Excellent self-rated health and health behaviors in the United States adolescent population

by

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Abstract

Background: Adolescence represents a uniquely critical period for establishing health behaviors. As behaviors established in youth tend to track into adulthood, there is opportunity to encourage establishment of positive lifestyle behaviors. However, more research is needed evaluating relationships between lifestyle behaviors and positive health outcomes like well-being, especially in youth populations. Thus, the aim of this study was to examine health behaviors in the United States adolescent population and their association with excellent self-rated health.

Methods: The FLASHE study, a cross-sectional survey of parent-adolescent dyads conducted by the National Cancer Institute, provided publicly available data used to examine multiple lifestyle behaviors. Participants in this analysis were adolescents (n=1350, mean age = 14.5) with complete data for exposures (beneficial and detrimental food intake, importance of family meals, typical free time physical activity and sedentary time, trouble sleeping, and meeting sleep guidelines), excellent well-being, and potential confounders. Logistic regression analyses were used to evaluate relationships between individual lifestyle behaviors and excellent well-being.

Results: In this sample 47% of males and nearly 35% of females reported excellent self-rated health. After complete statistical adjustment, the following lifestyle variables were statistically significantly associated with excellent self-rated health: beneficial food intake, family meal importance, physical activity levels, and sleep quality.

Conclusions: Adolescents engaging in healthy lifestyle behaviors were more likely to report excellent self-rated health. These findings support interventions targeting improvements in lifestyle behaviors.

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Chapter 1 - Literature Review

Health status in the United States (U.S.) is overwhelmingly and alarmingly poor. The chronic disease burden remains high, and disproportionately affects marginalized populations (White et al., 2013). In particular, obesity is an ongoing public health problem (Centers for Disease Control and Prevention, 2020; Ogden et al., 2014; World Health Organization, 2021b). As of 2017–2018 National Health and Nutritional Examination Survey (NHANES) data, 42.4% of adults in the U.S. were classified as obese (Warren et al., 2020). Combined, overweight and obesity account for approximately 75% of the adult population (Fryar et al., 2020). Obesity is associated with multiple chronic diseases, including heart disease and cancer. Notably, these two diseases far outpace other mortality causes in the U.S., accounting for a total of 43% of annual deaths in the U.S., more than the other top ten leading causes of death combined (*Data Brief 395: Mortality in the United States, 2019*, 2019). Cancer is the second leading cause of mortality in the United States (NCHS, 2018); lifetime risk of a cancer diagnosis as a U.S. adult is nearly 40% (Howlander et al., 2020). Further, cancer is the second leading cause of death globally, with 9.8 million deaths attributed to cancer worldwide (Ferlay et al., 2019).

Costs of obesity and associated chronic diseases range from individual health outcomes to poor population health more broadly, as well as financial and economic costs. Individually, estimates suggest that obese individuals sustain health care costs 42% higher than healthy-weight peers (Warren et al., 2018). The estimated annual cost of obesity in the U.S. is 149 billion dollars in medical expenses, and $66 billion in lowered productivity. Costs to mental health and reduced quality of life should be noted as well. Higher rates of depression in both adults and children are a risk of obesity, as are weight bias and stigma, which can worsen such conditions (Warren et al.,

2020). Further, unhealthy weight status is an established risk factor for cancer development (Schillinger et al., 2017).

Beyond health behaviors, the well-established role of other determinants of health should be noted, including: race/ethnicity, socioeconomic status, sex/gender, and age, for example (Braveman & Gottlieb, 2014; Chetty et al., 2016; Williams & Jackson, 2005; World Health Organization, 2017). These disparities hold in youth and young adult populations as well, with disparities in race/ethnicity and socioeconomic status well-documented in these younger populations (Schillinger et al., 2017). Income inequality across variables is associated with increased mortality from preventable diseases (White et al., 2013). People of color are also subject to disproportionate negative health outcomes (Williams & Jackson, 2005), and both people of color and those of lower income status tend to be disproportionately affected by many cancers specifically (White et al., 2013). Aspirational health outcomes, such as excellent self-rated health, display similar socioeconomic disparities as well, with self-rated health and longevity differing by levels of both education and income, as well as race (Bombak & Bruce, 2012; Dowd & Zajacova, 2007). Disparities in finances predictably lead to inequality regarding access to quality medical care, less access to healthy environments, and consequently, poorer health outcomes (Holman et al., 2013).

These influences can be tracked onto youth as well (Reiss, 2013). It follows that children from lower socioeconomic backgrounds have a similar lack of access to quality care and environments, and poorer health outcomes than their peers from higher income families. Further, children living in poverty have displayed a higher incidence of behavioral challenges, and are two to three times more likely to develop mental health problems (Reiss, 2013). Given that health behaviors do not occur in isolation, but rather as components of a more complex and

interrelated reality, these determinants are influential impacts to consider in well-being (Oftedal, Vandelanotte, et al., 2019; Shoemaker et al., 2015). Indeed, *Healthy People 2030* includes social determinants of health as one of four goals for the decade, aiming for health promoting environments, both social and physical (Centers for Disease Control and Prevention, 2021). Thus improvement of health will necessarily address and incorporate these disparities (Artiga & Hinton, 2018).

Cancer Prevention

Multiple lifestyle behaviors are associated with weight status and overall health, as well as subsequent chronic disease diagnoses. Despite the continued high rates of cancer across the country and world, it is encouraging that altering health behaviors can work to prevent a cancer diagnosis in 30–40% of the population (Brown et al., 2018). Nutritional composition of the diet is well-recognized as an important lifestyle factor in cancer prevention, along with physical activity and overall weight status (Kushi et al., 2012; Makarem et al., 2015; Wiseman, 2019). There is strong evidence to indicate that relatively higher physical activity rates in adults are associated with decreased risk for a number of cancers, including: bladder, breast, colon, endometrial, esophageal, gastric, and renal cancer (2018 Physical Activity Guidelines Advisory Committee, 2018). For prevention, The World Cancer Research Fund and American Institute of Cancer Research have detailed several lifestyle behaviors to prevent the development of cancer, including: maintaining a healthy weight, increasing consumption of fruits, vegetables, and whole grains in the diet, limiting processed foods, red meats, fast foods, and sugar-sweetened beverages in the diet, as well as increasing physical activity and reducing sedentary time (World Cancer Research Fund/American Institute for Cancer Research, 2018).

Despite the preponderance of evidence to indicate positive outcomes associated with these heath behaviors, a majority of adults fail to meet most recommended health behavior guidelines (U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2015). Dietary patterns of the average adult indicate that nearly 75% of the population has a diet low in consumption of beneficial foods such as fruits and vegetables. A majority also exceed recommendations of detrimental food consumption, such as added sugar, saturated fat, and sodium (U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2015). Indeed, nine out of ten adults in the United States do not meet the recommended guidelines for fruit and vegetable consumption (Lee-Kwan et al., 2017). Dietary fiber levels are similarly low and are identified as a nutrient of public health concern because of the minimal percentages of individuals meeting recommended daily amounts (U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2015).

Physical activity rates also fall short. Only 24% of adults meet guidelines for recommended levels of aerobic and muscle strengthening activity (U.S. Department of Health and Human Services, 2018). Adults more not meeting physical activity guidelines are more likely to report poor self-rated health (Bennie et al., 2019). Sedentary time, also associated with increased mortality risk (Diaz et al., 2017), is another behavior of concern. Adults are estimated to spend 9–10 hours per day sitting (Duncan et al., 2016), and while there is not a specific recommendation for daily sitting time, evidence indicates that increased sedentary behavior is associated with increased health risks (Bauman et al., 2011). Furthermore, per the Behavioral Risk Factor Surveillance System, approximately one-third of adults do not meet recommended nightly sleep duration guidelines (U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2015). Poor sleep quantity and quality, like diet and physical activity,

is also a lifestyle factor associated with detrimental health outcomes (Centers for Disease Control and Prevention, 2020a; Kabat et al., 2018). A lack of sleep is associated with increased morbidity from a number of chronic conditions, including cancer (Chattu et al., 2018).

Beyond Disease Prevention

Accepting health as merely the lack of presenting pathology is not enough, as well-being may not necessarily follow (Seligman, 2008; Westerhof & Keyes, 2010). Given that the World Health Organization defines health as beyond the mere absence of disease, it follows that well-being and aspirational health outcomes are important targets for research and policy. Additionally, gain-framed health messages have been demonstrated to be more effective in promoting health behaviors than loss-framed messages. (Gallagher & Updegraff, 2012). This messaging showed a particularly persuasive effect in behavior measures of smoking, skin cancer prevention, and physical activity, in addition to modifying attitudes and intentions. Thus, investing in aspirational outcomes such as excellent well-being are warranted. This need is exemplified by the World Health Organization's "Health2020" inclusion of subjective well-being as a measure of overall health (Vik & Carlquist, 2018; World Health Organization, 2021a; World Health Organization & Regional Office for Europe, 2013). This positive conceptualization of health, (that is, well-being beyond the absence of physical and mental illness) can be an important measure of overall health, and is increasingly a topic of research. There is evidence that excellent self-rated health is associated with positive health outcomes and reduced mortality (Keyes, 2007; Prendergast et al., 2016; Pressman & Cohen, 2005). Likewise, some research suggests that implementation of positive health behaviors is associated with improved self-rated health (Prendergast et al., 2016; Seligman, 2008). Nevertheless, there is still a lack of research focusing on well-being or aspirational health markers as an outcome (Huppert

& So, 2013). Though subjective well-being is increasingly recognized as a research and policy priority, data are limited, particularly in youth populations (Guo et al., 2018; Mansfield et al., 2018). Therefore, this presents an opportunity for new emphases of messaging and health promotion research (Huppert & So, 2013).

In young adult populations, research has demonstrated that a number of lifestyle behaviors, including physical activity and beneficial dietary habits, are positively associated with life satisfaction (Grant et al., 2009). Similarly, self-reported health outcomes tend to be poorer in populations with higher numbers of negative lifestyle behaviors (Chan et al., 2015; Molarius & Janson, 2002; Song et al., 2018). However, much of the evidence to date regarding aspirational health comes from analyses in adults. There is a lack of evidence pertaining to youth populations specifically. As behaviors established in childhood tend to track into adulthood (Kelder et al., 1994; te Velde et al., 2007; Telama et al., 2005), the importance of upstream interventions in youth populations to address this public health issue is clear. Furthermore, many studies to date address one or two lifestyle behaviors, but do not display a comprehensive overview of lifestyle behaviors, especially in youth populations (Song et al., 2018). As health behaviors tend to co-occur (Oftedal, Kolt, et al., 2019; Prendergast et al., 2016), establishing an understanding of current youth behavior is important for moving forward in development of effective prevention programming (Holman et al., 2013; White et al., 2013) toward chronic disease prevention. Therefore, evaluation of the novel FLASHE data to this end presents an opportunity to address this current gap in the literature.

Chapter 2 - Health Behaviors in the United States Adolescent Population and Associations with Excellent Self-Rated Health

Keywords: excellent self-rated health, aspirational health outcomes, health behavior, health promotion, wellbeing, cancer prevention

Introduction:

Adolescence represents a unique time in the human life span, of both great potential as well as great vulnerability for establishing health behaviors (Biro & Deardorff, 2013; Santelli et al., 2013). Habits, both beneficial and detrimental, are often established during adolescence, including tobacco use and ultra-violet radiation exposure for example, making this time period particularly disposed to preventative intervention (Schillinger et al., 2017). However, overall health status of children and adolescents has deteriorated over time. Childhood obesity has increased 85% from 1988–2016 reports, such that in 2015, 18.5% of children in United States were classified as obese (Warren et al., 2018). In total, approximately one-third of U.S. children are either overweight or obese. Though rates of obesity increases have slowed in more recent years, the high number of obese children is nevertheless concerning, as obesity in childhood tends to track into adulthood (Guo et al., 2018). Additionally, while health status trends in youth (defined here 5-17 years of age) populations have remained stable over time, there has not been marked improvement (National Center for Health Statistics, 2018). In 2000, 82.8% of youth under the age of 18 reported excellent or very good health status. By 2018 this number was only slightly higher, at 85.6%. Children reporting fair or poor health status showed even less of a change, with this percentage remaining essentially the same, at 1.8 and 1.7%, in 2000 and 2018, respectively.

Mirroring trends of U.S. adults, a majority of children in the U.S. also fail to meet numerous health behavior recommended guidelines. Currently more than 80% of the youth population in the U.S. does not meet recommended physical activity levels for aerobic and muscle strengthening activity (U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion, n.d.). Sleep quality and quantity also fall short. School-aged children need 9–11 hours of sleep, and teenagers need 8–10 hours of sleep each night (Hirshkowitz et al., 2015). However, 68.8% of youth report a short sleep duration (<8 hours/night) (Centers for Disease Control and Prevention, 2019). Further, poor sleep quality in adolescents is associated with weight gain and depression (Chattu et al., 2018). Dietary goals fall similarly short as well, with most children not meeting recommended fruit and vegetable consumption. NHANES data from 2003-2010 displayed no youth population meeting Healthy People 2020 vegetable guidelines, and only children 2–5 meeting fruit consumption targets (Kim et al., 2014). Consequently, these data suggest that most children today are missing the protective effects of fruit and vegetable consumption on cancer risk later in life (Maynard et al., 2003).

Behavioral habits established in childhood tend to track into adulthood (Kelder et al., 1994; te Velde et al., 2007; Telama et al., 2005). Encouragingly though, nearly 40% of cancers are associated with these preventable lifestyle factors (Brown et al., 2018). In this way, there is room to reduce cancer diagnoses in future with effective early lifestyle intervention. Positive well-being in youth is associated with improved physical health in adulthood and aspirational health outcomes of this nature are a warranted direction of research (Kern et al., 2015). Results indicate excellent self-rated health is associated with positive health outcomes, improved self-rated health, and reduced mortality (Keyes, 2007; Prendergast et al., 2016; Pressman & Cohen, 2005; Seligman, 2008). Health as merely the absence of disease is not enough, as well-being does not

necessarily follow (Seligman, 2008; Westerhof & Keyes, 2010). Nevertheless, there is still a lack of research focusing on a positive conception of health as an outcome (Huppert & So, 2013). Though subjective well-being is increasingly recognized as a research and policy priority, data is limited, particularly in youth populations (Guo et al., 2018; Mansfield et al., 2018). Hence, intervening to establish positive health behaviors early in life is of critical importance in public health efforts to reduce future chronic disease. Following the behavioral epidemiology framework (Sallis et al., 2000), which outlines a stepwise approach to systematize behavioral science approaches in efforts to ameliorate common chronic disease, given the established links between these health behaviors and well-being, understanding the influence of these factors on positive health outcomes are warranted. Sallis et al. (2000) detail explicitly the need to document demographic information and influences on behavior. Therefore, the purpose of the current study was to examine health behaviors in a U.S. youth population, and their association with excellent self-rated health. It was hypothesized that adolescents engaging in more positive health behaviors, including consumption of beneficial foods, physical activity, and quality sleep, would be more likely to report excellent health.

Methods:

The FLASHE Study

The Family, Life, Activity, Sun, Health, and Eating (FLASHE) study is a cross-sectional study examining behavioral measures, including: diet, physical activity and sedentary time, sun safety, sleep, and tobacco use in parent-adolescent dyads (Westat, 2015). The study took place from April to October 2014 and was conducted by the National Cancer Institute. FLASHE was an internet-based study, using a sample recruited from the Ipsos Consumer Opinion Panel. Balanced sampling was used to ensure the FLASHE sample closely matched the current U.S.

population according to gender, census division, household size and income, and race/ethnicity. Participants were eligible for inclusion if they were at least 18 years old, lived with an adolescent aged 12–17y for at least 50% of their time, and agreed to be contacted by the FLASHE team. A total of 5,088 parent-adolescent dyads met inclusion criteria, 5,027 were invited to participate, and 1,272 dyads enrolled in a survey only group, with 693 in a survey and motion group, for a cumulative 38.7% enrollment rate. All participanting dyads completed the same four surveys (2 parental, 2 adolescent), with the motion group adding an accelerometer worn by the adolescent for one week. Total completion rates were 76%, for a dyad response rate of 29.4.%

Lifestyle Behavior Measures

Adolescents completed a 49-question survey addressing dietary habits in the FLASHE study. For this analysis three variables, total daily detrimental food intake, total daily beneficial food intake, and family meals were utilized. A 27-question dietary screener was used to calculate these totals. Frequency was reported from zero to three times per day, and then converted to a daily frequency value. The detrimental food variable included pizza, heat and serve foods, tacos, fried chicken, burgers, processed meat, fried potatoes, candy/chocolate, cookies/cake, potato chips, frozen desserts, sugary cereals, sweetened fruit drinks, soda and energy drinks, and sports drinks. All beneficial foods included 100% fruit juice, water, fruit, green salads, other non-fried vegetables, cooked beans, whole grain bread, cooked whole grains, non-sugary cereal, and other potatoes. Relative healthfulness of foods was assigned from a literature review targeting obesity and cancer-related outcomes. Finally, also included here in analysis is the importance of family meals (at least one family meal per day) as detailed by the adolescents on a five-point Likert scale.

Physical activity was measured using variables for adolescent physical activity derived from the Youth Activity Profile (Welk et al., 2021). Adolescents completed a 78-item survey. Two variables reflecting activity were included here, both typical weekly physical activity in free time and typical weekly sedentary behavior. Adolescents reported physical activity in school, out of school, and on weekends, and these domains were combined to create a total physical activity measure. Sedentary behavior was represented as accumulated outside of school. Sleep was also represented in the physical activity survey. Teens responded to five questions targeting sleep behavior, addressing both weekdays and weekends. In this analysis presence of a regular bedtime (yes/no) and trouble staying asleep (yes/no) were utilized. Finally, tobacco use was also determined using five questions. Responses to smoking at least 100 cigarettes across adolescents' entire life were utilized here.

Other Variables

Health status was assessed as part of the teen demographic survey. Adolescents were to classify their health as either excellent, very good, good, fair, or poor. Demographic measures included race and ethnicity. Additionally, variables for determining economic status included adolescent response to crime as a barrier to PA in their neighborhood when walking at night, and school distinction (attendance at private or public school, homeschooling, other, etc.).

Statistical Analysis

Data from the FLASHE study were analyzed using IBM SPSS Statistics V25 (IBM, Armonk, NY, USA). Logistic regression analysis (alpha=0.05) was used to access the relationship between these exposures and self-rated health generating odds rations and 95% confidence intervals. Univariate, unadjusted relationships between each behavior and health were evaluated. The first model included all three nutrition-related variables, controlling for weight

status. The second model adjusted for nutrition, weight status, and other lifestyle factors, with a final model including additional adjustment for demographic variables. The analyses included all participants (n = 1350) who had complete data for all variables of interest. Crude odds ratios and adjusted odds ratios were calculated and used to examine associations between exposure to the listed health behaviors and the outcome variable of excellent self-rated health.

Results:

Table I presents demographic detail of the study population by sex. In this sample 47% of males and nearly 35% of females reported excellent health. In addition, 48.4% and 58.5% of males and females, respectively, reported a health status of good or very good. A remaining 4.2% of males and 6.4% of females described their health status as fair or poor (Table 1). Unadjusted, partially adjusted, and fully adjusted associations between health and lifestyle variables and excellent self-reported health are reported in Table 2. After full adjustment, statistically significant associations were displayed between a number of lifestyle variables and excellent self-rated health (Figure 1), including beneficial food intake, family meal importance, physical activity levels, sleep quality, as well as weight status, age, and sex of the adolescents. Results from this analysis support the initial hypothesis that youth participating in more positive health behaviors would be more likely to report excellent self-reported health.

Table 1 Demographic Characteristics According to Sex

Variable	Male (Mean +/- SD)	Female (Mean +/- SD)
Age (yrs)	14.5 (1.61)	14.4 (1.57)
Height (cm)	169.6 (11.40)	161.5 (8.68)
Weight (kg)	64.5 (17.40)	57.9 (14.80)
BMI Percentile (%)	61.8 (30.35)	60.2 (28.84)
Detrimental food intake (daily frequency)	5.1 (2.80)	4.6 (2.81)
Beneficial food intake (daily frequency)	5.5 (2.96)	5.7 (3.24)
Family meals important	4.1 (1.08)	4.1 (1.13)
Typical SB in free time	2.9 (0.95)	3.1 (1.00)

Typical PA in free time	3.1 (1.16)	2.8 (1.14)
Sleep (hours)	8.68 (1.40)	8.82 (1.28)

	Male %(n)	**Female %(n)**
Not white	37.1 (232)	34.5 (215)
NH white	62.9 (394)	65.5 (409)
Crime barrier to PA		
Agree	22.2 (139)	24.7 (154)
Not agree	77.8 (487)	75.3 (470)
Smoked 100 cigarettes	1.4 (9)	2.1 (13)
Have regular bedtime	62.6 (392)	59 (368)
No regular bedtime	37.4 (234)	41 (256)
Have trouble sleeping	10.4 (65)	16.8 (105)
No trouble sleeping	89.6 (561)	83.2 (519)
In private school	7.3 (46)	6.6 (41)
Not in private school	92.7 (580)	93.4 (583)
Weight Status		
Obese	13.9 (87)	11.9 (74)
Overweight	14.9 (93)	14.1 (88)
Healthy weight	71.2 (446)	74 (462)
Meeting sleep guidelines	74.1 (464)	73.6 (459)
Not meeting sleep guidelines	25.9 (162)	26.4 (165)
Family meals important		
Strongly agree	44.6 (279)	49.8 (311)
Agree	31.5 (197)	26.3 (164)
Not Agree	24 (150)	23.9 (149)
Health Status		
Excellent	47.1 (295)	34.8 (217)
Very good	35.8 (224)	42.8 (267)
Good	12.6 (79)	15.7 (98)
Fair	3.7 (23)	6.1 (38)
Poor	0.5 (3)	0.3 (2)

Table 2 Associations between Lifestyle Variables and Excellent Self-Rated Health

	Unadjusted OR (95% CI)	**Partially Adjusted OR (95% CI)[a]**	**Fully Adjusted OR (95% CI)[b]**
Variable			
Detrimental food intake (daily)	0.998 (0.958–1.039)	1.007 (0.963–1.054)	0.998 (0.952–1.046)
Beneficial food intake (daily)	1.117 (1.076–1.160)	1.054 (1.010–1.099)	1.065 (1.020–1.112)
Family meals important			
REFERENCE GROUP: not agree	1	1	1*

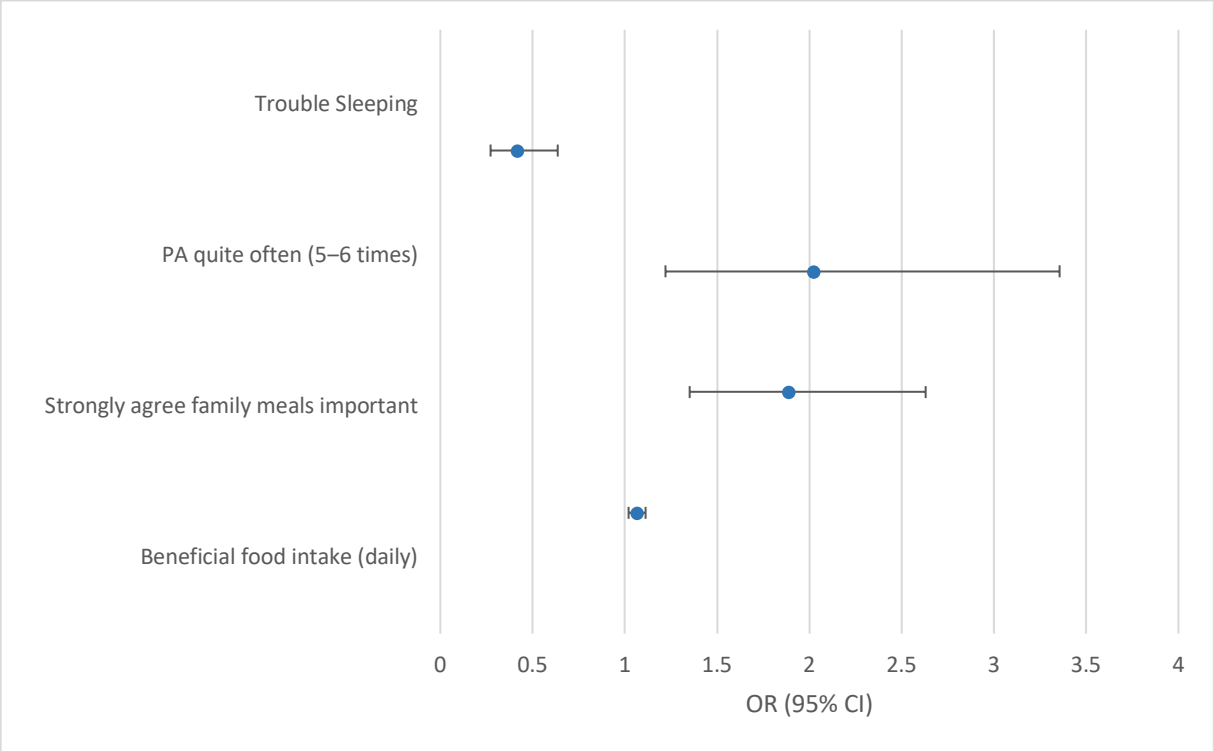
Somewhat agree	1.405 (1.011–1.952)	1.092 (0.767–1.555)	1.052 (0.735–1.504)
Strongly agree	2.404 (1.786–3.236)	1.866 (1.343–2.591)	1.885 (1.351–2.630)
Weight Status			
REFERENCE GROUP: not overweight or obese	1	1	1
Overweight	0.538 (0.384–0.755)	0.585 (0.408–0.839)	0.552 (0.382–0.797)
Obese	0.261 (0.172–0.397)	0.310 (0.200–0.480)	0.291 (0.186–0.454)
Typical weekly SB in free time			
REFERENCE GROUP: almost none	1	1	1
Lot of time	1.154 (0.668–1.996)	1.108 (0.604–2.031)	1.095 (–.593–2.019)
Moderate time	0.625 (0.369–1.059)	0.759 (0.421–1.368)	0.790 (0.435–1.432)
Little time	0.363 (0.206–0.640)	0.649 (0.344–1.224)	0.686 (0.361–1.305)
Almost none	0.415 (0.216–0.798)	0.765 (0.368–1.591)	0.838 (0.399–1.759)
Typical weekly PA in free time			
REFERENCE GROUP: none	1	1	1
Sometimes (1–2 times)	1.189 (0.760–1.1862)	1.145 (0.710–1.848)	1.036 (0.637–1.685)
Often (3–4 times)	1.830 (1.175–2.850)	1.404 (0.862–2.286)	1.294 (0.788–2.126)
Quite often (5–6 times)	3.301 (2.108–5.171)*	2.310 (1.406–3.796)	2.023 (1.220–3.356)
Very often (7+ times)	3.891 (2.301–6.578)	2.626 (1.470–4.691)	2.167 (1.197–3.922)
Regular bedtime	1.414 (1.229–1.786)	1.098 (0.847–1.424)	0.984 (0.749–1.294)
Trouble Sleeping	0.328 (0.222–0.484)	0.386 (0.253–0.587)	0.416 (0.272–0.636)
Meet sleep guidelines	1.208 (0.932–1.566)	0.999 (0.750–1.330)	1.005 (0.751–1.344)
Smoked 100 cigarettes	0.535 (0.208–1.377)	0.772 (0.257–2.315)	0.919 (0.297–2.850)
Age	0.874 (0.814–0.939)		0.894 (0.822–0.971)
Sex of adolescent	0.598 (0.476–0.751)		0.584 (0.453–0.753)
NH white	1.157 (0.914–1.466)		1.055 (0.810–1.374)
In private school	1.246 (0.804–1.930)		0.939 (0.581–1.516)
Crime barrier to PA	0.726 (0.553–0.953)		0.823 (0.605–1.119)

Note: Refers to non-categorical variables and the odds associated with a one-unit change in the variable level

[a] Adjusted for nutrition, weight status, and other lifestyle factors

[b] Includes additional adjustment for demographic variables

Figure 1 Fully Adjusted Odds Ratios and 95% Confidence Intervals



Nutrition:

Daily intake of detrimental foods was not demonstrated to be significantly associated with self-reported health throughout modeling. In contrast, daily consumption of beneficial foods was consistently associated with excellent self-reported health. Indeed, with each increase in beneficial food consumption, a 6.5% increase is displayed (Table II), even after adjusting for weight status, lifestyle, and demographic factors. Strong agreement as to the importance of family meals displayed similar consistently significant results. In the fully adjusted model, participants reporting strong agreement with the importance of family meals were 88.5% more likely to report excellent self-rated health as compared to those who did not agree.

Physical Activity and Sedentary Behavior:

Physical activity was continually important to health outcomes in this model. Adolescents reporting highest levels of physical activity were consistently more likely to report excellent self-

rated health, across all models. Adolescents reporting exercising quite often (5–6 times per week) were 3.3 times as likely to report excellent health with no adjustment, and still remained over 2 times as likely to report excellent health with full adjustment. Ratios were slightly higher in participants reporting physical activity as very often, or 7+ times weekly. This group was 3.9 and 2.18 times as likely to report excellent self-rated health at both unadjusted and fully adjusted modeling, respectively.

Those reporting spending higher proportions of time in sedentary behavior (a lot and almost all) were significantly less likely to report excellent health as compared to those reporting less time in sedentary behaviors prior to adjustment (OR: 0.363 (0.206–0.640); OR: 0.415 (0.216–0.798). However, after initial adjustment including nutrition, weight status, and other lifestyle factors, significance did not remain. Sedentary behavior at all levels was not significantly related to likelihood of excellent health after full adjustment either.

Sleep:

Three sleep variables were analyzed (regular bedtime, trouble sleeping, and meeting sleep guidelines as outlined by the National Sleep Foundation). Both having a regular bedtime and reported trouble sleeping were significantly associated with excellent health before adjustment (CI: 1.414 (1.229–1.786), and 0.328 (0.222–0.484), respectively), though only trouble sleeping remained consistently significant across all modeling (CI: 0.416 (0.272–0.636), as regular bedtime attenuated with adjustment. Meeting sleep guidelines was not shown to be significantly associated with excellent health.

Finally, males were more likely to report excellent health than females, and likelihood of excellent health was inversely associated with age.

Discussion:

This study aimed to evaluate associations between health behaviors and excellent well-being in youth populations. As informed by a salutogenic approach (Haapasalo et al., 2018) and aspirational health outcomes, variables including diet, physical activity, sleep quality, and demographic markers were examined. It was hypothesized that youth completing positive health behaviors, including consumption of beneficial foods, physical activity, and quality sleep, would be more likely to report excellent health. Results generally support the hypothesis, and indicate increased positive lifestyle behaviors to be associated with increased likelihood of excellent self-reported health. Namely, results here suggest intake of beneficial food, importance of family meals, physical activity levels, and sleep quality to be associated with increased self-rated health. Though attenuated after adjustment, highest levels of beneficial food intake, ranked importance of family mealtime, physical activity, and least troubled sleep all remained statistically significant. These data mirror previous results, which also suggest physical activity to be positively associated with excellent self-rated health in youth populations (Choudhury, 2011; Zullig & White, 2011).

Further factors, including adolescent age and sex also remained statistically significant, even after full adjustment. Excellent health was inversely associated with adolescent age, and males were more likely than females to report excellent self-rated health. These results support previous research indicating positive relationships between lifestyle behavior and positive health outcomes (Haapasalo et al., 2018; Rosenkranz et al., 2013). The results also fit well with previous research suggesting the inverse, that increased engagement with risky health behaviors is more likely to be associated with negative health outcomes (Duncan et al., 2014). Therefore, these results support an emphasis on positive health outcomes and messaging. Focusing research

on building out positive health behaviors to improve health outcomes seems a viable direction from these results (Mansfield et al., 2018). Furthermore, the association between age and excellent health also supports the importance of intervening early given the uniquely vulnerable period of adolescence ("Adolescent Health Services: Missing Opportunities," 2009).

Data collected via online survey in the FLASHE study utilized validated, reliable measures throughout. Dose response data were limited to importance of family meals and typical weekly sedentary and physical activity time. Trends seen in the data suggest a dose-response relationship for all three variables. That is, stronger agreement as to family meal importance consistently resulted in higher likelihood reporting excellent well-being. Similarly, youth reporting increased levels of physical activity were more likely to report excellent well-being as well. Finally, a dose-response relationship was seen between groups reporting spending a little, moderate, or a lot of time in sedentary behaviors, though the direction reversed for those reporting spending almost all of their free time in sedentary behavior. Health promotion through reduced sedentary time in this way also matches earlier work (Rezende et al., 2016; Vandelanotte et al., 2013). Consumption of beneficial and detrimental food, sleep quality, and smoking status were unable to result in dose-response conclusions as these were reported in a binary fashion.

The FLAHSE dataset, while novel, is limited in that it is cross-sectional in nature. Therefore, conclusions drawn are limited to associations and cannot be stated causally. Further, while the dataset from which the FLASHE participants were drawn is quite representative of the United States population, specific measures of socioeconomic status were limited. The only variables available to access this adjacently were residence in a neighborhood where crime served as a barrier for physical activity, and characterization of education status (public vs. private vs. other schooling). Given that SES is an important determinant of health, the lack of a

clear variable to address this limits results as there may be confounding. Moving forward, future research would benefit from stronger study design to address temporality and allow for more distinct conclusions to be drawn, as well as clear measurement of SES to properly accommodate for this influence and ensure a representative sample. Though limited, the study is valuable for a number of reasons, including the large, generally representative sample, validated and appropriate measures, and novel nature. To our knowledge this is the first reporting of adolescent health behavior and well-being specifically, and this analysis is the first to investigate the results as such.

Conclusion:

The current study indicated that adolescents engaging in healthy lifestyle behaviors were more likely to report excellent self-rated health. Beneficial food consumption, higher levels of physical activity and limited sedentary time, and quality sleep were positively associated with excellent well-being in this adolescent population. These results fit well into previous findings, and support efforts to address health behaviors as approaches to improve health outcomes in youth. Aspirational health outcomes such as excellent self-rated health can be viable approaches to framing health messing, intervention approaches addressing multiple lifestyle behaviors, and in addressing the widespread concern of chronic disease prevention and health promotion.

Chapter 3 - Applied Practice Experience

Portfolio Products:

My Applied Practice Experience (APE) was completed at the Riley County Extension Office located in Manhattan, KS. The Cooperative Extension System, established in 1914, is housed and operated via the United States' Land-Grant university system (K-State Research and Extension, 2021). Extension offices are present in or near most all U.S. counties and consequently, the extension system has a unique reach nationally (United States Department of Agriculture, 2021). The extension philosophy is to "help people help themselves," bringing university knowledge and research findings into local communities (K-State Research and Extension, 2021). The Riley County office supports a variety of specializations, including: 4-H, health and nutrition, family resource management, horticulture, and agriculture and natural resources. My APE was housed under health and nutrition, though I also was able to support horticulture and general office outcomes as well. My primary responsibility included assisting with delivery of a Junior Master Gardner program to area schools. This program leads students through planting and harvesting of a school garden, with horticulture and nutrition lesson outcomes. I participated in the entire project from preparation, through supporting horticulture lessons and leading nutrition lessons of the Junior Master Gardner program, through harvest of the garden. The products produced through my time with the program include a program delivery manual, teaching materials for two new lessons, as well as an assessment tool for lesson efficacy.

Summary of Portfolio Products:

Portfolio Product		Description
	Program delivery manual	The delivery manual serves as written instruction for the leader implementing the nutrition lessons. Learning objectives, materials, approximate timing, and a sequence of events are provided.
	Lesson materials	Two nutrition lessons were designed aiming to target increasing fruit and vegetable

		knowledge and consumption. Sequencing, student activities, and accompanying materials were designed.
	Lesson assessment tool	Included in the new lessons are a pre- and post-assessment tool (short quiz) designed to capture student learning outcomes.

Portfolio Products and Competency Addressed:

Portfolio Product		**Number and Competency Addressed**	
	Program delivery manual	9, 21	Design a population-based policy, program, project, or intervention Perform effectively on interpersonal teams
	Lesson materials	18, 19	Select communication strategies for different audiences and sectors Communicate audience-appropriate public health content, both in writing and through oral presentation
	Lesson assessment tool	11	Select methods to evaluate public health programs

Competencies:

Competency 9—involves designing a population-based policy, program, project, or intervention. This competency was achieved through creation of two new, updated lessons to contribute to the Junior Master Gardner nutrition programming. The lessons are summarized and outlined in a teacher instruction manual, which provides an overview of lesson delivery. The manual was created to allow streamlined delivery by any volunteer, improving transparency, efficiency, and not only relying on the trained extension agent.

Competency 11—details selecting methods to evaluate public health programming. It was observed that the original Junior Master Gardner program lacked any data collection

measures to support its efficacy in schools. Therefore, an assessment tool for elementary student use was created. Using educationally appropriate measures, an assessment was designed and integrated into the end of the newly designed lessons to capture student learning outcomes.

Competency 18—focuses on selecting communication strategies for different audiences and sectors. This competency was employed throughout my time with Extension, for example in both my delivery of nutrition lessons to students as well my authorship of program leader manuals for newly created lessons. Age-appropriate language and communication styles were essential when teaching to young students at the elementary level, and were necessarily different than the writing style employed when creating an instructor manual, for example. Both communication strategies were different from communication with volunteer master gardeners or Extension agents. In this way, my experience with the Jr. Master Gardener program provided numerous diverse audiences with which to communicate.

Competency 19—involves communicating audience-appropriate public health content, both in writing and through oral presentation. This competency was addressed through both creation and delivery of nutrition lessons to elementary students. The newly developed lessons were rooted in evidence-based design but crafted using audience-appropriate language. For example, student facing writing was age appropriate and free from technical jargon. Further, in delivering the lessons to students orally, language was mediated accordingly as well.

Competency 21—comprises performing effectively on interpersonal teams. By design, the Junior Master Gardner program (a team effort between the horticulture and health and nutrition agent) was an interpersonal endeavor. As I was able to participate from program preparation through complete delivery, I had the opportunity to engage with both sides of the program. Additionally, Master Gardeners provided volunteer support to program implementation, adding another layer of interpersonal development opportunities in this setting.

Summary of MPH Foundational Competencies:

Number and Competency		**Description**
9	Design a population-based policy, program, project, or intervention	I created two new nutrition and health lessons as a part of the Junior Master Gardner Program.
11	Select methods to evaluate public health programs	I developed a student assessment tool to evaluate student learning. There was

		previously no measurement of student learning from the program.
18	Select communication strategies for different audiences and sectors	I created two nutrition lessons as well as a teacher manual for a new Junior Master Gardner program. Selecting appropriate communication methods was an important focus.
19	Communicate audience-appropriate public health content, both in writing and through oral presentation	A primary responsibility was communication to varied audiences--delivering nutrition lessons to elementary students as well as leading Master Gardeners in volunteer support, for example.
21	Perform effectively on interpersonal teams	I served both the nutrition and health branch of Riley County Extension, as well as the horticulture emphasis. I interacted with Riley County Extension agents, support staff, and Master Gardner volunteers.

MPH Foundational Competencies Course Mapping:

22 Public Health Foundational Competencies Course Mapping	MPH 701	MPH 720	MPH 754	MPH 802	MPH 818
Evidence-based Approaches to Public Health					
1. Apply epidemiological methods to the breadth of settings and situations in public health practice	x		x		
2. Select quantitative and qualitative data collection methods appropriate for a given public health context	x	x	x		
3. Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate	x	x	x		
4. Interpret results of data analysis for public health research, policy or practice	x		x		

Public Health and Health Care Systems					
5. Compare the organization, structure and function of health care, public health and regulatory systems across national and international settings		x			
6. Discuss the means by which structural bias, social inequities and racism undermine health and create challenges to achieving health equity at organizational, community and societal levels					x
Planning and Management to Promote Health					
7. Assess population needs, assets and capacities that affect communities' health		x		x	
8. Apply awareness of cultural values and practices to the design or implementation of public health policies or programs					x
9. Design a population-based policy, program, project or intervention			x		
10. Explain basic principles and tools of budget and resource management		x	x		
11. Select methods to evaluate public health programs	x	x	x		
Policy in Public Health					
12. Discuss multiple dimensions of the policy-making process, including the roles of ethics and evidence		x	x	x	
13. Propose strategies to identify stakeholders and build coalitions and partnerships for influencing public health outcomes		x		x	x
14. Advocate for political, social or economic policies and programs that will improve health in diverse populations		x			x
15. Evaluate policies for their impact on public health and health equity		x		x	
Leadership					
16. Apply principles of leadership, governance and management, which include creating a vision, empowering others, fostering collaboration and guiding decision making		x			x
17. Apply negotiation and mediation skills to address organizational or community challenges		x			
Communication					
18. Select communication strategies for different audiences and sectors	DMP 815, FNDH 880 or KIN 796				
19. Communicate audience-appropriate public health content, both in writing and through oral presentation	DMP 815, FNDH 880 or KIN 796				
20. Describe the importance of cultural competence in communicating public health content		x			x
Interprofessional Practice					
21. Perform effectively on interprofessional teams		x			x
Systems Thinking					
22. Apply systems thinking tools to a public health issue			x	x	

Student Attainment of MPH Emphasis Area Competencies

Summary of MPH Emphasis Area Competencies:

MPH Emphasis Area: Public Health Nutrition		
Number and Competency		**Description**
1	Information literacy of public health nutrition	Inform public health practice through analysis of evidence-based policy, systems, and environmental change
2	Compare and relate research into practice	Examine chronic disease surveillance, policy, program planning and evaluation, and program management, in the context of public health nutrition
3	Population-based health administration	Critically examine population-based nutrition programs
4	Analysis of human nutrition principles	Examine epidemiological concepts of human nutrition in order to improve population health and reduce disease risk
5	Analysis of nutrition epidemiology	Describe criteria for validity in nutritional epidemiological methodology

Competency 1—comprises informing public health practice via evidence-based analysis of policy, systems, and environmental change. The entire Extension experience served as an opportunity to view the in-practice application of research outcomes, as this is the primary role of Extension offices nationwide. However, in particular, in reviewing the Jr. Master Gardener

program, it was observed that there were no data collection points to inform program efficacy. The newly developed lessons were not only informed by published research findings in the field, but also include an assessment measure embedded to provide new learning outcome data as a recommendation from my analysis. Additionally, through development of new materials I was able to place my own public health nutrition research literacy into practice.

Competency 2—details comparing and examining program management in the context of public health nutrition. My time with the Jr. Master Gardener program provided hands on experience of delivering programming. Handling logistics of delivering the nutrition lessons in real-time across a number of area schools gave me a real-world appreciation for implementing an intervention and for general program management as well. In this way the program allowed for viewing program management in the public health nutrition context.

Competency 3—describes critically examining population-based nutrition programming. In my role supporting the Jr. Master Gardener program, I was able to observe program delivery from start to finish. Through this observation and review, and in creation of the new lessons, I observed a few gaps to resolve. Individual lesson manuals for the instructor were developed and included to improve consistency across delivery, regardless of instructor, and to streamline and improve efficiency for the extension agent. Additionally, the assessment data was included to better ascertain student learning and could be used in outcomes ranging from informing future teaching to advocacy for program effectiveness. In this way both the development of new material and hands-on experience with the Jr. Master Gardener program supported the development of critical program evaluation skills.

Competency 4—involves analysis of human nutrition principles, examining epidemiological concepts for improvement of population health. Given the Extension mission, to

improve lives through application of university research, much of my experience met these principles. The Jr. Master Gardner program itself is rooted in improving the health of young people. The upstream nature of targeting youth populations, as well as literature analysis in lesson-development, are two such examples of the overlap between epidemiology and population health in my time with Extension.

Competency 5—describes analysis of nutritional epidemiology. In developing my new lessons for the Jr. Master Gardener program, a review of relevant published literature was conducted to ensure the lessons were rooted in current research evidence. Consequently, research skills and literacy, including validity of methodologies, were utilized to examine the literature and inform evidence-based lesson content.

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Appendix

Assessment Tool:

Circle the response that best answers the question:

1. The daily fruit and vegetable recommendation for children like me is:
    a. 1-2 cups per day
    b. 3-5 cups per day
    c. 5-6 cups per day
    d. 7+ cups per day

2. To what extent do you agree with the following statement: "I am confident I can meet the daily fruit and vegetable recommended amount."
    a. Strongly agree
    b. Agree
    c. Disagree
    d. Strongly disagree

3. Sugar consumption should be no more than ___ % of my total daily calorie consumption.
    a. 5%
    b. 7.5%
    c. 10%
    d. 15%

Short Answer:

4. Where would you look to find nutrition information on food products?

5. Name at least two categories of food that are rich in fiber.

Lesson I:

Junior Master Gardener Program

Title: Sugar Sleuths

Grade Level: 4

Objective: By the end of the lesson students will successfully locate sugar on a nutrition facts panel; students also will identify guidance to reduce and limit added sugar intake

Approximate Length of Lesson: 30 minutes

New and Familiar Vocabulary: new—nutrition facts panel

Materials: pre-assessment tool (1/student), empty food items (1/student), measuring utensils and container of sugar (1/small group), plastic bag to hold sugar sample (1/student), snack (3 different flavored waters) and cups (3/student)

Lesson Activities

Beginning—engage: Estimated time 5 minutes

What will you say? Name the strategies you will use.	What will students do?
• Pre-assessment tool • Thank for completing • Introduce sugar as topic	• Complete pre-assessment

Middle—explore: Estimated time 20 minutes

What will you say? Name the strategies you will use.	What will students do?

• Where do we find sugar in food?
  o Added vs. naturally occurring
• How much sugar is too much?
  o <10% of our total daily calories
• So what does that look like?
  o Transition to sleuth activity
  ▪ Pass out packaged foods, measuring supplies, sugar
	• Group discussion, sugar identification on nutrition facts panel, sleuth activity, snack taste test

▪ Work through sample sugar example as a class ▪ Students identify and measure sugar of their own food item ▪ Show and tell ▪ Compare to reference amount • Some alternative ideas… • Transition to snack and guided discussion • Taste test of three naturally flavored waters (lemon, berry, and cucumber/mint) o What are some other low sugar ideas you have?	

End—evaluate and closure: Estimated time 5 minutes

What will you say? Name the strategies you will use.	What will students do?
• What did you learn today? • What is something you can share at home?	• Guided discussion

Lesson 2:

Junior Master Gardener Program

Title: Fun with Fiber

Grade Level: 4

Objective: By the end of the lesson students will successfully locate fiber details on at least one nutrition facts panel; students also will identify at least one reason to increase fiber in their diets

Approximate Length of Lesson: 30 minutes

New and Familiar Vocabulary: new—fiber; familiar—nutrients, nutrition facts panel

Materials: fiber worksheet (1 per small group); bowls, forks, napkins (1/student); snack (1/3 cup whole wheat pasta, ¼ cup chopped veggies, 1 Tbps oil vinegar dressing/student)

Lesson Activities

Beginning—engage: Estimated time 5 minutes

What will you say? Name the strategies you will use.	What will students do?
• What did we cover last time we met? ○ Hints as needed, including: we looked at different packaged foods, looked at labels, discussed sugar, etc. • Now we will look at another component of nutrition—fiber!	• Guided group discussion

Middle—explore: Estimated time 20 minutes (as schools allow)

What will you say? Name the strategies you will use.	What will students do?
What is fiber discussion ~7 minutes • Ask: What do you think I mean when I say fiber? Has anyone ever heard of fiber before? • Give definition: type of complex carbohydrate that we cannot break down. Found in foods like apples and	• Guided group discussion, small group work in completing fiber game, build snack

other fruits, oatmeal, beans, broccoli and other vegetables • Explain why fiber important ○ Helps with digestion—ease of passing fecal matter, helps keep you regular, slows glucose absorption, and cancer prevention—acts like a scrub to clean out colon! • Transition: Where do you think we find fiber? Find the fiber game ~7 minutes ○ Pass out fiber key ○ Explain that they will work in small groups (tables) to build two dinners—one with the most fiber they can find and one with the least ○ Groups will select a leader to share results with the class at the end ○ Wrap up questions: so where do we find fiber? Build snack ~6 minutes ○ Hand out snack components ○ Have students mix pasta, vegetables, and dressing	

End—evaluate and closure: Estimated time 5 minutes

What will you say? Name the strategies you will use.	What will students do?
As they eat • What did you learn today? • What is something you can share at home? • What are some other high fiber snacks you might make?	• Full group discussion

Lesson 2 Supplement:

Fiber in Foods!

Fruits	Serving Size	Fiber (g/serving)
Apple w/skin	1 medium	3.7
Banana	1 medium	2.7
Blueberries (raw)	1 cup	4.0
Orange	1 medium	3.0
Pineapple	1 cup (pieces)	2.0
Strawberries	1 cup	3.4
Vegetables		
Asparagus, boiled	1.2 cup	1.4
Carrot	1 medium	2.0
Eggplant	½ cup	1.0
Peas, green	½ cup	4.0
Potato, baked w/skin	1 medium	5.0
Protein		
Baked beans	1 cup	14.0
Lima beans, boiled	1 cup	13.2
Grains		
Cheerios	1 cup	3.0
Fiber One	½ cup	13.0
Raisin bran	1 cup	8.2
Bagel	1 bagel	1.5
Pancakes	1 medium	1.0
Macaroni	1 cup	1.8
Spaghetti, whole wheat	1 cup	6.3
Brown rice	1 cup	3.5