# Adolescent Health Lifestyles and Educational Risk: Findings From the Monitoring the Future Study, 2010−2016

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**Introduction:** Research has linked educational risk to various risky health behaviors (e.g., drug use, violence, risky sexual behaviors). This study builds upon this research by examining the link between additional health lifestyle indicators—nutritional risk factors, low sleep quantity, and low exercise frequency—and academic risk factors among a recent, nationally representative sample of adolescents.

**Methods:** Data from the 7 most recent cohorts (2010−2016) of the Monitoring the Future survey were analyzed in 2018 ($n$=45,757−46,206). A multistage random sampling technique was used to acquire the sample.

**Results:** All examined risky health lifestyle indicators were associated with significantly greater odds of school disengagement and lower academic expectations. Youth were especially likely to exhibit educational risks when they engaged in multiple risky health behaviors. Each additional risky health lifestyle indicator conferred significant increases in the odds of every examined educational risk factor, with the odds of school disengagement increasing by a factor of 7.48 when youth engaged in 4 or more risky health behaviors (relative to none).

**Conclusions:** Findings suggest that activities that promote adolescent health across multiple dimensions (i.e., nutrition, physical exercise, and sleep) may also promote academic engagement and expectations for future academic achievements.
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## INTRODUCTION

Research has revealed a connection between academic achievement, health, and well-being.[1−3] Bradley and colleagues[4] conducted an extensive review of the cross-sectional and longitudinal literature from 1985 to 2010 regarding the relationship between health risk behaviors and academic achievement among school-aged youth. Even so, their review focused on externalizing health behaviors such as violence, tobacco use, alcohol and other drug use, and sexual risk behaviors. Although some contemporary work has begun to focus on exercise, nutrition, and sleep as predictors of educational outcomes,[5−11] there are important ways in which this research might be expanded.

First, extant studies examining the link between health habits and school outcomes often overlook the cumulative influence of these health habits, and instead examine 1 or 2 health behaviors in isolation.[11,12] Second, a number of studies examining health habits like diet, exercise, and sleep utilize data from a single year[9] in a single state[8] or province of Canada,[11] somewhat hampering the generalizability of the findings across space and time. Rasberry et al.[9] also note that, until recently, research linking health

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behaviors and various academic outcomes only rarely has employed nationally representative samples and has tended to rely on outdated data. Third, research in this area commonly examines academic performance or achievement[8,9,12,13] and overlooks factors related to school disengagement, truancy, and low expectations for high school graduation and college attendance. The few studies examining disengagement and academic expectations, moreover, have typically employed samples outside of the U.S.[14−16] Examining these alternative indicators of academic risk (e.g., disengagement, absenteeism, and educational expectations) is important, as they have been found to predict high school dropout[17−19] and the expectation to attend college.[20] Understanding predictors of intentions to attend college is also of value, perhaps especially among groups who are least likely to attend, as research shows they are the most likely to benefit from college (financially and otherwise, i.e., negative selection).[21] Thus, any intervention that can alter educational trajectories for at-risk youth away from dropout and avoidance of postsecondary education would be economically and socially impactful.

This study employs a large, pooled, cross-sectional design to examine the role of health lifestyle risk factors (i.e., low sleep quantity, low exercise frequency, and nutritional risk factors) in academic disengagement and low academic expectations among youth across the U.S. The study is couched within a biobehavioral framework, which suggests that basic physiologic systems are compromised when there is insufficient energy intake, nutrients, rest, and stress release.[22−24] Ultimately, this study examines both independent and cumulative risky health habits, which is particularly worthwhile in light of the interconnectedness of these myriad health behaviors with cognitive systems of behavioral inhibition[25] and hippocampal-dependent memory.[26] If compromised, these systems can result in negative emotional states, withdrawal from learning activities, and impaired processing and storage of language necessary for learning.[27,28] Consistent with this viewpoint, the hypothesis of this study suggests that not only will there be associations between an unhealthy lifestyle and educational risk, but also that these will follow a severity-based gradient such that cumulative increases in poor diet quality, lack of exercise, and sleep deprivation will be associated with a heightened probability of educational risk.

## METHODS

### Study Sample

In the present study, data came from a sample of 8th and 10th grade youth who participated in Form 2 of the Monitoring the Future (MTF) survey[29] during any of the 7 most recent cohorts

(2010−2016, n=71,708). More information concerning the MTF data, sample restrictions, and missing data can be found in the Appendix, available online. The MTF data used in this study (2010−2016) are available to the public through open access, and therefore the current study did not require IRB approval.

### Measures

Nine items covering various dimensions of disengagement that have been employed in prior research, including poor attendance and truancy, failure to complete schoolwork, lack of interest in school and schoolwork, difficulty in carrying out schoolwork, and overall negative orientation toward school (e.g., does not enjoy school), were averaged into an index of school disengagement ($\alpha$=0.74).[18,30−32] More details on these items can be found in the Appendix, available online.

The following 2 items reflecting low expectations of youths' future academic attainment were also included in this study: "unsure of high school graduation" and "unlikely to attend college." Youth were asked the following questions: *How likely is it that you will do each of the following things? (1) Graduate from high school? and (2) Go to college?* Response options to each of these items included *(1) definitely won't, (2) probably won't, (3) probably will, and (4) definitely will.* As expected in this nationally representative sample, most of these 8th and 10th grade youth fully expected to graduate high school (89%). Therefore, students who expressed any doubt about whether they would graduate high school were categorized as at-risk in this dimension, and labeled "unsure of high school graduation." To be precise, this measure was created by assigning those who responded that they definitely will graduate from high school a value of 0, and all other participants who did not fully expect to graduate high school a value of 1 (i.e., *definitely won't, probably won't,* or *probably will;* 11% of the sample).

Next, a measure labeled "unlikely to attend college" was constructed. A large subset of youth (approximately 1 in 3) expressed some level of uncertainty about whether they would attend college, which is not surprising given that roughly half of the youth in the sample were in 8th grade. Nearly a quarter of the sample expressed that they probably will go to college but were not willing to say that they definitely will. However, fewer youth responded that they definitely or probably won't go to college (6%). In light of the distribution of responses on this variable, an at-risk measure labeled "unlikely to attend college" was constructed by assigning those who responded that they *definitely won't* or *probably won't* go to college a value of 1 (6%), and assigning those who responded that they *definitely will* or *probably will* go to college a value of 0.

A count measure ranging from 0 to 3 was created to assess the overall academic risk of youth in terms of both disengagement and low academic expectations. Scores on both indicators of academic expectations and the dichotomous indicator of relatively severe levels of disengagement were summed.

To measure the degree of nutritional risk, youth were asked: *How often do you… (1) eat breakfast?, (2) eat at least some green vegetables?,* and *(3) eat at least some fruit?* Response options included *(1) never, (2) seldom, (3) sometimes, (4) most days, (5) nearly every day,* and *(6) every day.* To identify youth who rarely, if ever, eat breakfast, green vegetables, and fruits, participants who responded that they *never* or *seldom* eat breakfast, green

vegetables, or fruits were assigned a value of 1 on each respective measure (22%, 15%, and 7%, respectively), whereas all other participants with valid data were assigned a value of 0 on those measures.

One item pertaining to the sleep habits of youth was also available on Form 2. On this form, youth were asked: *How often do you get at least 7 hours of sleep?* Response options included *(1) never, (2) seldom, (3) sometimes, (4) most days, (5) nearly every day,* and *(6) every day.* To identify youth who rarely, if ever, sleep ≥7 hours a night, participants who responded that they *never* or *seldom* get at least 7 hours or sleep were assigned a value of 1 (15%), whereas all other participants with valid data were assigned a value of 0 on this measure.

One item pertaining to the physical fitness activities of youth was also available on Form 2. On this form, youth were asked: *How often do you exercise vigorously (jogging, swimming, calisthenics, or any other active sports)?* Response options included *(1) never, (2) seldom, (3) sometimes, (4) most days, (5) nearly every day,* and *(6) every day.* To identify youth who rarely, if ever, engage in vigorous physical fitness activities, participants who responded that they *never* or *seldom* exercise in this manner were assigned a value of 1 (15%), whereas all other participants with valid data were assigned a value of 0 on those measures.

Finally, in an effort to assess the extent to which participants engaged in a number of risky health habits across dimensions (i.e., diet, sleep, and exercise habits), a count measure, ranging from 0 to 4, was created in which scores on each of the risky dietary, sleep, and exercise items were summed. This measure was truncated at 4 owing to the very small percentage of subjects with a score of 5 (i.e., only 1% of the sample exhibited all the risky health habits, whereas slightly more than 2% of the sample exhibited 4 of them, yielding about 3% of participants obtaining the highest score on the truncated count measure). More details concerning this measure and its rationale can be found in the Appendix, available online.

To the greatest extent possible, the possibilities of statistical confounding (i.e., spurious results) were taken into account by including controls for the following covariates: sex (male=1), race (African American or Hispanic [white/other reference category]), parental education (grade school [1] through graduate school [6]; maternal and paternal index, $\alpha$=0.73), parental involvement (e.g., parents check on homework, help with homework, require the child to perform household chores, or limit the amount of TV; $\alpha$=0.65), female-headed household, unstructured socializing (e.g., nights out per week, riding around in cars unsupervised, hanging out with friends unsupervised, or going to parties; $\alpha$=0.66), grade (8th grade [10th grade reference category]), urbanicity, screen-based sedentary activities (e.g., time spent watching TV or playing video games; $\alpha$=0.73), and year (i.e., controls for year or cohort specific fixed effects).

### Statistical Analysis

First, descriptive statistics were calculated and examined. Next, various regression-based multivariate models were conducted (e.g., logistic regression for binary outcomes and negative binomial regression for zero-inflated, over dispersed count outcomes) to examine the association between each of the 5 indicators of risky health lifestyles (3 nutritional items, 1 sleep item, and 1 fitness item) and the educational risk outcomes

(3 binary outcomes, 1 composite count outcome). Finally, the cumulative effects of the composite risky health lifestyle measure on the academic risk outcomes were calculated. A subset of ancillary results indicating the predicted probabilities of each of the 3 individual academic risk outcomes (i.e., school disengagement, unsure of high school graduation, and unlikely to attend college) by number of risky health lifestyle indicators were also plotted.

## RESULTS

As noted previously, 11% of the youth in the sample were unsure of whether they would graduate high school in the future, and slightly more than 6% expressed that they were unlikely to attend college. In terms of nutrition, 22% of participants rarely or never ate breakfast, 15% rarely or never ate green vegetables, and only 7% rarely or never ate fruit. Furthermore, 15% of subjects rarely or never slept at least 7 hours a night and another 15% rarely or never engaged in vigorous physical exercise. Finally, 3% exhibited 4 or more risky health habits across dimensions and 7% exhibited 3 or more, suggesting a small subset of participants in which these risky health behaviors tend to cluster.

The results of the multivariate models are displayed in Tables 1 and 2. Each of the risky health habits was associated with significant increases in the odds of school disengagement, being unsure of high school graduation, and being unlikely to attend college. The increased odds of these academic risk factors ranged from 85% to 197% among participants engaging in specific high-risk health behaviors. Low fruit consumption was consistently the strongest diet-related predictor of each of the academic risk factors, and had a significantly larger effect on the academic risk factors than breakfast skipping. Sleep quantity and physical fitness were also significantly associated with the academic risk outcomes, with neither yielding consistently stronger effects than the other.

The findings displayed in Table 2, which includes a composite count measure of all risky health habits across diet, sleep, and fitness, suggest a dose−response relationship between risky health lifestyles and each of the academic risk factors. Health lifestyle indicators appeared to be associated both independently and cumulatively with the measures of academic risk. To illustrate, although engaging in only 1 of the risky health habits was associated with a 90% increase in the odds of school disengagement, engaging in 4 or more of the risky health habits was associated with a 648% increase in the odds of school disengagement, an increase by a factor of 7.48. A similar pattern of findings existed in the case of unsure of high school graduation (1 high-risk health behavior: OR=1.49, 95% CI=1.37, 1.63; 4 or more high-risk health behaviors: OR=5.01, 95% CI=4.30, 5.83) and unlikely to attend

**Table 1.** The Association Between Unhealthy Diet, Sleep, and Fitness Habits and Academic Risk Factors, 2010–2016 (Form 2 Sample)[a]

| Risky health lifestyle indicators | Academic risk factors | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Model 1: school disengagement | | Model 2: unsure of high school graduation | | Model 3: unlikely to attend college | | Model 4: cumulative academic risk | |
| | n | OR (95% CI) | n | OR (95% CI) | n | OR (95% CI) | n | IRR (95% CI) |
| Breakfast skipping | 45,145 | **2.32 (2.21, 2.45)** | 45,037 | **1.85 (1.72, 2.00)** | 44,742 | **1.99 (1.82, 2.17)** | 44,720 | **1.79 (1.73, 1.86)** |
| Low vegetable consumption | 44,927 | **2.28 (2.15, 2.42)** | 44,820 | **1.98 (1.82, 2.14)** | 44,527 | **2.24 (2.03, 2.46)** | 44,506 | **1.81 (1.74, 1.88)** |
| Low fruit consumption | 44,373 | **2.71 (2.49, 2.95)** | 44,269 | **2.35 (2.11, 2.63)** | 43,990 | **2.97 (2.63, 3.35)** | 43,970 | **2.03 (1.92, 2.13)** |
| Low sleep quantity | 44,808 | **2.79 (2.63, 2.96)** | 44,705 | **2.15 (1.98, 2.34)** | 44,415 | **2.23 (2.02, 2.46)** | 44,396 | **1.99 (1.91, 2.06)** |
| Low physical fitness frequency | 44,841 | **2.49 (2.34, 2.65)** | 44,737 | **2.24 (2.06, 2.44)** | 44,452 | **2.69 (2.43, 2.97)** | 44,432 | **1.97 (1.89, 2.05)** |

*Note:* Boldface indicates statistical significance ($p<0.05$).
[a]Controls included in all models for sex, race (African American, Hispanic [white/other reference category]), parental education, parental involvement, female-headed household, unstructured socializing, grade (8th grade [10th grade reference category]), urbanicity, screen-based sedentary activities, and year (i.e., controls for year/cohort specific fixed effects).
IRR, incidence rate ratio.

**Table 2.** The Link Between the Number of Risky Health Lifestyle Indicators and Academic Risk Factors, 2010–2016 (Form 2 Sample)[a]

| Risky health lifestyle indicators | Academic risk factors | | | |
|---|---|---|---|---|
| | Model 1: school disengagement, OR (95% CI) | Model 2: unsure of high school graduation, OR (95% CI) | Model 3: unlikely to attend college, OR (95% CI) | Model 4: cumulative academic risk, IRR (95% CI) |
| 1 | **1.90 (1.80, 2.02)** | **1.49 (1.37, 1.63)** | **1.65 (1.48, 1.84)** | **1.59 (1.53, 1.65)** |
| 2 | **3.19 (2.97, 3.42)** | **2.35 (2.12, 2.60)** | **2.53 (2.23, 2.86)** | **2.26 (2.16, 2.37)** |
| 3 | **4.96 (4.47, 5.50)** | **3.11 (2.70, 3.57)** | **4.18 (3.56, 4.90)** | **2.95 (2.77, 3.14)** |
| 4 or more | **7.48 (6.57, 8.51)** | **5.01 (4.30, 5.83)** | **6.20 (5.21, 7.37)** | **3.70 (3.46, 3.96)** |
| n | 43,783 | 43,684 | 43,415 | 43,397 |

*Note:* Boldface indicates statistical significance ($p<0.05$).
[a]Controls included in all models for sex, race (African American, Hispanic [white/other reference category]), parental education, parental involvement, female-headed household, unstructured socializing, grade (8th grade [10th grade reference category]), urbanicity, screen-based sedentary activities, and year (i.e., controls for year/cohort specific fixed effects).
IRR, incidence rate ratio.

attend college (1 high-risk health behavior: OR=1.65, 95% CI=1.48, 1.84; 4 or more high-risk health behaviors: OR=6.20, 95% CI=5.21, 7.37). Furthermore, the results of negative binomial regression models indicated that the rate of cumulative academic risk increased by 59% in the presence of 1 risky health habit, 126% in the presence of 2 risky health habits, 195% in the presence of 3 risky health habits, and 270% in the presence of 4 or more risky health habits, reflecting once again a dose−response relationship.

This dose−response relationship, in the case of each academic risk outcome, is displayed in Figures 1 and 2. In these figures, the predicted probabilities of school disengagement and low academic expectations are plotted by the number of risky health lifestyle indicators, with covariates set to their means. Importantly, using marginal standardization instead of predicted probabilities with covariates set to their means did not meaningfully alter the findings.[33] In each case, the predicted probability of academic risk increased as risky health habits also increased from none to 4 or more. Specifically, the predicted probability of school disengagement increased from 0.14 among participants exhibiting no risky health behaviors to 0.55 among subjects exhibiting 4 or more risky health behaviors. When examining academic expectations, the predicted probability of being unsure of high school graduation increased from <0.05 among participants exhibiting no risky health behaviors to >0.20 among subjects exhibiting 4 or more risky health behaviors, whereas the predicted

probability of being unlikely to attend college increased from >0.02 among participants exhibiting no risky health behaviors to >0.13 among subjects exhibiting 4 or more risky health behaviors. A number of ancillary analyses were also conducted, the results of which are included in the Appendix, available online.

## DISCUSSION

This study is one of the first to examine the role of this set of health behaviors in multiple educational risk factors among a nationally representative sample of U.S. youth. The results reveal that, both individually and collectively, a risky health lifestyle in the areas of poor nutrition, lack of sleep, and insufficient physical exercise is predictive of significantly higher odds of various educational risks, including school disengagement and low academic expectations. Youth were especially likely to exhibit educational risks when they engaged in multiple risky health behaviors, and each additional unhealthy behavior consistently conferred significant increases in the odds of every examined educational risk factor.

### Limitations

The study is not without its limitations. First, the possibility of the bidirectionality or reverse causation of the findings cannot be ruled out.[34] Second, the sample is limited to adolescents, suggesting that the results may not be applicable to school engagement and academic
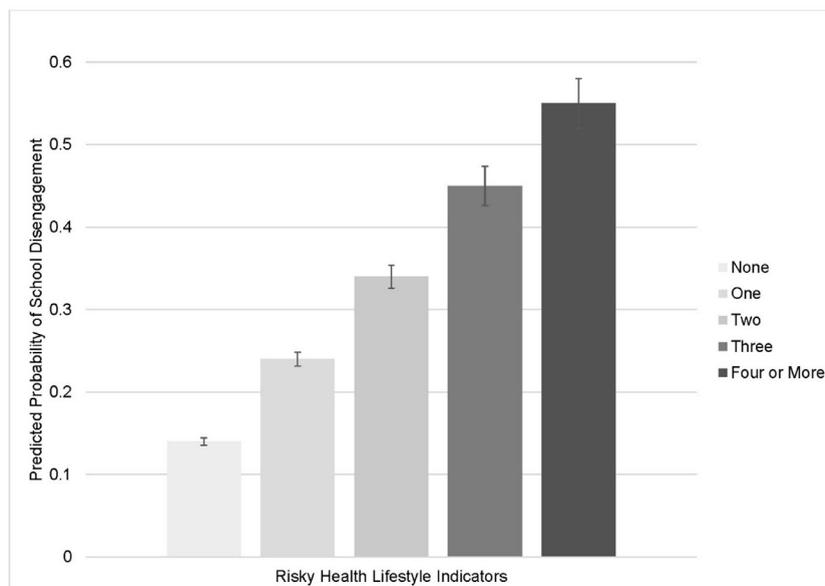


**Figure 1.** The predicted probability of school disengagement by number of risky health lifestyle indicators (covariates set at their means).
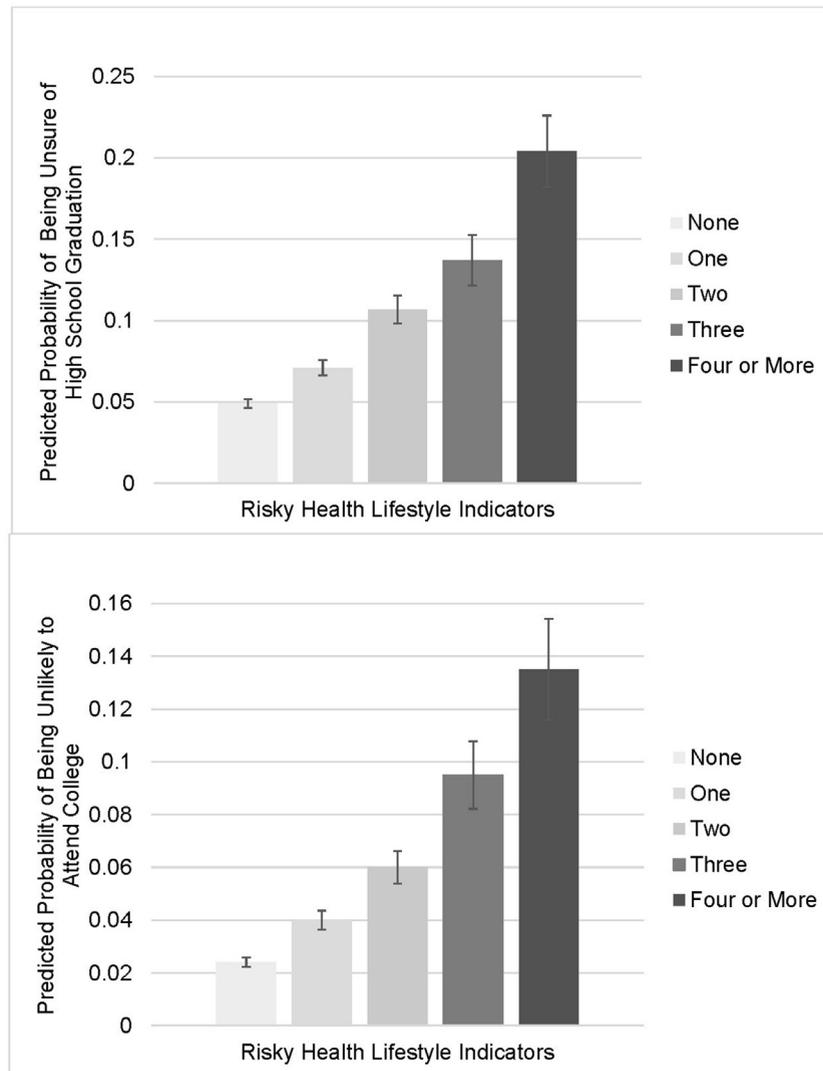
**Figure 2.** The predicted probability of low academic expectations by number of risky health lifestyle indicators (covariates set at their means).

functioning more generally among younger children (e.g., elementary school children). Third, cases were not missing completely at random in terms of race/ethnicity, which might limit the generalizability of the findings to black and Latino youth. Even so, missing cases were similar on other key demographics, like sex and parent education. Fourth, the dietary items used (e.g., breakfast skipping and low fruit and vegetable consumption) are somewhat limited, but may serve as proxies for other dietary practices. Additional dietary details would have been preferable, but such information was not available in the data. Finally, the data were based on youth reports only. Future research should consider employing multi-informant data (e.g., parents, teachers, and youth).

## CONCLUSIONS

The results reaffirm the notion that "healthier students are better learners",[35] and that promoting healthy lifestyles among at-risk youth might be an important component of interventions seeking to reduce dropout and possibly to enhance postsecondary education attendance. The main implications of these findings for health and school policy and programming are to ensure that youth and their families are sufficiently educated on the interconnectedness of health behaviors and long-term scholastic well-being, and that at-risk youth and their families are provided with an adequate supply of health resources, both at home and in the school setting, that permit beneficial shifts in health behaviors—ideally across multiple dimensions (e.g., sleep, nutrition, and

physical exercise). In terms of fostering health education among youth, Stratford[36] contends that school engagement should entail educating the whole child. He found that students were more likely to be academically engaged in schools where policies and programs emphasized health and healthy behaviors such as universal and free breakfast and lunch programs (in addition to the core academic curriculum),[37,38] suggesting that schools may want to promote health as a means of preventing school disengagement and future dropout. There is a wide array of possible school-based interventions that can enhance academic outcomes by adhering to the whole child perspective, including teen pregnancy prevention services[39] and referrals for youth with mental health conditions.[40] The findings speak to the potential benefits of such initiatives as these may be especially important for children living in food deserts or food-insecure homes and in neighborhood contexts (e.g., violent neighborhoods) that can negatively impact health lifestyles (e.g., sleep and diet).[41,42] Addressing these broader contextual social problems is likely also to have diffuse benefits for the health lifestyles of youth.

## ACKNOWLEDGMENTS

## SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at https://doi.org/10.1016/j.amepre.2019.05.008.

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