %	26 %
85th to < 95th percentile	15,423	47 %	28 %	26 %	73 %	25 %
100 to < 120 % >95th percentile	12,611	50 %	29 %	30 %	74 %	29 %
120 to < 140 % >95th percentile	5,178	51 %	30 %	32 %	75 %	31 %
≥140 % >95th percentile	2,091	54 %	33 %	38 %	79 %	36 %

Abbreviations: NDI, neighborhood deprivation index; BMI, body mass index.

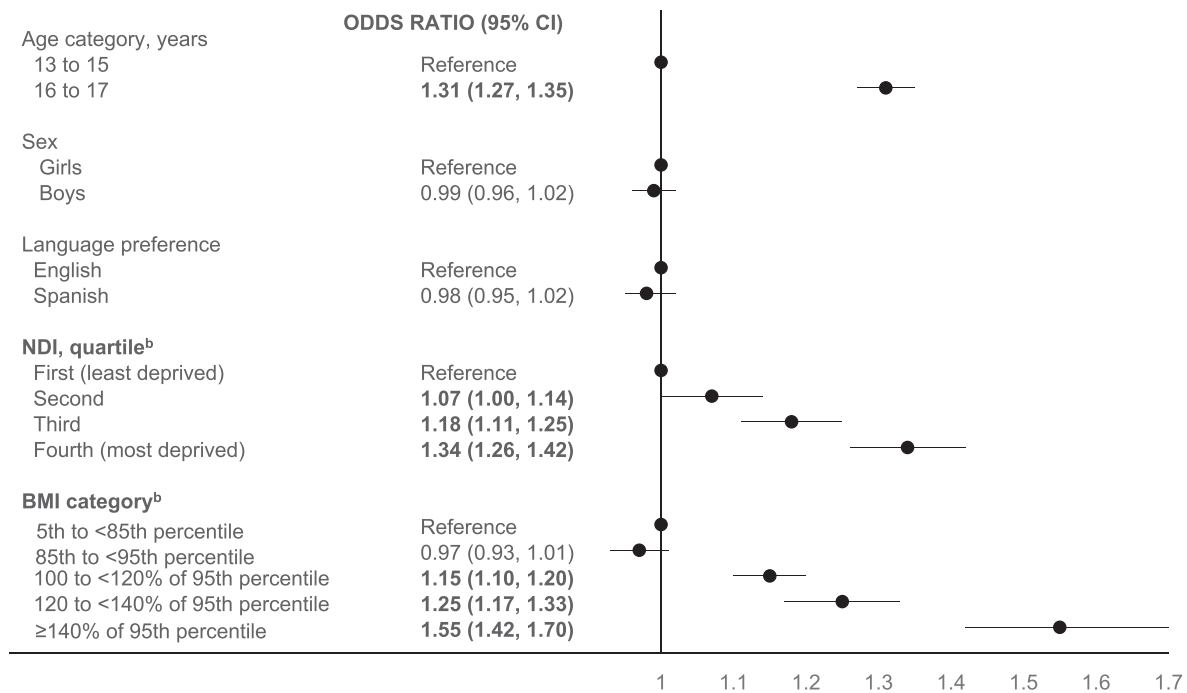


Fig. 1. Multivariable^a predictors of ≥ 3 daily obesogenic behaviors reported by Latino adolescents at a well-child visit during 2016–2019. Boldface indicates statistical significance ($p < 0.05$). ^aMultivariable logistic regression model including age category, sex, language preference, neighborhood deprivation index and BMI category. Odds Ratios and 95 % Confidence Intervals are shown. ^bTest for trend, P -trend < 0.01.

3. Discussion

In this cross-sectional study conducted in a large integrated healthcare delivery system, we found that older Latino adolescents who had more severe obesity or lived in more deprived neighborhoods were more likely to report obesogenic behaviors. This study adds to prior literature showing that high sugary drink intake, low fruit/vegetable intake, inadequate exercise and excessive screen time, increase with age during adolescence, (Mayne et al., 2020; Russo et al., 2020; Skinner et al.,

2018) and identifies practical targets for primary care intervention. Approaches that shape healthy lifestyle behaviors (e.g., reducing soda intake and increasing physical activity), including clinical, (Sargent et al., 2011; Doymaz and Neuspiel, 2009) school-based (Vézina-Im et al., 2017) and policy interventions (soda taxes), (Edmondson et al., 2021) early in adolescence when behaviors may be more easily influenced are especially important.

Not surprisingly, our study found an association between obesogenic behaviors and higher obesity, consistent with prior studies showing that

inadequate physical activity and poor diet contribute to obesity in adolescents. (Merlo et al., 2020; Haerens et al., 2010) A meta-analysis found that although primary care weight management interventions among children and adolescents have minimal effects on BMI, many result in healthy behaviors changes. (Sim et al., October 2016) Because healthy behavior changes even in the absence of weight loss lead to improved health outcomes, such interventions should be encouraged. (Sargent et al., 2011; Sc and Defining, 2016) In clinical practice, identifying these modifiable health behaviors affords a unique opportunity for pediatricians to provide counseling to address these health-related behaviors and referral to more comprehensive lifestyle or weight loss programs. (Ford et al., 2016; Coker et al., 2013).

We also found differences by sex and primary language that persisted after accounting for BMI category, age and NDI. For instance, insufficient exercise and higher screen time was more commonly reported by adolescent girls compared to boys, whereas boys reported lower intake of fruits/vegetables and higher intake of sugary drinks, consistent with prior findings. (Mayne et al., 2020; Russo et al., 2020) Similarly, adolescents living in Spanish-speaking homes reported higher intake of fruits/vegetables and slightly less screen time, but also less exercise than adolescents living in English-speaking homes. These unique behavioral differences by sex and language preference have implications as these can serve as the basis for developing targeted public health and primary care interventions.

It is notable that a majority of our study population lived in more deprived neighborhoods, a significant predictor of obesogenic behaviors. (Hanson and Chen, 2007) While primary care providers typically respond to the health issues at hand, it is essential that upstream root causes are addressed. These include social determinants of health such as food insecurity or lack of green spaces to engage in exercise, (Hanson and Chen, 2007; Tebb et al., 2018) problems that are more common in deprived neighborhoods. In recent years, a number of multisectoral interventions have been implemented across the country and have shown promise in their ability to improve coordination of services that address both social and health needs. (Tebb et al., 2018) These health care-community partnerships can support clinician's ongoing efforts to promote healthy behaviors in their patients.

The present study has some limitations. First, the well-check questionnaire responses were based on self-reported behaviors, potentially subject to underreporting of unhealthy behaviors, particularly by adolescents in the overweight and obese categories, who have a greater tendency to underreport. (Stice et al., 2015) Second, the four binary nutrition and physical activity questions included in the well-check questionnaire are good screener questions that are easy to administer during a clinical visit, but they lack detail about the behaviors and could introduce misclassification of reported behaviors. Third, the study was restricted to adolescents at comprehensive well-child visits (an additional 22 % without well-check questionnaire responses include those with unscheduled preventive care at visits for other indications). Hence our findings may not represent behaviors in children with chronic disease, major comorbidities, or those who less frequently access preventive services. This last group, in particular, may include adolescents from low-income families at higher risk for obesogenic behaviors. (Nyberg et al., 2011) Fourth, the cross-sectional design limits our ability to draw conclusions about the direction of associations (e.g., obesity may lead to more sedentary behavior). Fifth, we lacked individual-level socioeconomic status and did not have data on other important social determinants of health factors. (Centers for Disease Control and Prevention. About Social Determinants of Health (SDOH). <https://www.cdc.gov/socialdeterminants/about.html>. Published March 10, 2021) Future research should include food and environmental social determinants of health factors associated with obesogenic behaviors, such as food insecurity and access to healthy food options, transportation barriers, safety issues, neighborhood walkability, and access to parks or playgrounds. Lastly, our sample was limited to KPNC members seeking primary care, thus findings may not be generalizable to the broader U.S.

Latino population.

4. Conclusion

In conclusion, we found that Latino adolescents who were older, had more severe obesity, or lived in the most deprived neighborhoods were more likely to report obesogenic behaviors. This study underscores the need to target lifestyle interventions earlier during childhood and within households, and to address systemic and structural barriers that increase obesogenic behaviors at the neighborhood level. Our findings also support the value of assessing obesogenic behaviors in primary care to identify high-risk populations for intervention. Findings from this study can help pediatricians and health-care systems identify Latino adolescents at the highest risk of developing obesity-related chronic diseases and target intervention strategies to mitigate this risk.

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CRedit authorship contribution statement

Luis A. Rodriguez: Conceptualization, Investigation, Methodology, Writing – original draft, Writing – review & editing, Visualization, Supervision, Funding acquisition. **Anjali Gopalan:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Funding acquisition. **Jeanne A. Darbinian:** Software, Data curation, Writing – review & editing. **Malini Chandra:** Software, Formal analysis, Data curation, Writing – review & editing. **Louise C. Greenspan:** Conceptualization, Writing – review & editing. **Amanda Howell:** Conceptualization, Writing – review & editing. **Joan C. Lo:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Supervision, Funding acquisition.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

References

- American Academy of Pediatrics. Recommendations for Preventive Pediatric Health Care. March 2021. https://downloads.aap.org/AAP/PDF/periodicity_schedule.pdf. Accessed April 14, 2022.
- Bender, M.S., Nader, P.R., Kennedy, C., Gahagan, S., 2013. A Culturally Appropriate Intervention To Improve Health Behaviors in Hispanic Mother-Child Dyads. *Childhood Obesity*. 9 (2), 157–163. <https://doi.org/10.1089/chi.2012.0118>.
- Coker, T.R., Thomas, T., Chung, P.J., 2013. Does well-child care have a future in pediatrics? *Pediatrics* 131 (Suppl 2), S149–S159. <https://doi.org/10.1542/peds.2013-0252f>.
- Cote, A.T., Harris, K.C., Panagiotopoulos, C., Sandor, G.G.S., Devlin, A.M., 2013. Childhood Obesity and Cardiovascular Dysfunction. *J. Am. Coll. Cardiol.* 62 (15), 1309–1319. <https://doi.org/10.1016/j.jacc.2013.07.042>.
- Doymaz, S., Neuspel, D.R., 2009. The Influence of Pediatric Resident Counseling on Limiting Sugar-Sweetened Drinks in Children. *Clin Pediatr (Phila)*. 48 (7), 777–779. <https://doi.org/10.1177/0009922809332685>.

- Edmondson, E.K., Roberto, C.A., Gregory, E.F., Mitra, N., Virudachalam, S., 2021. Association of a Sweetened Beverage Tax With Soda Consumption in High School Students. *JAMA Pediatrics*. 175 (12), 1261–1268. <https://doi.org/10.1001/jamapediatrics.2021.3991>.
- Ford, M.C., Gordon, N.P., Howell, A., Green, C.E., Greenspan, L.C., Chandra, M., Mellor, R.G., Lo, J.C., 2016. Obesity Severity, Dietary Behaviors, and Lifestyle Risks Vary by Race/Ethnicity and Age in a Northern California Cohort of Children with Obesity. *J. Obesity*. 2016, 1–10.
- Haerens, L., Vereecken, C., Maes, L., Bourdeaudhuij, I.D., 2010. Relationship of physical activity and dietary habits with body mass index in the transition from childhood to adolescence: a 4-year longitudinal study. *Public Health Nutr.* 13 (10A), 1722–1728. <https://doi.org/10.1017/S1368980010002284>.
- Hanson, M.D., Chen, E., 2007. Socioeconomic Status and Health Behaviors in Adolescence: A Review of the Literature. *J. Behav. Med.* 30 (3), 263–285. <https://doi.org/10.1007/s10865-007-9098-3>.
- Kann, L., McManus, T., Harris, W.A., Shanklin, S.L., Flint, K.H., Queen, B., Lowry, R., Chyen, D., Whittle, L., Thornton, J., Lim, C., Bradford, D., Yamakawa, Y., Leon, M., Brener, N., Ethier, K.A., 2018. Youth Risk Behavior Surveillance — United States, 2017. *MMWR Surveill. Summ.* 67 (8), 1–114.
- Mayne, S.L., Virudachalam, S., Fiks, A.G., 2020. Clustering of unhealthy behaviors in a nationally representative sample of U.S. children and adolescents. *Prev. Med.* 130, 105892.
- Merlo, C.L., Jones, S.E., Michael, S.L., Chen, T.J., Sliwa, S.A., Lee, S.H., Brener, N.D., Lee, S.M., Park, S., 2020. Dietary and Physical Activity Behaviors Among High School Students — Youth Risk Behavior Survey, United States, 2019. *MMWR Suppl.* 69 (1), 64–76.
- Messer, L.C., Laraia, B.A., Kaufman, J.S., Eyster, J., Holzman, C., Culhane, J., Elo, I., Burke, J.G., O'Campo, P., 2006. The Development of a Standardized Neighborhood Deprivation Index. *J. Urban Health.* 83 (6), 1041–1062.
- Nyberg K, Ramirez A, Gallion K. *Physical Activity, Overweight and Obesity Among Latino Youth*. Princeton, NJ: The Robert Wood Johnson Foundation Research Network to Prevent Obesity Among Latino Children; 2011:1<https://salud-america.org/wp-content/uploads/2017/09/PhysicalActivityBrief.pdf>. Accessed September 29, 2021.
- Patrick, K., Norman, G.J., Calfas, K.J., Sallis, J.F., Zabinski, M.F., Rupp, J., Cella, J., 2004. Diet, Physical Activity, and Sedentary Behaviors as Risk Factors for Overweight in Adolescence. *Arch. Pediatr. Adolesc. Med.* 158 (4), 385.
- SAS Program (ages 0 to < 20 years) | Resources | Growth Chart Training | Nutrition | DNPAO | CDC. <https://www.cdc.gov/nccdphp/dnpao/growthcharts/resources/sas.htm>. Published February 26, 2019. Accessed September 28, 2021.
- Russo, R.G., Northridge, M.E., Wu, B., Yi, S.S., 2020. Characterizing Sugar-Sweetened Beverage Consumption for US Children and Adolescents by Race/Ethnicity. *J Racial Ethnic Health Disparities*. 7 (6), 1100–1116. <https://doi.org/10.1007/s40615-020-00733-7>.
- SanGiovanni, C., Fallar, R., Green, R., Mogilner, L., 2018. Parental Knowledge of AAP Juice Guidelines Is Associated With Parent and Children's Consumption of Juice and Sugar-Sweetened Beverages in an Underserved Population. *Clin. Pediatr (Phila)*. 57 (2), 205–211. <https://doi.org/10.1177/0009922817696466>.
- Sargent, G.M., Pilotto, L.S., Baur, L.A., 2011. Components of primary care interventions to treat childhood overweight and obesity: a systematic review of effect: Components of childhood primary care interventions. *Obes. Rev.* 12 (5), e219–e235. <https://doi.org/10.1111/j.1467-789X.2010.00777.x>.
- Sc, A., Defining, A.S., 2016. "Success" in Childhood Obesity Interventions in Primary Care. *Pediatrics* 138 (4). <https://doi.org/10.1542/peds.2016-2497>.
- Centers for Disease Control and Prevention. About Social Determinants of Health (SDOH). <https://www.cdc.gov/socialdeterminants/about.html>. Published March 10, 2021. Accessed July 14, 2022.
- Sim, L.A., Lebow, J., Wang, Z., Koball, A., Murad, M.H., October 2016. Brief Primary Care Obesity Interventions: A Meta-analysis. *Pediatrics*. <https://doi.org/10.1542/peds.2016-0149>.
- Skinner AC, Ravanbakht SN, Skelton JA, Perrin EM, Armstrong SC. Prevalence of Obesity and Severe Obesity in US Children, 1999–2016. *Pediatrics*. 2018;141(3). doi: 10.1542/peds.2017-3459.
- Stice, E., Palmrose, C.A., Burger, K.S., 2015. Elevated BMI and Male Sex Are Associated with Greater Underreporting of Caloric Intake as Assessed by Doubly Labeled Water. *J. Nutr.* 145 (10), 2412–2418. <https://doi.org/10.3945/jn.115.216366>.
- Tebb, K.P., Pica, G., Twietmeyer, L., Diaz, A., Brindis, C.D., 2018. Innovative Approaches to Address Social Determinants of Health Among Adolescents and Young Adults. *Health Equity*. 2 (1), 321–328.
- Vézina-Im, L.-A., Beaulieu, D., Bélanger-Gravel, A., Boucher, D., Sirois, C., Dugas, M., Provencher, V., 2017. Efficacy of school-based interventions aimed at decreasing sugar-sweetened beverage consumption among adolescents: a systematic review. *Public Health Nutr.* 20 (13), 2416–2431.