Nutrition Knowledge of High School Senior Students in Northwest Arkansas

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Nutrition Knowledge of High School Senior Students in Northwest Arkansas

An Undergraduate Honors Thesis

in the

School of Human Environmental Sciences

Submitted in partial fulfillment of the requirements for the
University of Arkansas
Dale Bumpers College of Agricultural, Food and Life Sciences
Honors Program

by

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May 2014

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Nutrition Knowledge of High School Senior Students in Northwest Arkansas

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Abstract

Though there are many complex factors influencing diet, nutrition knowledge correlates with healthier food choices in older adolescents and can play a pivotal role in health. Nutrition curriculum was addressed in the state of Arkansas through Arkansas Act 1220 of 2003. Numerous changes have been seen in the school environment regarding nutrition, but there is no means of testing nutrition curriculum effectiveness in terms of nutrition knowledge of students. It is the purpose of this descriptive study to improve understanding of the nutrition knowledge of high school seniors. High school senior students (n=25; males=12, females=13) successfully completed a validated Survey to Assess the Knowledge of Conventional and Unconventional Dietary Methods of Weight Control based on the Dietary Guidelines for Americans 2010. The survey also included demographic questions and items regarding sources of nutrition information. The mean nutrition knowledge score (out of 24) was 8.7± 2.8 or 36% (min. score=4, max. score=14). A positive, though not significant, trend was noted between knowledge and physical activity. An inverse, though not significant, relationship was identified between knowledge and frequency of eating out. This study supports the hypothesis that high school seniors have insufficient nutrition knowledge as assessed by this instrument. Further testing with a larger sample size is recommended.

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2Dr. Cynthia Moore is the faculty mentor and an associate professor in the School of Human Environmental Sciences.
Acknowledgements

I would first like to thank Dr. Cynthia Moore for her tremendous help and support during this project. Thank you also to Dr. Curt Rom for his outstanding leadership of the Bumpers Honors program as well as his personal support of my academic and athletic careers. Thank you to committee members Ms. Mechelle Bailey and Dr. Kate Shoulders for their help with the completion of this Honors thesis. I was fortunate to receive the Honors College and Bumpers College Undergraduate Research grants, which allowed me to complete this project. I would like to thank my father, Dr. Ernie Heymsfield, for his passion for teaching that inspired me to similarly pursue my academic passions.
Introduction

Despite the increasing accessibility of health information in our country, adolescents continue to struggle with unhealthy weight. National rates of overweight or obesity in children ages 10-17 years reached 31.3% in 2011 (Ogden et al., 2012). Children who are overweight or obese are more likely to be overweight or obese in adulthood, and they are more likely to develop cardiovascular disease as well as Type II Diabetes Mellitus during childhood (CDC, 2014). Though diet is incredibly complex, nutrition knowledge has been shown to correlate with healthier food choices (Crockett and Sims, 1995; NSCH, 2012; Pirouznia, 2001; Rabiei et al., 2013; Worsley, 2002). The purpose of this study was to determine the level of nutrition knowledge of senior high school students in a Northwest Arkansas school district. Relationships between nutrition knowledge, sources of nutrition information, and demographic characteristics were also investigated. It was hypothesized that high school senior students have insufficient nutrition knowledge. Results may indicate the need for a set nutrition curriculum in public schools.
Review of the Literature

Nutrition and Adolescent Health

Body Mass Index (BMI) is a measure of weight relative to height, defined specifically as weight in kilograms divided by height in meters squared (Center for Disease Control and Prevention, n.d.). For children, a BMI above the 85th percentile and below the 95th percentile of growth for children of the same age and gender is overweight (CDC, 2012). Obese children have BMI measures above the 95th percentile (CDC, 2012). For adults (18 years and older), BMI is not plotted on a growth chart (NHLBI, 2014). A BMI of 18.5 to 24.9 is considered normal for adults; a BMI greater than 25 is considered overweight and greater than 30 is obese (NHLBI, 2014). Numerous studies have shown that the risk of obesity and related conditions in adulthood is much greater when obesity is present in adolescence; some cite correlations as high as 80% (Daniels et al., 2005; Hayman et al., 2002; Thakur and D’Amico, 1999).

Arkansas has historically had rates of overweight and obesity in adolescents that exceed the national average. Rates of overweight and obese Arkansas adolescents were 37.5% and 33.9% in 2007 and 2011, respectively (NSCH, n.d.). As of 2011, 15% of high school students in Arkansas were obese (CDC, n.d.).

Adolescent Eating Behaviors and Knowledge

Sound nutrition is critical during adolescence; in fact, total nutrition needs are highest during this stage of life due to rapid growth (Story, 1992). As adolescents become more autonomous, the behavior patterns they acquire during this part of the life cycle are likely to affect long-term behaviors (Kelder et al., 1994). As they become more capable of controlling their own diet and food choices, increased nutrition knowledge during the adolescent stage is essential (Sichert-Heller et al., 2011).
American adolescents today do not meet all current dietary recommendations. The United States Department of Agriculture (USDA) and the United States Department of Health and Human Services (DHHS) jointly issue the *Dietary Guidelines for Americans* every five years (USDA and DHHS, 2010). These guidelines are recommendations for healthy diets in Americans ages 2 years and over (USDA and DHHS, 2010). Topics addressed include balancing calories, food components to reduce, food components to increase, and healthy eating patterns (USDA and DHHS, 2010). Less than 5% of males and females ages 9-13 years met the minimum recommendations of the *Dietary Guidelines for Americans* when surveyed in the mid-1990s (Gleason and Suitor, 2001). In 2002, less than 1% of adolescents met all of the *Dietary Guidelines for Americans* (Story et al., 2002). Inadequate consumption of fruits and vegetables was found among teenagers in Minnesota, even when inadequate consumption was defined as “less than daily” (Neumark-Sztainer et al., 1996). This definition fails to meet the current recommendations per the *Dietary Guidelines for Americans 2010* of at least 2 ½ cups of fruits and vegetables per day (USDA and DHHS, 2010).

Results from the National Health and Nutrition Examination Survey (NHANES) 2005-2006 indicated that adolescents were largely unaware of the *Dietary Guidelines for Americans* (Wojcicki and Heyman, 2012). Only 29.3% of adolescents indicated awareness of the recommendations, and less than 25% indicated reading nutrition labels when making food decisions (Wojcicki and Heyman, 2012). Mean knowledge scores for 11th graders were only 54% when tested on the *Dietary Guidelines for Americans* in 1993, and knowledge about number of servings for each of the food groups was particularly low (Murphy et al., 1994). Correlates of overweight/obesity and poor school performance have been linked to inadequate nutrition compared to the *Dietary Guidelines for Americans* (Neumark-Sztainer et al., 1996).
senior year of high school is critical as adolescents prepare to transition to a more autonomous lifestyle, whether it be the work force or college. Though the literature does not support the “Freshman 15” weight gain theory, significant weight gain has been found to occur during the freshman year of college in both males and females (Richardson et al., 2009). 

**Effect of Nutrition Knowledge on Adolescent Eating Behaviors**

There are many complex factors that influence dietary intake. Nutrition knowledge correlates with healthier food choices in older adolescents, and according to Worsley in a comprehensive study it has been shown to play a “small but pivotal” role in healthier food habits (NSCH, 2012; Pirouznia, 2001; Worsley, 2002). Health education is conducted in part with the goal of increasing health literacy, which is defined by the DHHS and the Institute of Medicine as “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions” (NRC, 2004). Health literacy in a specific nutrition context was termed “nutrition literacy” by Zoellner and defined as “the degree to which individuals have the capacity to obtain, process, and understand nutrition information and skills needed in order to make appropriate nutrition decisions” (2009).

“Appropriate nutrition decisions” encompasses choosing appropriate serving sizes and reading food labels. Persons with low health literacy have been found to be significantly less capable of estimating portion sizes (Gibbs and Chapman-Novakofski, 2012). The same study found worse diabetes outcomes in those with reduced health literacy (Gibbs and Chapman-Novakofski, 2012). Another study of males and females found increasing BMI strongly predicts larger than recommended portion size estimation (Burger et al., 2007). No significant relationship was found between use of nutrition labels and obesity in NHANES; however, the
percentage of adolescents who reported reading nutrition labels (less than 25%) was so low that further research in this specific area is needed (Wojcicki and Heyman, 2012).

A major study of over 1,000 adults ages 18-75 years identified that participants in the highest quintile of nutrition knowledge were nearly 25% more likely to meet current fruit, vegetable, and fat intake recommendations than those in the lowest quintile (Wardle et al., 2000). The HELENA Study was the first to examine the nutrition knowledge of a large sample of European adolescents (Sichert-Hellert et al., 2011). It was found that while body weight did not correlate with nutrition knowledge as much as parental education level, formal knowledge of dietary principles is required to make an informed food choice (Sichert-Hellert et al., 2011).

Self-efficacy is a strong correlate with nutrition knowledge. According to Lytle and Achterberg in their article “Changing the Diet of America’s Children: What Works and Why,” self-efficacy is “one’s perception of one’s ability to make a change or accomplish a task” (1995). Rabiei et al. found a significant correlation between nutrition knowledge, self-efficacy, and self-concept in a study of overweight students in Iran (2013). High self-efficacy has also been associated with lower consumption of high sugar/ fat items (Story et al., 2002). Interestingly, self-efficacy in nutrition may decrease as children progress through schooling. In a 1994 study involving eighteen randomly selected Michigan schools, more fifth grade students rated their nutrition knowledge as “excellent” than did eighth or 11th grade students (Murphy et al., 1994).

Nutrition Education in High Schools

The Child Nutrition and WIC Reauthorization Act of 2004 required all education agencies enrolled in the National School Lunch Program (NSLP) to create a School Wellness Policy (Schwartz et al., 2009). Over 100,000 public and non-profit private schools nationwide enrolled in the NSLP, and there were over 400,000 child participants in the state of Arkansas as
School Wellness Policies require goals for nutrition education and are evaluated by the School Nutrition Association (Story et al., 2009). In a study coding the strength and comprehensiveness of the seven goal areas of School Wellness Policies, nutrition education goals were found to be variable among states and weak overall (Schwartz et al., 2009). A joint position statement on comprehensive school nutrition services between the American Dietetic Association (now named the Academy of Nutrition and Dietetics), the School Nutrition Association, and the Society for Nutrition Education and Behavior stated few students receive the 50 hours of recommended nutrition education (American Dietetic Association et al., 2010). As of 1995, students were only receiving 10-15 hours of nutrition education per school year (Lytle and Achterberg, 1995). In a 2006 study across the 50 states and the District of Columbia, it was found that 86% of schools across the country require teaching of nutrition and diet behaviors in high schools (Kann et al., 2007). Instruction of health topics averaged 12 weeks in grade 12 across the states, and only 74% of schools included the *Dietary Guidelines for Americans* in their nutrition curriculum (Kann et al., 2007). From grades 9 to 12, the median number of weeks of required health education decreased from 17 to 12 (Kann et al., 2007).

It is important to acknowledge that nutrition education in schools alone is not as effective as education efforts that also involve parental involvement. Although teachers can serve as excellent role models in educating students in attempts to improve their health, long-term behavior change is more likely to occur if education involves one or both parents (Kandiah and Jones, 2002). However, nutrition education in schools can reduce some of the variation in intake
due to socioeconomic status differences, particularly for fruits and vegetables (Wardle et al., 2000).

School Wellness Policies in Arkansas

Factors influencing the health of children in Arkansas and a plan to decrease high obesity rates were both addressed in Arkansas Act 1220 of 2003. The Act outlined a set of initiatives to battle unhealthy BMI measures through school-based change in both physical activity and nutrition (State of Arkansas, 2003). With this Act, Arkansas became the first state to mandate evaluation of BMI in all public schools (Trust for America’s Health, 2007).

Numerous changes in school nutrition environment, practices, and physical education courses as a result of this Act have been implemented statewide (Phillips et al., 2010). For example, significant improvements were seen in the number of school districts offering low-fat/skim milk options with meals, banning “junk foods” in cafeterias and vending machines, and raising standards for the food options allowed at school-sponsored events (Phillips et al., 2010). Act 1220 also requires integration of nutrition education in school-wide curriculum (State of Arkansas, 2003). Each district’s school nutrition and physical activity committee is responsible for integrating nutrition education into the overall curriculum (State of Arkansas, 2003). Foodservice personnel, teachers, parents, students, health care providers in the community, and representatives of the school district governing boards and school administrators compose these committees (State of Arkansas, 2003).

A means of testing the effectiveness of the nutrition curriculum in each district is lacking. High school students are tested statewide in the areas of algebra, biology, geometry, and literacy per the Arkansas Department of Education (Arkansas Department of Education, 2014). No survey or test has been administered in Arkansas to test nutrition knowledge specifically. The
only nutrition intervention study concerned with the effect on diet of a nutrition intervention was conducted in Little Rock in the 1970s. The study sample included first through third grade students, and the results indicated nutrition efforts by teachers did improve food choices (Blakeway & Knickrehm, 1978).

School-Based Interventions in Nutrition Education

Many school-based interventions in nutrition education have been documented with varying results. Diet improvement is more likely to occur if changes in school environment are also integrated into classroom education (Lytle et al., 2004). Studies that focused exclusively on adolescents who received nutrition education without any sort of dietary intervention did have sustained body fat improvements post-treatment (Academy of Nutrition and Dietetics Evidence Analysis Library, 2014). Longevity of improvement is another matter. A comprehensive study conducted with eighth grade students titled “TEENS” included ten nutrition lessons, education delivery by trained peer students, and completion of nutrition related projects (Lytle et al., 2004). TEENS also had a family component that included newsletters and coupons to motivate behavior change in food purchasing (Lytle et al., 2004). Sustained improvements in diet were seen after one year in these students; however, positive fruit and vegetable outcomes were not maintained in the students after two years (Lytle et al., 2004).

Because school performance correlates positively with indicators of a healthy diet such as adequate fruit and vegetable consumption, school-based nutrition education alone that follows traditional curriculum patterns might not meet the requirements of students who are most in need (Neumark-Sztainer et al, 1996). Interventions in nutrition education must target specific behaviors, devote proper time and intensity, and take into consideration the interests of students
Lytle and Achterberg identified six elements that distinguish successful nutrition education curriculum:

1. Behaviorally based and theory driven,
2. Family involvement (particularly for elementary children),
3. Self assessment of eating patterns in older students (middle school to senior high school),
4. Intervention in school environment,
5. Interventions in the larger community, and

The most important component in a successful nutrition education program is a behaviorally based and theory driven model (Lytle & Achterberg, 1995).

**Barriers to Nutrition Education**

The American Dietetic Association cited lack of standards and time due to the No Child Left Behind Act as reasons for the shortage of time spent on nutrition in schools (American Dietetic Association et al., 2010). Elementary teachers cited unavailability of educational materials as the largest barrier to nutrition education; 96% reported teaching about foods in their classrooms and 75% created their own educational materials (Zemel et al., 1993). Availability of nutrition experts as resources to teachers in schools is low but increasing: only 2.8% of school foodservice directors were Registered Dietitian Nutritionists (RDNs) in 1995 (Pateman et al., 1995). Approximately 52% of school nutrition coordinators in states who responded to a nationwide survey (63%) held an RDN credential in 2012 (Merlo et al., 2013). Ninety-four percent of school nutrition coordinators held undergraduate degrees, and 64% of those undergraduate degrees were in nutrition/dietetics (Merlo et al., 2013). Of respondents who held
an undergraduate degree, 68% held a graduate degree and 47% of graduate degrees were in nutrition/dietetics (Merlo et al., 2013). Laura Jill Richmond, the Assistant Director for the Child Nutrition Unit of the Arkansas Department of Education, identified 12 districts in Arkansas (out of 253) with RDNs as child nutrition directors (Richmond, 2014).

A potential area of improvement is inclusion of nutrition coursework in education of health/physical education teachers. A study investigating the nutrition knowledge of Michigan high school teachers was conducted in the early 1980’s. Over 500 teachers were surveyed, and all taught health and/or physical education courses that were likely to include nutrition information (Penner & Kolasa, 1983). Of these teachers, 43% had never taken a food/nutrition course and 65% had received no nutritional education training since obtaining their degree (Penner & Kolasa, 1983). The average nutrition knowledge score on a nutrition knowledge test was 57% (Penner & Kolasa, 1983). Home economics teachers scored the highest and were also more likely to teach topics related to food groups and nutrients than those who specialized in health and physical education (Penner & Kolasa, 1983).

A similar study in Nebraska found over half of science, health, and physical education teachers considered themselves to be “very knowledgeable” or “knowledgeable” regarding nutrition, even though less than 40% had completed a nutrition course in college (Stanek et al., 1991). Similarly to the Penner & Kolasa study, home economic teachers ranked highest in self-rated nutrition knowledge (96% reported “very knowledgeable” or “knowledgeable”) and 97% had taken one nutrition course in college (Stanek et al., 1991).

In the TEENS intervention discussed in the previous section, 20% of teachers said that nutrition curriculum took too long to teach and 25% said it would require a lot of changes if intended for actual implementation in schools (Lytle et al., 2004). The same study suggested that
teachers might not prioritize nutrition as much as other risky health behaviors, such as sexual activity and alcohol use (Lytle et al., 2004). However, when asked to rank health-related topics that most required staff development and training, 46% of a nationwide sample of elementary through high school teachers chose nutrition and dietary behavior (Kann et al., 2007). This percentage was higher than those who wished to receive training in alcohol-use or drug-use prevention (29%) and tobacco-use prevention (24%) (Kann et al., 2007). Thus, nutrition may be an area of increasing interest to teachers.

Another barrier to nutrition education in schools that targets adolescents is their growing sense of autonomy. Questioning of authority affects how teenagers respond to nutrition education efforts; thus, involving and empowering adolescents in their food choices is crucial (Perry, 2000). When asked to rank their preferences in learning styles, 11th graders ranked videos, games, and actual food preparation as more interesting than individual projects (Murphy et al., 1994). This raises an interesting opportunity to involve food service personnel in education efforts. The challenge in educating adolescents lies in acknowledging their status as nearly-adults while still presenting information that is important but “uninteresting,” such as limiting sugar and increasing fiber intake (Murphy et al., 1994).

Theoretical Background

Story et al. conceptualized four levels of influence on adolescent eating behavior in a comprehensive review of the literature (2002). The model was based on the social cognitive theory of behavior as well as ecological influence (Story et al., 2002). According to social cognitive theory, a person’s behavior is influenced dynamically by their thoughts, behavior, and surroundings (Baranowski et al., 1997). It has been found to be an appropriate theory for health interventions because it acknowledges multiple levels of influence (Baranowski et al., 1997).
The ecological perspective in Story’s model concerns the interaction between people and their environment (Story et al., 2002). Adolescents participate in microsystems (for example: family and school), mesosystems (interrelationships of family and school), exosystems (media and community), and macrosystems (culturally based beliefs) (Story et al., 2002).

Combining social cognitive theory and the ecological model, the four levels of influence proposed in the Story model for adolescent eating behavior were individual influences, social environmental influences, physical environmental influences, and macrosystem influences (Story et al., 2002). The spheres of influence examined in this study include intrapersonal and physical environmental influences (Story et al., 2002). Health and nutrition, meanings of food, self-efficacy, and knowledge are all intrapersonal (individual) factors in making dietary decisions (Story et al., 2002). Knowledge is addressed in the survey instrument in 24 of the 32 questions. Meanings of food are specifically addressed in item #28 of the survey: “Which statement best describes your daily thoughts about eating?” Because the participants of the survey were all students, the school as a physical environmental influence can be considered (Story et al., 2002). A large amount of eating is done outside of the home; thus, community settings such as schools have a particularly large influence on adolescent eating (Story et al., 2002). Though more of the emphasis in this area of influence is on the NSLP and vending machines, this study is more concerned with the school environment as an educational resource (Story et al., 2002). The survey instrument addresses this factor through the knowledge questions as well as item #30: “Where do you get most of your information about dieting and nutrition?”

Development of a Valid Survey Instrument

Dwyer et al. created a valid and reliable instrument to assess nutrition knowledge in senior high school students (1981). They found “close collaboration between content experts
and measurement experts is essential for the development of valid and reliable instruments for measurement of nutrition knowledge” (Dwyer et al., 1981). In her 2006 dissertation at the University of Alabama, Dr. Cynthia Moore developed a nutrition knowledge questionnaire based on the *Dietary Guidelines for Americans 2005* (Moore, 2006). The validation method for the survey was a 12-step process based on the interdisciplinary literature (Moore, 2006). The steps included focus groups and input from a panel of nationwide experts in dietetics/nutrition, medicine, social sciences, and education (Moore, 2006). The survey was pilot tested with a small sample at a large university with non-nutrition experts and with nutrition experts at the annual meeting of the Alabama Dietetic Association (Moore, 2006). A field test was then conducted with faculty, staff, and graduate students at a small university (Moore, 2006). The instrument was found to be both valid and reliable (Moore, 2006). The changes between the *Dietary Guidelines for Americans 2005 and 2010* did not impact the content of the survey; therefore, it remains valid. Though the emphasis in the *2010 Guideline “key recommendations”* is on food groups to eat more or less of rather than specific amounts, an entire chapter and several appendices do include the quantities included in the *2005 Guidelines* (USDA and DHHS, 2010). Moore’s validated instrument was adapted for the purpose of this study, with eight added demographic items.

*Purpose of the Study*

The purpose of this study was to determine the level of nutrition knowledge of senior high school students in a Northwest Arkansas school district. Relationships between nutrition knowledge, sources of nutrition information, and demographic characteristics will also be investigated. It was hypothesized that high school senior students have insufficient nutrition knowledge.
Methods

The target population for this study was high school senior students from a Northwest Arkansas school district. The specific district was chosen for the study due to convenience and permission from the district. This district has only one high school. The sample selection for this study was taken from the senior graduating class of 2014. Only students who gave consent, or returned parental consent forms if less than 18 years old, were included in the study (Appendices 1 and 2).

The final survey instrument (Appendix 3) was 32 items- 24 of the questions were nutrition knowledge based, and there were eight added demographic questions. The 24 nutrition knowledge items were adapted for the purpose of this study from the Survey to Assess the Knowledge of Conventional and Unconventional Dietary Methods of Weight Control as well as the Dietary Guidelines for Americans 2010 (Moore, 2006). Institutional Review Board approval was granted at the University of Arkansas (IRB #13-09-070) (Appendix 4).

Data collection for this study was done on-site. Paper assent forms and parental consent forms were distributed, and the researcher explained the study during a forty-minute college preparation class required of all senior students in the district. All students were given parental consent forms regardless of age, though only students under 18 years of age were required to return one for participation in the study. One month later, printed surveys were distributed to students who returned signed consent forms or parental assent forms, if under 18 years old. The guidance counselor at the school assisted in verifying birth dates and ages according to school records. The students completed the survey with pencil under supervision of the researcher to ensure no interpersonal collaboration nor electronic devices were used to aid in completion of the survey. No compensation or incentive was provided to the subjects or the district.
SPSS Statistics 21 was used to analyze descriptive statistics and to conduct a series of t-tests, as well as analysis of variance tests (ANOVA). The researcher investigated differences in knowledge score by gender, ethnicity, thoughts about eating, medical condition, reported sources of nutrition information, frequency of eating out, and physical activity level. Knowledge score was re-coded into “low” score and “high” score. “High score” was defined as greater than or equal to 50% (12 out of 24 correct answers or higher). The same series of t-tests and ANOVAs were conducted.
Results

The survey was distributed to seventy students in a college preparatory class that is required of all students in the senior class at the school district. Forty-four students indicated a desire to participate in the study on the assent form. Nineteen students with signed assent forms were unable to complete the survey due to lack of parental consent or absence. Twenty-five students completed the survey, resulting in a response rate of 36%.

Demographic information and mean knowledge score are contained in Table 1. Of the twenty-five students who completed the survey, 12 (48%) were males and 13 (52%) were females. Nineteen students (76%) identified themselves as “White (not Hispanic)” when asked about their ethnicity. The remaining 24% selected American Indian/Alaska Native, Black or African American, Hispanic or Latino, Native Hawaiian or Pacific Islander, and other. Family income information was not requested on the survey, and family income data for the city could not be found. Median household income for the county was $41,429 as of 2012, which was higher than the state’s value (US Census Bureau, 2014).

Demographic information and knowledge score are shown in Table 1. The mean nutrition knowledge score (out of 24) was 8.7± 2.8, or 36%. The minimum score recorded was 4, and the maximum score was 14. Knowledge score was re-coded into “low” score and “high” score. “High score” was defined as greater than or equal to 50% (12 out of 24 correct answers or higher). Using this definition, 76% of students recorded “low” scores and 24% recorded “high” scores. The mean score for females (8.9±2.8) was higher than the mean score for males (8.5±3), though not statistically significant (p=0.884). A nearly significant difference existed between scores of males and females when re-coded as high/low scores (p=0.111). There was no significant difference in nutrition knowledge scores based on ethnicity (p=0.585), following a
special diet for a medical condition (p= 0.922), or frequency of eating out (p= 0.659). No significant differences were found in nutrition knowledge scores based on those criteria when re-coded to high/low scores. Two listed sources of information nearly significantly correlated with nutrition knowledge scores: sources of information from a teacher (p= 0.055; n=1) and sources of information from a doctor (p= 0.132; n=4). It is worth noting that the survey participant who identified a teacher as a source of nutrition information also scored highest on the survey (14 questions answered correctly).

A positive though not significant trend was noted between knowledge and physical activity (p= 0.290) (Graph 1). Eleven students reported “light physical activity” and had a mean knowledge score of 8.2±2.8. Eight students reported between “30-60 minutes of physical activity per day” and scored 8.3±2.9. The group that reported “an hour or more physical activity per day” (n=6) scored 10.3±2.7.

<table>
<thead>
<tr>
<th>Demographic Information &amp; Mean Knowledge Score</th>
<th>Demographic Information and Mean Knowledge Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic Information</td>
<td>Gender</td>
</tr>
<tr>
<td>Frequency</td>
<td>Male</td>
</tr>
<tr>
<td>Percentage</td>
<td>Female</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>White</td>
</tr>
<tr>
<td></td>
<td>Other</td>
</tr>
<tr>
<td>Frequency of eating out</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>1-6 times weekly</td>
</tr>
<tr>
<td></td>
<td>Daily</td>
</tr>
<tr>
<td>Special Diet</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Sources of Nutrition Info.</td>
<td>Teacher</td>
</tr>
<tr>
<td></td>
<td>Doctor</td>
</tr>
<tr>
<td>Physical Activity</td>
<td>Light</td>
</tr>
<tr>
<td></td>
<td>30-60 mins/ day</td>
</tr>
<tr>
<td></td>
<td>Hour+</td>
</tr>
<tr>
<td>Nutrition Knowledge Score</td>
<td></td>
</tr>
</tbody>
</table>
An inverse though not significant relationship was identified with knowledge and frequency of eating out (p = 0.659) (Graph 2). The students who selected “I do not eat out” (n=7) had a mean knowledge score of 9.1±2.4. Students who identified themselves as eating out “1-6 times per week” (n=16) scored 8.8±3.2. Two students reported eating out “daily,” and their mean score was 7.0±1.4.
Five questions on the survey addressed fruit and vegetable consumption. Knowledge scores calculated with these five items were 40%. Fruit and vegetable answers for this sample are represented in Table 2. The fruit and vegetable question most frequently answered correctly was item #13: “Based on a 2000 calorie diet, the average American adult should consume at least ____ cup(s) of vegetables per day,” with thirteen students answering correctly. Six correct answers were given for items number 17 and 18, respectively, making them the fruit and vegetable consumption questions least frequently answered correctly.
Sources of nutrition information varied among respondents (Table 3). Family was the most common source of nutrition information (n=11). The second most common source of nutrition information was a three-way tie between television, doctor, and Internet (n=4). The next most common source of nutrition information was friends (n=3).

Table 3: Sources of Nutrition Information

<table>
<thead>
<tr>
<th>Sources of Nutrition Information</th>
<th>Total (N)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family</td>
<td>11</td>
<td>44%</td>
</tr>
<tr>
<td>Friends</td>
<td>3</td>
<td>12%</td>
</tr>
<tr>
<td>Television</td>
<td>4</td>
<td>16%</td>
</tr>
<tr>
<td>Dietitian</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Doctor</td>
<td>4</td>
<td>16%</td>
</tr>
<tr>
<td>Nurse</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>Internet</td>
<td>4</td>
<td>16%</td>
</tr>
<tr>
<td>Magazines</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>Books</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Texbooks</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Food Advertisements</td>
<td>2</td>
<td>8%</td>
</tr>
<tr>
<td>Other: __________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>Coach</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>Do Not Receive Information</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>School</td>
<td>1</td>
<td>4%</td>
</tr>
</tbody>
</table>

Table 4 represents daily thoughts about food. When asked about daily thoughts about food, the majority of students tried to think about health when making food decisions but did not
let it determine everything they ate (n=13). The second most common thought regarding food was eating whatever “sounds good at the time” (n=8).

Table 4: Thoughts about Food

<table>
<thead>
<tr>
<th>Daily Thoughts about Food</th>
<th>Total (N)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consciously think about what I eat</td>
<td>3</td>
<td>12%</td>
</tr>
<tr>
<td>Plan out what I eat</td>
<td>3</td>
<td>12%</td>
</tr>
<tr>
<td>Try to think about what is healthy to eat, but do not let that determine everything I eat</td>
<td>13</td>
<td>52%</td>
</tr>
<tr>
<td>Eat what is convenient at the time</td>
<td>5</td>
<td>20%</td>
</tr>
<tr>
<td>Eat whatever sounds good at the time</td>
<td>8</td>
<td>32%</td>
</tr>
<tr>
<td>Do not consciously think about what I eat</td>
<td>2</td>
<td>8%</td>
</tr>
</tbody>
</table>

The question most frequently answered correctly was item #3: “Which type of meat contains the most nutrients (for example: iron) for the fewest calories?” Seventeen students answered this question correctly. The most frequently missed question was item #11: “An example of a low-fat snack food would be: a) potato chips, b) trail mix, c) microwave popcorn, d) peanut butter crackers” with only one student giving the correct answer.
Discussion

Though the findings of this study regarding nutrition knowledge were statistically insignificant, certain trends in the results were consistent with the literature. First and foremost, the results of this study supported the concerns raised by various sources including NHANES data, the Wardle study, and the TEENs study regarding poor nutrition knowledge of adolescents (Sichert-Hellert et al., 2011; Wardle et al., 2000; Wojcicki and Heyman, 2012). Adolescents in this study were found to have low nutrition knowledge scores as assessed by this instrument regardless of age, gender, and ethnicity.

A particularly troublesome area of adolescent nutrition is low fruit and vegetable intake (Neumark-Sztainer et al., 1996; Sichert-Hellert et al., 2011; Wardle et al., 2000). Five items on the survey instrument addressed fruit and vegetable recommendations: Items numbers 12, 13, 17, 18, and 21. Nutrition knowledge calculated with these five items alone was 40%. This is higher than the overall score recorded on the survey (36%), but not substantially.

Students’ responses regarding daily thoughts about eating were also consistent with the literature. Increasingly autonomous adolescents may not see the need to concern themselves with sound nutrition during their current stage of life; 52% did not let health concerns determine everything they ate, 20% ate according to convenience, and 32% ate whatever sounded good at the time. Thus, nutrition education and intervention efforts may need to address the importance of health during adolescence in terms of future consequences, particularly because obesity in adolescence is a strong risk factor for obesity in adulthood (CDC, 2014).

Several limitations were noted in this study. The first limitation lies in the small sample size. Inclement weather on data collection day resulted in a one-month delay in distribution of the surveys, per the convenience of the school district. A higher student participation rate would
have provided a better understanding of the nutrition knowledge of the senior student population. Furthermore, surveying students from only one school limited generalization of the results. Because school wellness policies vary among school districts, the inclusion of at least one additional school district would have provided more information about the nutrition knowledge of high school seniors in the Northwest Arkansas region overall. Several school districts cited lack of time and standardized testing as reasons for not participating.

Possible limitations lie in the survey instrument itself as well. The survey was distributed in English only. Though relatively long (32 questions), the 40-minute class period was considered ample time to complete the survey. Item #30 on the survey read as follows: “Where do you get most of your information about dieting and nutrition? (Indicate all that apply)” (Moore, 2006). Options listed were as follows:

a) Family  
b) Friends  
c) Television  
d) Dietitian  
e) Doctor  
f) Nurse  
g) Internet  
h) Magazines  
i) Peer-reviewed research articles  
j) Books  
k) Textbooks  
l) Food and/or product advertisements  
m) Other (please list)___________

One student wrote “teacher” in the blank line allotted for the “other” option (choice “m”). Another student wrote “school” and a third student answered “coach,” resulting in a total of three students who indicated school-related resources of nutrition information. Should this pilot study be replicated, an option that specified “teacher,” “health class,” or “home economics course” may provide more information about students’ perceptions of nutrition efforts in the classroom.
Re-wording of item #27 may need to be considered should the study be replicated; “How old were you on your last birthday” may have confused participants, as some listed years that contradicted school records (i.e. 16 years old). “How many years old are you currently?” may provide more accurate answers.

No data was collected from teachers or foodservice personnel for the purpose of this study, though future studies might yield valuable information if they were to do so. Three students answered (un-prompted) school-related sources as sources of nutrition information. The literature supports the increasing interest of teachers in receiving nutrition education training (Kann et al., 2007). Thus, it is suggested that later studies include a survey instrument to assess the nutrition knowledge of teachers, as well as their attitudes toward and self-efficacy in teaching nutrition curriculum.

The trend identified in this study support the hypothesis that adolescents across the state and nation are lacking in nutrition knowledge. Research on this topic should not stop here. Assessment of nutrition knowledge of adolescents should be made region-wide (Northwest Arkansas) and statewide (Arkansas) if improvements in statewide nutrition curriculum are to be suggested. Replication of this pilot study with the revisions addressed earlier could aid in understanding how to best improve nutrition education for high school students.


Richmond, Jill. Arkansas Department of Education. Email interview. 26 March 2014.


State of Arkansas. 84th General Assembly. House of Representatives. 2003. Act 1220: An Act to Create a Child Health Advisory Committee; To Coordinate Statewide Efforts to Combat Childhood Obesity and Related Illnesses; To Improve the Health of the Next Generation of Arkansans; and for Other Purposes. 84th General Assembly, Regular Session, April 10, 2003.


Story M, Nanney MS, Schwartz MB. 2009. Schools and obesity prevention: creating school environments and policies to promote healthy eating and physical activity. Milbank Q. (03);87(1):71-100.


Appendix 1: Consent Form

Dear Parent,

Your child is invited to participate in a research project being conducted by Grace Heymsfield, a student, and Dr. Cynthia Moore, a faculty member, in the Department of Food, Human Nutrition, and Hospitality at the University of Arkansas, Fayetteville. The project is a nutrition knowledge survey that will take approximately fifteen minutes to complete. The purpose of this study is to investigate the nutrition knowledge of high school senior students in Northwest Arkansas. This project is funded by the Honors College Research Grant and the Bumpers College Research Fund.

Your child will be asked to complete a survey that consists of 32 items. Of the 32 items, 24 are multiple choice questions regarding nutrition knowledge based on the 2010 Dietary Guidelines for Americans. The Dietary Guidelines for Americans are jointly issued by the Department of Agriculture and the Department of Health and Human Services every five years. The Guidelines are recommendations for healthy diets in Americans ages 2 years and over. The remaining eight items are demographic questions regarding gender, age, ethnicity, level of physical activity, attitude towards eating, medical conditions requiring a special diet, nutritional information sources, and habits of eating out. The survey should take approximately twenty minutes to complete. Your child will participate in the study only one day for one twenty minute period on a date convenient for the school district after the return of your signed consent form.

There are no risks to your child for participating in this study. You may withdraw your child from participation at any time without penalty. There is no penalty for you or your child for not participating. Following your consent, participation of your child in this study remains voluntary. Your child will also be asked to provide assent to participate and may refuse even if you consent. Your child can also refuse to answer any questions and may withdraw from the study at any time without penalty.

Your child will receive no direct benefit from participation in this study, but his/her participation may help us better understand nutrition knowledge of adolescents and effectiveness of nutrition curriculum in schools.

No identifying information will be included in the data your child provides. Your signed consent form, and their assent form, will be kept separate from the data, and nobody will be able to link their responses to them.

If you have any questions about this study, you may contact Grace Heymsfield at gheymsfi@email.uark.edu or Dr. Cynthia Moore at ckm001@email.uark.edu. If you have any questions regarding your rights in this study you may contact the University of Arkansas’ Institutional Review Board Coordinator at the University of Arkansas IRB Office, 120 Ozark Hall, Fayetteville, AR 72701-1201; phone: (479)575-2208. Thank you for your anticipated help in this effort. We know that you are very busy as a parent, but your child’s participation is greatly appreciated!

Grace Heymsfield  Cynthia Moore, Ph.D., RD
Student  Assistant Professor
Department of Food, Human Nutrition, and Hospitality  Department of Food, Human Nutrition, & Hospitality
118 Home Economics Building  118 Home Economics Building
1 University of Arkansas  1 University of Arkansas
Fayetteville, AR 72701  Fayetteville, AR 72701
gheymsfi@email.uark.edu  ckm001@email.uark.edu

I have read the information provided above and all of my questions have been answered. I voluntarily agree to the participation of my child in this study. I will receive a copy of this consent form for my information.

<table>
<thead>
<tr>
<th>Parent / Legal Guardian Signature</th>
<th>Date</th>
<th>Parent / Legal Guardian Signature</th>
<th>Date</th>
</tr>
</thead>
</table>

Name of Child _______________________________
Assent Form for Participation in the
Research Study Entitled Nutrition Knowledge of High School Seniors in Northwest Arkansas

Funding Source: Bumpers College Research Grant
Honors College Research Grant

Principal Investigator: Co-Investigator:
Grace Heymsfield Cynthia Moore, Ph.D., RD
118 HOEC 118 HOEC
1 University of Arkansas 1 University of Arkansas
Fayetteville, AR 72701 Fayetteville, AR 72701
gheymsf@gmail.uark.edu Ckm001@uark.edu

Institutional Review Board
University of Arkansas IRB Office
120 Ozark Hall
Fayetteville, AR 72701-1201
(479)575-2208

What is a research study?
We’re inviting you to participate in a research study to help us discover new information. Research is voluntary: only those who want to participate will be included in the study. This assent form describes the study. We encourage you to discuss your decision with your parents/guardians. They also have to provide their permission for you to enter this research study.

Why is this study being done?
This purpose of this study is to investigate the nutrition knowledge of high school senior students in Northwest Arkansas.

What will happen to me?
You will be asked to complete a survey consisting of 32 items. Of these 32 items, 24 will be multiple-choice questions regarding nutrition. The additional eight questions will be demographic questions. Demographic questions tell us more about you; for example, there will be questions about your age and gender.

What are the good things about being in this study?
There are no benefits directly to you by participating in this study. However, we believe that your participation may help us better understand nutrition knowledge of teenagers and effectiveness of nutrition curriculum in schools.

Will being in the study hurt me?
We do not think that being in the study will have any disadvantages.

Initials: ________ Date: ________
How long will I be in the study?
Your total time commitment for this research study is approximately 20 minutes on one school day.

Do I have other choices?
You can decide not to be in the study at any time.

Will people know that I am in the study?
The people in the school office will know that you are in the study, but they will not discuss your participation anyone else. If they talk about the study or write about it they won’t use your name. If the researchers present the study results or write up the results, they won’t use your name. Your name, assent form, and parental consent form will not be linked to your survey.

Whom should I ask if I have questions?
If you have any questions you can ask Ms. Heymsfield. Remember, you should also discuss your participation with your parents or your guardian.

Is it OK if I say “No, I don’t want to be in the study”? You do not have to participate in this study if you do not want to. If you change your mind once you start the study, you can decide to stop participating.

Other Information
If we learn important new information about this study we will tell you and let you decide if you want to stop being a part of the study.

Do you understand and do you want to be in the study?
I understand. All my questions were answered.
☑ I want to be in the study.
☑ I don’t want to be in the study.

__________________________________________
Your name

__________________________________________  ____________
Your signature Date

__________________________________________  ____________
Signature of person explaining the study Date

Page 2 of 2
SURVEY TO ASSESS THE KNOWLEDGE OF CONVENTIONAL AND UNCONVENTIONAL DIETARY METHODS OF WEIGHT CONTROL

The following questionnaire was developed to assess the knowledge of conventional and unconventional dietary methods of weight control. The term “conventional” in this questionnaire indicates that a diet plan follows the standards set by the Dietary Guidelines for Americans. The term “unconventional” indicates a diet plan that does not follow those standards.

Your participation will assist in research related to what people know about diets. It is important for the purposes of this research that you answer these questions based upon what you know right now. Do not look up any answers or ask anyone for answers.

This assessment will take about 15-20 minutes to complete. There are a total of 24 knowledge questions. These are followed by a few questions about you. Your answers are confidential. Please do not write your name on any of these pages.

General Instructions: Please select the one best answer for questions 1 through 24. It is important that you answer all questions.

1. Eating _____ will help a person to lose weight as fat.
   a. more vitamins and minerals.
   b. fewer dietary supplements.
   c. fewer calories.
   d. more high protein foods.

2. Which milk product contains the most nutrients (for example: calcium) for the fewest calories?
   a. whole milk
   b. low fat milk
   c. 2% milk
   d. fat-free milk

3. Which type of meat contains the most nutrients (for example: iron) for the fewest calories?
   a. sirloin steak
   b. prime rib
   c. ground beef patty
   d. meat loaf

4. A 3 ounce portion of meat, chicken, or fish is about the size of
   a. 3 dice.
   b. a golf ball.
   c. a deck of cards.
   d. a baseball.
5. If a person eats or drinks 100 fewer calories a day than he needs, he can lose about
   a. 1 pound in a day.
   b. 1 pound in a week.
   c. 10 pounds in a week.
   d. 1 pound in a month.

6. Consuming foods that are high in _____ will make a person feel full with fewer calories.
   a. protein
   b. fiber
   c. sugars
   d. fat

7. If a person ate the same weight in grams of each of the following, which would provide the most
   calories?
   a. fat
   b. carbohydrate
   c. protein
   d. alcohol

8. Which of the following is usually true of conventional weight loss diets?
   a. High protein foods may be eaten in unlimited amounts.
   b. Eating a variety of foods and being physically active are emphasized.
   c. Some foods are considered bad and should not be eaten.
   d. Promises fast weight loss.

9. A conventional diet
   a. has rules about separating or combining specific foods.
   b. focuses only on foods eaten and not behavior changes.
   c. warns you to follow the diet, or certain stages of it, for limited amounts of time.
   d. is based on a large amount of scientific research.

10. Conventional diets
    a. are low in fiber.
    b. are not boring to follow long-term.
    c. result in rapid weight loss.
    d. lack key nutrients.

11. An example of a low-fat snack food would be
    a. potato chips.
    b. trail mix.
    c. microwave popcorn.
    d. peanut butter crackers.

12. Based on a 2000 calorie diet, the average American adult should consume at least ___ cup(s) of
    fruit per day.
    a. 1
    b. 2
    c. 3
    d. 4
13. Based on a 2000 calorie diet, the average American adult should consume at least ___ cup(s) of vegetables per day.
   a. 1
   b. 2 ½
   c. 3 ½
   d. 5

14. The average American adult should consume ___ as whole grains (for example: whole wheat bread, oatmeal) every day.
   a. at least ¼ of total grains
   b. at least ½ of total grains
   c. at least ⅔ of total grains
   d. all grains

15. The average American adult should consume ___ milk products or equivalent milk products (for example: calcium-fortified soy milk) daily.
   a. only fat-free
   b. mostly low-fat and fat-free
   c. only low-fat
   d. mostly high fat

16. The average American adult should consume at least ___ cup(s) of milk products or equivalent milk products daily.
   a. ½
   b. 1
   c. 2
   d. 3

17. One should eat dark green vegetables (for example: greens, broccoli) at least
   a. once a month.
   b. once a week.
   c. several times a week.
   d. every day.

18. One should eat deep orange vegetables (for example: carrot, winter squash) at least
   a. once a month.
   b. once a week.
   c. several times a week.
   d. every day.

19. One should eat legumes (for example: pinto beans, black-eyed peas) at least
   a. once a month.
   b. once a week.
   c. several times a week.
   d. every day.
20. One should eat starchy vegetables (for example: potato, corn) at least
   a. once a month.
   b. once a week.
   c. several times a week.
   d. every day.

21. If a person were to follow a diet plan for a long period of time that limited fruits and
    vegetables, which nutrients might he be lacking?
   a. vitamins A and C
   b. zinc and vitamin E
   c. iron and calcium
   d. niacin and riboflavin

22. A diet plan that is low enough in carbohydrate to cause ketosis makes a person
   a. build more muscle.
   b. break down muscle to provide glucose.
   c. lose large amounts of fat.
   d. need less water or fluids.

23. A diet plan that is high in protein is usually
   a. expensive.
   b. high in fiber.
   c. low in fat.
   d. high in antioxidant vitamins (for example: A and C).

24. Which diet plan has the greatest long-term success at keeping weight off?
   a. low carbohydrate, high protein diet
   b. very low calorie liquid diet
   c. gradual changes to lower fat and calories
   d. raw foods diet

Please tell a little about yourself by answering questions 25-32.

25. What is your gender?
   a. male
   b. female

26. How would you describe yourself?
   a. American Indian or Alaska Native
   b. Asian
   c. Black or African American (not Hispanic)
   d. Hispanic or Latino
   e. Native Hawaiian or other Pacific islander
   f. White (not Hispanic)
   g. Other
27. How old were you on your last birthday? (Example: 18 years)
_________________________________________ years

28. Which statement best describes your daily thoughts about eating? (Please answer all that apply).
   a. I consciously think about everything I eat.
   b. I plan out what I eat.
   c. I try to think about what is healthy to eat, but do not let that determine everything I eat.
   d. I eat what is convenient at the time.
   e. I eat whatever sounds good at the time.
   f. I do not consciously think about what I eat.
   g. Other (please list) ____________________________________________

29. Have you ever followed a special diet for a medical condition?
   a. Yes
   b. No

30. Where do you get most of your information about dieting and nutrition? (indicate all that apply)
   a. family
   b. friends
   c. television
   d. dietitian
   e. doctor
   f. nurse
   g. internet
   h. magazines
   i. peer-reviewed research journals
   j. books
   k. textbooks
   l. food and/or product advertisements
   m. other (please list) ____________________________________________

31. How often do you eat out? (This includes times that you eat out with your family.)
   a. I do not eat out.
   b. 1-6 times per week.
   c. daily
   d. more than 7 times per week.

32. Which of the following best describes your level of physical activity on a typical day?
   a. Only light physical activity typical of a normal day
   b. Between 30 minutes and less than an hour of physical activity
   c. An hour or more of physical activity per day

The end—thanks for your time!
February 5, 2014

MEMORANDUM

TO: Grace Heymsfield  
    Cynthia Moore

FROM: Ro Windwalker  
      IRB Coordinator

RE: PROJECT MODIFICATION

IRB Protocol #: 13-09-070

Protocol Title: Nutrition Knowledge of High School Senior Students in Northwest Arkansas

Review Type: ☑ EXCPEITED ☐ EXEMPT ☐ FULL IRB

Approved Project Period: Start Date: 02/05/2014 Expiration Date: 09/07/2014

Your request to modify the referenced protocol has been approved by the IRB. This protocol is currently approved for 190 total participants. If you wish to make any further modifications in the approved protocol, including enrolling more than this number, you must seek approval prior to implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

Please note that this approval does not extend the Approved Project Period. Should you wish to extend your project beyond the current expiration date, you must submit a request for continuation using the UAF IRB form “Continuing Review for IRB Approved Projects.” The request should be sent to the IRB Coordinator, 210 Administration.

For protocols requiring FULL IRB review, please submit your request at least one month prior to the current expiration date. (High-risk protocols may require even more time for approval.) For protocols requiring an EXPEDITED or EXEMPT review, submit your request at least two weeks prior to the current expiration date. Failure to obtain approval for a continuation on or prior to the currently approved expiration date will result in termination of the protocol and you will be required to submit a new protocol to the IRB before continuing the project. Data collected past the protocol expiration date may need to be eliminated from the dataset should you wish to publish. Only data collected under a currently approved protocol can be certified by the IRB for any purpose.

If you have questions or need any assistance from the IRB, please contact me at 210 Administration Building, 5-2208, or irb@uark.edu.