

EVALUATION OF A NUTRITION AND PHYSICAL ACTIVITY-BASED CURRICULUM
ON CHILDREN'S LIFESTYLE CHOICES

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ABSTRACT

This study assessed the effectiveness of the “On the Move to Better Health” program, specifically whether it promoted 4th to 6th grade North Dakota students, as well as their families, to make healthier lifestyle choices. “On the Move,” NDSU Extension Service’s five-lesson nutrition and physical activity-based public health intervention program, was taught in 211 elementary school classrooms throughout North Dakota. Both students and parents were given presurveys at the beginning of the program and postsurveys at the end. Students increased their fruit intake, vegetable intake, and amount of time spent being physically active over the course of the 5-week program. They also decreased their sugary beverage consumption and time spent being sedentary. This study also examined parental involvement in the “On the Move” program. Most parents found the “On the Move” family newsletters helpful and informative. Additionally, parents reported their children increased consumption of fruits and vegetables after the program.

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CHAPTER 1: INTRODUCTION

The issue of child overweight and obesity has become a major health problem and public health concern in the United States (Centers for Disease Control and Prevention (CDC), 2015; Ogden, Carroll, Kit, & Flegal, 2014; Janssen et al., 2005). In fact, the United States ranks second for the highest prevalence of overweight children (25.1%), falling short only to Malta (Janssen et al., 2005). A more recent study found an even higher prevalence of overweight youth; nearly 32% of youth were categorized as either overweight or obese, with over half of this percentage (16.9%) being obese (Ogden et al., 2014). Ogden et al. (2014) also reported that according to the 2011-2012 National Health and Nutrition Examination Survey (NHANES) data, these percentages have plateaued since the 2003-2004 survey, but are much higher than they were in the 1980's. While national percentages have plateaued in recent years, the prevalence of overweight and obese youth in North Dakota has risen. According to the North Dakota Compass (2016), 35.8% of North Dakota youth are classified as overweight or obese, with 15.4% of these being obese. In 2007, only 25.7% of youth were classified as overweight or obese, showing a 10% increase over four years (North Dakota Compass, 2016). The prevalence of obesity for both North Dakota and the United States remains high, which is a major concern for public health officials.

One major lifestyle trend related to obesity is the amount of time spent in sedentary and physical activities (PA). Studies have found that children spend more time being sedentary than they do being physically active (Basterfield et al., 2011; Herman, Sabiston, Mathieu, Tremblay, & Paradis, 2014). In fact, children spent 45% of their waking hours, totaling approximately six hours per day, engaged in sedentary behaviors. Meanwhile, only 46% of boys and 15% of girls reached the recommended 60 minutes of moderate to vigorous physical activity (MVPA) per day

(Herman et al., 2014). Basterfield et al. (2011) also found low physical activity levels among children, including slight decreases in activity during a two-year time period. Initially, only 6.4% of children reached the recommended 60 minutes of MVPA, averaging only 26 minutes per day. After two years, only 5.7% of children were active for 60 minutes or more per day, with an average of 24 minutes. With these decreases in physical activity, concomitant increases in sedentary behaviors were also observed (Basterfield et al., 2011). Furthermore, overweight or obese children are more sedentary than their normal weight peers, averaging approximately 18 more sedentary minutes per day and many are not meeting the PA guidelines (Herman et al., 2014). These results indicate strong evidence that a high amount of sedentary behavior and low amount of PA are correlated with the prevalence of childhood obesity. Therefore, further issues could arise if children continue replacing physical activity with sedentary behavior.

Unhealthy dietary patterns are another lifestyle trend contributing to childhood obesity. Many children are in positive energy balance, meaning their caloric intake is greater than their energy expenditure (Troiano, Briefel, Carroll, & Bialostosky, 2000). This is likely due to children consuming high amounts of fats and empty calories (solid fats and added sugars). Approximately 40% of total energy being consumed by children was from empty calories, which is much higher than the recommended daily allowance of 8-20% of total energy coming from empty calories (Reedy & Krebs-Smith, 2010). Similarly, children consumed 33-34% of their total energy from fats, which exceeds the dietary recommendations of 30% or less of total energy coming from fats (Troiano et al., 2000). Both Troiano et al. (2000) and Reedy & Krebs-Smith (2010) found that beverages contributed largely to children's total energy intake, reporting 20-24% and 21.4%, respectively. These percentages are alarmingly high, and a reduction in

children's consumption of high-fat and high-sugar foods and beverages is likely necessary to decrease childhood obesity.

With the prevalence of children classified as overweight or obese being so high, targeting public health interventions increasing PA and healthy food choices at young age groups is important (Basterfield et al., 2011; Boumtje, Huang, Lee, & Lin, 2005; Cunningham, Kramer, & Narayan, 2014; Epstein et al., 1995; Herman et al., 2014; Reedy & Krebs-Smith, 2010; Troiano et al., 2000). These interventions should focus on increasing physical activity and reducing sedentary activities that children partake in (Boumtje et al., 2005; Epstein et al., 1995; Herman et al., 2014; Troiano et al., 2000). Specifically, reducing access to screen time, such as television viewing, may be an important factor in reducing the prevalence of childhood obesity (Epstein et al., 1995; Herman et al., 2014). Public health interventions also should focus on promoting healthful eating and reducing consumption of fats, sugars, and low-nutrient energy sources (Boumtje et al., 2005; Reedy & Krebs-Smith, 2010; Troiano et al., 2000). Targeting beverage consumption is especially important. Children should be educated on the health benefits of limiting soft drinks and replacing these sugary beverages with nutrient-dense alternatives such as low-fat milk (Boumtje et al., 2005; Troiano et al., 2000). Implementing public health interventions in schools (Janssen et al., 2005; Reedy & Krebs-Smith, 2010; Troiano et al., 2000), as well as encouraging parental involvement (Boumtje et al., 2005), may be especially helpful in decreasing childhood obesity.

In recent years, many physical activity and nutrition policies and programs have been implemented across the United States. However, research on their effectiveness is limited and conflicting. An analysis of 15 school-based physical activity intervention programs found no significant differences between intervention and control groups for any body composition

measurements, including body mass index (BMI) (Harris, Kuramoto, Schulzer, & Retallack, 2009). However, an analysis of seven school-based nutrition intervention programs found increases, ranging from 15% to 36%, in fruit and vegetable intake between intervention and control groups in six of the seven programs (Howerton et al., 2007). Additionally, lower BMIs were associated with regular participation in the School Breakfast Program, but no changes in BMI were found for those participating in the National School Lunch Program (Gleason & Dodd, 2009). Because research on physical activity and nutrition intervention programs is limited and contradictory, further research is necessary to evaluate and understand the effectiveness of various intervention programs. The current study assessed the effectiveness of the “On the Move to Better Health” program, which is a physical activity and nutrition-based program, and whether it promoted 4th to 6th grade students across the state of North Dakota to make healthier lifestyle choices. Therefore, the current study was important to add to the literature on the effectiveness of physical activity and nutrition-based public health intervention programs.

Statement of the Problem and Purpose of the Study

Childhood obesity is a major health problem that needs to be addressed. The literature clearly suggests that public health interventions aimed at decreasing childhood obesity should be implemented in schools and should promote an increase in physical activity and decrease in sedentary activity. They also should promote healthful dietary choices, such as limiting the consumption of fats and sugars and increasing the consumption of fruits and vegetables. Although many physical activity and nutrition programs are currently being implemented, research on their effectiveness is limited and conflicting. Previous analysis of the “On the Move to Better Health” program, a nutrition and physical activity-based public health intervention

program, reports improvements in children's lifestyle choices. However, analysis of more recent "On the Move" data is necessary to evaluate the program's current success. Further, evaluation of the family aspect of the "On the Move" program is lacking.

Therefore, the purpose of this study was to assess the effectiveness of the "On the Move to Better Health" program, specifically whether it promoted 4th to 6th grade students across the state of North Dakota, as well as their families, to make healthier lifestyle choices. Additionally, this study aimed to assess parental involvement in the "On the Move" program and whether parents found the "On the Move" family newsletters helpful and informative. This was accomplished via a 5-week quantitative study consisting of five "On the Move" lessons, which are nutrition and physical activity-based, evaluated by pre- and post-surveys of both children and parents. Lessons and surveys were implemented in 211 public and private elementary school classrooms across the following North Dakota counties: Barnes, Benson, Bowman, Burleigh, Cass, Cavalier, Dunn, Emmons, Grand Forks, Kidder, McHenry, McLean, Mercer, Morton, Pierce, Ramsey, Ransom, Richland, Rolette, Sargent, Stutsman, and Ward. The independent variable being examined in this study was the "On the Move" curriculum being taught, while the dependent variables being examined were the survey items measuring self-reported lifestyle knowledge and behaviors related to physical activity and dietary habits.

Research Questions

This study investigated the following research questions:

- Does the “On the Move to Better Health” program, a 5-week nutrition and physical activity-based curriculum, promote healthier lifestyle choices in 4th to 6th grade students across the state of North Dakota?
 - Will students increase their fruit and vegetable intake over the 5-week period after learning about the health benefits these foods provide?
 - Will students decrease the amount of sugary beverages and empty calorie foods they consume?
 - Will students decrease the amount of time they spend doing sedentary activities and increase the amount of time they spend doing physical activities after learning how important physical activity is for a healthy lifestyle?
- Do students’ parents find the weekly “On the Move” family newsletters helpful and informative?
- Are families making healthier lifestyle choices over the course of the 5-week program?

Hypotheses

We hypothesized that implementing the “On the Move to Better Health” program would promote healthier lifestyle choices in 4th to 6th grade North Dakota students over a 5-week period. Specifically, students would increase their fruit and vegetable intake and decrease their sugary beverage and empty calorie foods intake, as well as decrease the amount of time they spent doing sedentary activities and increase the amount of time they spent doing physical activities. Similarly, we hypothesized that families would make healthier lifestyle choices after receiving family newsletters over the course of the 5-week program.

Limitations

There were several limitations to this study. First, the “On the Move” curriculum is only taught in 22 of North Dakota’s 53 counties, so a large portion of North Dakota students were not included in the sample. Secondly, because all surveys were anonymous and attendance was not taken at lessons, we were unable to know if or which students missed “On the Move” lessons or were absent for survey days. Therefore, we were unable to exclude these students’ responses from final data analysis. This study used self-report to collect survey data from students. Because children may not have been completely truthful when self-reporting (some may have over reported while others may have under reported), there is a possibility that this method may have slightly skewed results. Finally, the “On the Move” pre- and postsurveys have not been tested for reliability and validity, which posed another limitation.

Definition of Terms

Body mass index (BMI) is calculated by dividing an individual’s weight (in kilograms) by their height squared (in meters).

BMI-for-age is used to categorize children into the following weight classes: underweight, normal or healthy weight, overweight, and obese. Because BMI is age- and sex-specific for children and teens, BMI-for-age is used to determine a child’s weight status based on charts and percentiles for that child’s age and sex (CDC, 2015).

Centers for Disease Control and Prevention (CDC) Growth Charts are used to compare a child’s BMI-for-age to other children of the same age and sex, which places them into a percentile and determines the child’s weight status.

Childhood obesity is defined as a BMI-for-age at or greater than the 95th percentile.

Children classified as healthy or normal weight is defined as a BMI-for-age at the 5th percentile to less than the 85th percentile.

Children classified as overweight is defined as a BMI-for-age at the 85th percentile to less than the 95th percentile.

Children classified as underweight is defined as a BMI-for-age less than the 5th percentile.

Incidence is the number of people who suffer from a health-related condition or develop a disease over a certain period of time (Harvard School of Public Health, 2012).

Prevalence is the number of people who have a health-related condition or disease at a certain period of time, and is typically reported as a percentage of the population (Harvard School of Public Health, 2012).

CHAPTER 2: REVIEW OF LITERATURE

Obesity, especially childhood obesity, has become a major health problem and concern in the United States (Ogden et al., 2014; Janssen et al., 2005). In fact, according to Janssen et al. (2005), the United States ranks second for the highest prevalence of obesity (6.8%) and prevalence of overweight children (25.1%), falling short only to Malta in both incidences. A more recent study by Ogden et al. (2014) found an even higher prevalence of obesity and prevalence of overweight youth. The prevalence of obesity for U.S. adults was 34.9%, while 31.8% of youth were either overweight or obese and over half of this percentage (16.9%) being obese (Ogden et al., 2014). According to the 2011-2012 National Health and Nutrition Examination Survey (NHANES) data used in Ogden's study, these percentages have plateaued since the 2003-2004 survey, but are much higher than they were in the 1980's. For example, there was no significant change in prevalence of youth obesity between the 2003-2004 NHANES survey and the 2011-2012 NHANES survey (Ogden et al., 2014).

While national percentages have plateaued in recent years, the prevalence of overweight and obese youth in North Dakota has risen. According to the North Dakota Compass (2016), 35.8% of youth are classified as overweight or obese, with 15.4% of these being obese. In 2007, only 25.7% of youth were classified as overweight or obese, showing a 10% increase over four years (North Dakota Compass, 2016). The prevalence of obesity for both North Dakota and the United States remains high. In this review, the definition of obesity, some of the trends in children's lifestyle choices, possible explanations relating to childhood obesity, strategies that may be effective for preventing or treating childhood obesity, and current public health intervention programs will be discussed.

Definition of Obesity

Obesity is defined by predetermined weight classes. These weight classes are established by evaluating the accumulation of fat in adipose tissue, which is essentially excess energy that is stored as body fat and is a result of caloric intake exceeding energy expenditure (Boumtje et al., 2005). The most commonly used way to classify body weight status is by using body mass index (BMI), which is a person's body weight in kilograms divided by his or her height squared in meters (Boumtje et al., 2005). According to the Centers for Disease Control and Prevention (CDC) (2012), weight classes for adults are categorized as follows: a BMI less than 18.5 is considered underweight, a BMI between 18.5 and 24.9 is considered normal or healthy weight, a BMI between 25.0 and 29.9 is considered overweight, and a BMI of 30.0 or higher is considered obese.

However, obesity is defined differently for children than adults. While BMI is still used to classify children into weight classes, children's body weights and heights are compared to growth charts developed by the CDC based on their age and gender (Boumtje et al., 2005). According to the CDC (2015), children fall into age- and sex-specific percentiles for BMI, which are classified as follows: BMI-for-age less than the 5th percentile is considered underweight, BMI-for-age at the 5th percentile to less than the 85th percentile is considered normal or healthy weight, BMI-for-age at the 85th percentile to less than the 95th percentile is considered overweight, and BMI-for-age at or greater than the 95th percentile is considered obese. Children are placed into these percentiles by comparing their personal BMI to other children's BMIs of the same age and gender.

Trends in Children's Lifestyle Choices

Sedentary Behavior and Physical Activity

One major lifestyle trend related to obesity is the amount of time spent doing sedentary activities and the amount of time spent being physically active. Studies by Basterfield et al. (2011) and Herman et al. (2014) have found that children spend more time being sedentary than they do being physically active. According to Herman et al. (2014), children spent 45% of their waking hours, totaling approximately six hours per day, engaging in sedentary behaviors. Meanwhile, only 46% of boys and 15% of girls reached the recommended 60 minutes of moderate to vigorous physical activity (MVPA) per day (Herman et al., 2014). Basterfield et al. (2011) also found low physical activity levels among children, including slight decreases in activity throughout a two-year time period. Initially, only 6.4% of children reached the recommended 60 minutes of moderate to vigorous physical activity, averaging only 26 minutes per day. After two years, only 5.7% of children were active for 60 minutes or more per day, with an average of 24 minutes. With these decreases in physical activity, increases in sedentary behaviors also were observed (Basterfield et al., 2011).

Furthermore, overweight or obese children are more sedentary and less active than their normal weight counterparts, clocking about 18 more sedentary minutes per day, and many not meeting the physical activity guidelines (Herman et al., 2014). A study by Kemp and Pienaar (2011) found that overweight children met the recommended 60 minutes of physical activity per day, but obese children did not. These results display strong evidence that a high amount of sedentary behavior and low amount of physical activity are correlated to the prevalence of childhood obesity, and further issues could arise if children continue replacing physical activity with sedentary behavior.

Dietary Patterns

Unhealthy dietary patterns are another lifestyle trend contributing to childhood obesity. Many children are in positive energy balance, meaning their caloric intake is greater than their energy expenditure (Troiano et al., 2000). This is likely due to children consuming high amounts of fats and empty calories. Reedy and Krebs-Smith (2010) found that approximately 40% of total energy being consumed by children was from empty calories, such as solid fats and added sugars, which is much higher than the recommended daily allowance of 8-20% of total energy coming from empty calories. Similarly, Troiano et al. (2000) reported that children consumed 33-34% of their total energy from fats, which exceeds the dietary recommendations stating that less than 30% of total energy should come from fats. The major sources of energy containing fats were pizza, grain desserts (cakes, cookies, donuts, etc.), whole milk, regular cheese, and fatty meats (Reedy & Krebs-Smith, 2010). Both Troiano et al. (2000) and Reedy and Krebs-Smith (2010) found that beverages contributed largely to children's total energy intake, reporting 20-24% and 21.4%, respectively. Sugar-sweetened beverages were the largest contributor to empty calories, totaling 22% (Reedy & Krebs-Smith, 2010). These percentages are considerably high, and a shift away from children's consumption of high-fat and high-sugar foods and beverages is likely necessary to decrease childhood obesity.

Possible Explanations of Childhood Obesity

Physiological Constraints

The literature reports several possible explanations for childhood obesity and its prevalence. One thought is that obese children are partaking in more sedentary activities rather than physical activities due to physiological constraints, such as the burden of a heavy body weight (Epstein, Paluch, Coleman, Vito, & Anderson, 1996; Kemp & Pienaar, 2011). A heavy

body weight can cause discomfort or pain during physical activity (Kemp & Pienaar, 2011), so obese children may be straying from physical activities and turning to sedentary activities to avoid being uncomfortable. This lack of physical activity could lead to continued weight gain and the development of further physiological issues, which may be the start of lifelong health consequences.

Psychological Problems

Another explanation could be the influence of psychological problems, which are common in obese children (Epstein et al., 1996). Epstein et al. (1996) found that children's psychological problems were correlated to their measured accelerometer activity, providing evidence that high or low activity levels could be a symptom of certain psychological problems. For example, a child with attention deficit disorder may have a high activity level, whereas a child with depression may have a low activity level (Epstein et al., 1996). Since psychological issues such as depression are common in obese children (Epstein et al., 1996), this could potentially explain why they are less active and more sedentary.

Parental Influence and Involvement

As many children look up to their parents and use their actions as an example, children are likely influenced by their parents' activity and dietary habits, whether good or bad. For example, Epstein et al. (1996) also found that parent psychological problems were correlated to their children's measured accelerometer activity. Comparable to a child facing a psychological problem such as depression, a parent facing such a psychological problem may also have a lower activity level (Epstein et al., 1996). If children are indeed influenced by their parents' actions, this may negatively influence the child to be inactive.

Involvement of Schools

While physical activity and nutrition education are required by many schools, whether these guidelines are followed remains unclear. For example, Story, Nanney, and Schwartz (2009) reported that 70% of U.S. states require elementary, middle, and high schools to teach nutrition as a component in their health curriculum. Further, 83% of school districts have the same requirement (Story et al., 2009). Even with these requirements, the amount of nutrition education offered is restricted, averaging only 3.4 hours per year in elementary schools and 5 hours in middle and high schools (Story et al., 2009). Similarly, according to Schneider, Pestronk, and Jarris (2013) 88% of elementary schools, 80% of middle schools, and 60% of high schools in the United States require physical education. However, the majority of these policies didn't meet the national physical activity guidelines recommended for children (Schneider et al., 2013). Despite the requirement for both physical activity and nutrition education in schools, these policies may not be followed properly, which is a potential problem in regard to childhood obesity.

Strategies for Preventing or Treating Childhood Obesity

Increase Accessibility

One possible intervention for reducing childhood obesity is by reducing the availability of sedentary behaviors and increasing the availability of non-sedentary behaviors. A study by Epstein, Smith, Vara, and Rodefer (1991) found that children typically choose sedentary activities over vigorous activities even when they are equally available and equally rated on Likert scales. However, when access to a sedentary activity was more difficult to obtain, children switched from the sedentary activity to an easily obtainable vigorous activity (Epstein et al., 1991). Similarly, another study by Epstein et al. (1995) found that children chose more active alternatives when access to sedentary activities was limited by increasing the cost of being

sedentary. By reducing sedentary behaviors and substituting them with vigorous activities that require more energy expenditure, negative energy balance will likely increase, leading to weight loss (Epstein et al., 1995)

Eating behavior also has the potential to be modified by altering accessibility (Epstein et al., 1991). Decreasing the availability of food while increasing the availability of nonfood alternatives, such as physical activity, could influence children to consume less calories while also increasing energy expenditure. Further, by decreasing access to unhealthy foods and increasing access to healthy foods, children may be more likely to consume a healthy diet. Hanks, Just, and Wansink (2013) found that 13.4% of students were more likely to take a fruit and 23% of students were more likely to take a vegetable when school lunchrooms increased the convenience and attractiveness of these healthy foods. Further, students increased actual consumption of the fruits and vegetables they took by 18% and 25%, respectively (Hanks, Just, & Wansink, 2013). Both an increase in physical activity and consumption of a healthy diet are important to decrease childhood obesity. Therefore, making these easily accessible, as well as making sedentary behavior and unhealthy foods less accessible, may be important in preventing and treating childhood obesity.

Target Younger Age Groups

Both the prevalence of childhood obesity and adult obesity have become major concerns. A study by Cunningham, Kramer, and Narayan (2014) claims that factors contributing to the course of obesity are established in children by the age of five. Nearly 15% and 12.4% of children entering kindergarten were either overweight or obese, respectively. The prevalence of obesity continued to increase as they aged, reaching 20.8% by the eighth grade. Overweight kindergartners were four times more likely to become obese by the age of 14 than their normal-

weight counterparts (31.8% versus 7.9%). Further, children with a BMI at the 50th percentile of the CDC growth charts had a 6% chance of being obese at age 14, children at the 85th percentile had a 25% chance, children at the 95th percentile had a 47% chance, and children at the 99th percentile had a 72% chance (Cunningham et al., 2014). A study by Ogden et al. (2014) also found that the prevalence of obesity increases as children age, as evidenced by 8% of children two- to five-years old, 17.7% of children six- to eleven-years old, and 20.5% of children twelve- to nineteen-years old being obese. This could be explained by an increase in sedentary behaviors and a decrease in already low levels of physical activity found amongst children as they age (Basterfield et al., 2011). Because the course of obesity and the development of bad habits begin at young ages, it is important to target interventions at younger age groups. Promoting prevention of weight gain is especially important, due to the fact that treating obesity after it's developed is much more difficult, costlier, and less effective than preventing obesity from the start (Boumtje et al., 2005).

Public Health Intervention Programs

With the prevalence of childhood overweight and obesity being so high, targeting public health interventions at young age groups is important (Basterfield et al., 2011; Boumtje et al., 2005; Cunningham et al., 2014). These interventions should focus on increasing physical activity and reducing sedentary activities that children partake in (Boumtje et al., 2005; Epstein et al., 1995; Herman et al., 2014; Troiano et al., 2000). Specifically, Epstein et al. (1995) and Herman et al. (2014) state that reducing access to screen time, such as television viewing, may be an important factor in reducing the prevalence of childhood obesity. Public health interventions also should focus on promoting healthy eating and reducing consumption of fats, sugars, and low-nutrient energy sources (Boumtje et al., 2005; Reedy & Krebs-Smith, 2010; Troiano et al., 2000).

Targeting beverage consumption is especially important. Children should be educated on the health benefits of limiting soft drinks and replacing these sugary beverages with nutrient-dense alternatives such as low-fat milk (Boumtje et al., 2005; Troiano et al., 2000). According to Janssen et al. (2005), Reedy and Krebs-Smith (2010) and Troiano et al. (2000), implementing public health interventions in schools, as well as encouraging parental involvement (Boumtje et al., 2005), may be especially helpful in decreasing childhood obesity.

Physical Activity Policies and Programs

In recent years, many physical activity policies and programs have been implemented across the United States. A meta-analysis study by Harris et al. (2009) analyzed 15 physical activity intervention studies, in which the interventions took place in a school setting during class time. BMI was measured, as well as other body composition measurements (percent body fat, waist circumference, waist-to-hip ratio, skinfold measurements, total lean mass, and total fat mass), but there were no significant differences between intervention and control groups for any of these measurements, suggesting these PA interventions were ineffective (Harris et al., 2009). Similarly, a systematic review by Brown and Summerbell (2008) found that out of 15 PA intervention studies, only five showed decreases in BMI between the intervention group and the control group. On the other hand, Brown and Summerbell (2008) also reported lower BMIs between intervention and control groups in nine out of 20 physical activity and nutrition intervention programs, suggesting that the combination of the two may be the best way to maximize intervention program effectiveness.

Nutrition Policies and Programs

Many nutrition policies and programs also have been implemented across the United States. A meta-analysis study by Howerton et al. (2007) looked at seven studies involving

nutrition-based intervention programs targeting school-aged children. All of the intervention programs took place in school classrooms, and five of the seven incorporated a family aspect. Of the seven studies, six found significant increases, ranging from 15% to 36%, in fruit and vegetable intake between intervention and control groups. Additionally, approximately 0.45 more servings of fruits and vegetables were consumed by the intervention groups (Howerton et al., 2007). Similarly, Perry et al. (1998) found that implementing a behavior change curriculum, which included involvement of parents, in elementary school classrooms, as well as changing the foods offered at lunchtime to healthier choices, increased consumption of fruits and vegetables. Specifically, fruits consumed during lunch and fruits consumed daily increased among both boys and girls, while vegetables consumed during lunch increased among girls (Perry et al., 1998).

Brownell & Kaye (1982) evaluated a 10-week physical activity and nutrition behavior change program that was implemented in schools. The program aimed to educate obese students and their parents on behavior changes toward a healthful lifestyle. Children were sorted into an intervention group and a control group. While only 21% of children in the control group lost weight, 95% of children in the intervention group lost weight, and intervention group children showed a 15.4% average decrease in percentage overweight (Brownell & Kaye, 1982). Haerens et al. (2006) evaluated the effectiveness of a 2-year physical activity and nutrition intervention program using BMI comparisons. Subjects were assigned randomly to one of three groups: control, intervention, or intervention with parental support. While no significant changes were observed among boys, results showed that among girls in the intervention with parental support group, BMI increased less than in the control group (Haerens et al., 2006).

Gleason and Dodd (2009) examined the School Breakfast Program (SBP) and National School Lunch Program (NSLP) and found that those who regularly participated in the SBP had

lower BMIs. In fact, every one day of participation in the SBP was associated with a 0.15 decrease in BMI. However, there were no significant differences found with the NSLP (Gleason & Dodd, 2009). Farm-to-school programs and school-garden programs, which encourage fruit and vegetable consumption in schools, have gained interest in recent years, and, although research is limited, these programs have shown promise (Story et al., 2009).

A study by Wry (2008) evaluated the effectiveness of the “On the Move to Better Health” program in Fargo, North Dakota. Analysis of student pre-and postsurvey data revealed an increase in students’ knowledge of correct recommendations for cups of fruit, cups of veggies, and cups of milk/dairy products per day (Wry, 2008). Behavior changes over the course of the 5-week program also were analyzed. Wry (2008) found that students increased their intake of fruits and that boys decreased their consumption of sweetened beverages. Results also showed a decrease in screen time for girls (Wry, 2008). Although many nutrition programs, as well as physical activity programs, including “On the Move to Better Health” are currently being implemented, research on their effectiveness is limited and conflicting.

Summary

Childhood obesity is a major health problem that needs to be addressed. The literature clearly suggests that public health interventions aimed at decreasing childhood obesity should be implemented in schools and target younger age groups. Interventions should promote an increase in physical activity and decrease in sedentary activity. Additionally, they should promote healthy dietary choices, such as limiting the consumption of fats and sugars. Although many physical activity and nutrition programs currently are being implemented, research on their effectiveness is limited and conflicting. Previous analysis of the “On the Move to Better Health” program, a nutrition and physical activity-based public health intervention program, reports improvements

in children's lifestyle choices. However, analysis of more recent "On the Move" data is necessary to evaluate the program's current success. Further, evaluation of the family aspect of the "On the Move" program is lacking.

Therefore, the purpose of this study was to evaluate the effectiveness of the "On the Move to Better Health" program. Specific interest included whether "On the Move to Better Health" promoted 4th to 6th grade students, as well as their families, to make healthier lifestyle choices including: an increase in fruit and vegetable intake, a decrease in consumption of sugary beverages and empty calorie foods, and a decrease in the amount of time spent doing sedentary activities and an increase in the amount of time doing physical activities. Additionally, this study aimed to assess parental involvement in the "On the Move" program and whether parents found the "On the Move" family newsletters helpful and informative.

CHAPTER 3: METHODOLOGY

Purpose and Significance

Childhood obesity is a major health problem that needs to be addressed (CDC, 2015; Ogden et al., 2014; Janssen et al., 2005). The literature clearly suggests that public health interventions aimed at decreasing childhood obesity should be implemented in schools (Janssen et al., 2005; Reedy & Krebs-Smith, 2010; Troiano et al., 2000) and should promote an increase in physical activity and decrease in sedentary activity (Boumtje et al., 2005; Epstein et al., 1995; Herman et al., 2014; Troiano et al., 2000). They also should promote healthful dietary choices, such as limiting the consumption of fats and sugars (Boumtje et al., 2005; Reedy & Krebs-Smith, 2010; Troiano et al., 2000). Although many physical activity and nutrition programs currently are being implemented, research on their effectiveness is limited and conflicting (Brown & Summerbell, 2008; Gleason & Dodd, 2009; Harris et al., 2009; Howerton et al., 2007). Previous analysis of the “On the Move to Better Health” program, a nutrition and physical activity-based public health intervention program, reports improvements in children’s lifestyle choices. However, analysis of more recent “On the Move” data is necessary to evaluate the program’s current success. Further, evaluation of the family aspect of the “On the Move” program is lacking.

Therefore, the purpose of this study was to assess the effectiveness of the “On the Move to Better Health” program, specifically whether it promoted 4th to 6th grade students across the state of North Dakota, as well as their families, to make healthier lifestyle choices. Additionally, this study aimed to assess parental involvement in the “On the Move” program and whether parents found the “On the Move” family newsletters helpful and informative. Did students increase their fruit and vegetable intake over the 5-week period after learning about the health

benefits these foods provide? Did they decrease the number of sugary beverages they consumed? Did students decrease the amount of time they spent doing sedentary activities and increase the amount of time they spent doing physical activities after learning how important physical activity is for a healthy lifestyle? Did students' parents find the weekly "On the Move" family newsletters helpful and informative? Did students' families make healthier lifestyle choices over the course of the 5-week program?

Participants

Subjects consisted of 4th to 6th grade students between the ages of 8-13 years from various public and private elementary schools in 22 counties in North Dakota, as well as their parents. Subjects were recruited from 211 classrooms being taught the "On the Move" curriculum from the following North Dakota counties: Barnes, Benson, Bowman, Burleigh, Cass, Cavalier, Dunn, Emmons, Grand Forks, Kidder, McHenry, McLean, Mercer, Morton, Pierce, Ramsey, Ransom, Richland, Rolette, Sargent, Stutsman, and Ward. The student presurvey was completed by 3,144 students with a mean age of 10.21 ± 0.79 years, while the student postsurvey was completed by 2,906 students with a mean age of 10.26 ± 0.79 years. Of those who completed the student presurvey, 43.91% (n=1376) were 4th graders, 50.29% (n=1576) were 5th graders, and the remaining 5.81% (n=182) were 6th graders. Fourth graders comprised 46.75% (n=1352), 5th graders 48.13% (n=1392), and 6th graders 5.12% (n=148) of those who completed the student postsurvey. The percentage of boys and girls who completed the student presurvey was 50.16% (n=1565) and 49.84% (n=1555), respectively, while 50.29% (n=1453) of boys and 49.71% (n=1436) of girls completed the student postsurvey. The parent presurvey was completed by 1,694 participants, and the parent postsurvey was completed by 1,053 participants. Students participated in the "On the Move to Better Health" program as part

of their health curriculum. Students had the ability to win prizes through participation in the program, which served as an incentive. The implementation of “On the Move to Better Health,” the data collection protocol (via pre- and postsurvey) and use associated with the program, and a waiver of signed parental consent was approved by North Dakota State University’s Institutional Review Board (Appendices A & B). Students were read instructions prior to each survey, which included stating that the survey was optional. Students were asked to bring parent surveys home for their parents to complete, were informed that these surveys were optional, and were asked to pass that information along to their parents. Therefore, any student or parent who completed the survey provided implied informed consent. All students who participated in the “On the Move” program were included in the study, given they fit into the designated age group. However, because the surveys were anonymous and given five weeks apart, there was no way to match the surveys or ensure that the same students or parents completed both the presurvey and the postsurvey.

Procedure

Curriculum

“On the Move to Better Health” is a nutrition and physical-activity based curriculum that was originally developed by Cass County Extension and Fargo Cass Public Health and has undergone two major revisions with the release of new dietary guidance. It is a nationally recognized five-week curriculum that promotes healthy lifestyle choices (Ussatis, 2015). The program consists of five lessons taught over the course of five weeks. Each lesson highlights a different healthy lifestyle topic and takes about an hour to complete. Following each lesson, parent newsletters regarding the lesson’s topic are sent home to involve and educate parents on

healthy lifestyle choices. Each parent newsletter also contains a spot for families to set a weekly family goal.

The following lesson descriptions are brief overviews of each lesson.

Lesson 1

Lesson 1 provides students with an overview of the program. Students are given a map of North Dakota and are told they will be able to “walk” around the state (from Bismarck to Bismarck) by doing designated healthy activities (Appendices C & D). These include activities such as “I moved my body for at least 60 minutes today,” “I ate vegetables for a snack today,” “I ate three servings from the dairy group today,” and “I ate breakfast including three food groups today.” For each healthy activity students complete, they get to fill in a circle on the map, bringing them one step closer to the finish line. Students can also earn beads by completing their map. They earn one bead for every five circles, as well as special beads for completing special tasks such as returning their family goals. Each student who has completed their map by the end of the five-week program will be eligible for prize drawings (Garden-Robinson et al., “Lesson One”, 2012).

Lesson 2

Lesson 2 focuses on fruits and vegetables. This lesson highlights the main nutrients found in fruits and vegetables: vitamin C, vitamin A, potassium, fiber and phytochemicals. It also explains what fruits and vegetables are high in these nutrients as well as how many cups of fruits (2 cups) and vegetables (2 ½ cups) children should be consuming each day. To end the lesson, children play “Half Your Plate” Bingo, where the instructor reads off clues about certain fruits and vegetables and students have to guess which fruit or vegetable is correct and then mark it on

their bingo card. Students win a prize for getting a bingo (Garden-Robinson et al., “Lesson Two”, 2012).

Lesson 3

The focus of lesson 3 is physical activity. Instructors explain that physical activity is movement of the body, and it is important for a healthy lifestyle. Students learn about aerobic activity and how it uses more oxygen and increases heart rate, which makes the muscles and heart stronger. Students then do a heart rate activity in which they take their pulse for sixty seconds, do jumping jacks for one minute, then take their pulse again and compare the values. Instructors explain intensity as being a greater amount of work in a shorter amount of time. Instructors also discuss what it means to be sedentary and how students can replace sedentary activities with physical activities as well as the benefits of physical activities. Students are then divided into groups to participate in a scavenger hunt. Each group is given a clue sheet to find letters that are hidden around the school’s playground. They must find all the letters and unscramble them to spell the word “activity”. The first team to finish receives a prize (Garden-Robinson et al., “Lesson Three”, 2012).

Lesson 4

The topic of lesson 4 is healthy snacks and beverages. Instructors begin by explaining the difference between nutrient dense (offering more nutrients for the calories of energy) and empty calories (lots of calories but few nutrients). Instructors then read a story in which a child consumes a large amount of empty calories (soda, candy bars, doughnuts, fries) throughout the day. Students are then asked to identify the empty calorie foods and replace them with nutrient-dense alternatives (pretzels, banana, fat-free milk). To end the lesson, students play “Around the World,” in which they compete against their classmates by answering questions about which of

two foods would be the healthier choice (i.e. ice cream or frozen yogurt; apple or applesauce; soda pop or apple juice) for beads and prizes (Garden-Robinson et al., “Lesson Four”, 2012).

Lesson 5

The final lesson begins by showing “Thundar’s New Game Plan,” a video in which North Dakota State University athletes and NDSU’s mascot Thundar talk about the importance of physical activity and eating a healthy diet. After the video, students play “Eat Smart. Play Hard. Bingo,” during which instructors ask review questions from any of the previous lessons. Students answer the questions and mark the correct answer on their bingo card. Students are eligible to win prizes for getting a bingo. Following bingo, instructors collect the students’ maps and divide them into those who completed the map and those who didn’t. Instructors draw prize winners from the completed maps. Prizes include two Frisbees, two jump ropes, and one kickball (grand prize). All students receive a drawstring gym bag as a participation prize (Garden-Robinson et al., “Lesson Five”, 2012).

Qualifications of Instructors

The “On the Move to Better Health” curriculum was taught by Extension Agents and Assistants, as well as North Dakota State University nutrition and dietetics’ students as a part of their supervised practice experience. Students were trained to teach the curriculum by a professional Extension Agent, which qualified them to teach the “On the Move” program. Pre- and postsurveys were delivered by instructors to the North Dakota State University Extension office (E. Morrow Lebedeff Hall Room 351 and Katherine Kilbourne Burgum Family Life Center Room 307), where data was handled and processed by Extension staff.

Timeline

All data was collected during the 2015-16 academic year. Baseline data was collected during the first “On the Move” lesson and final data was collected during the fifth “On the Move” lesson. Following data collection, data was analyzed at the North Dakota State University Extension office during late fall semester of 2016 and early spring semester of 2017.

Instrumentation

The instruments used for data collection were the “On the Move to Better Health” student presurvey and student postsurvey, and parent presurvey and parent postsurvey (Appendices E, F, G, & H). These surveys were developed by NDSU Extension Agents and Cass County Extension Agents for use with the “On the Move to Better Health” curriculum (Cass County Extension Service, 2016; NDSU Extension Service, 2015). The “On the Move” pre- and postsurveys have not yet been tested for validity and reliability, which was a potential limitation of this study. However, the “On the Move” pre- and postsurvey questions were adapted from the Youth Risk Behavior Surveillance Survey (YRBSS), which was developed by the CDC to measure dietary behaviors (fruit, vegetable and soda intake) and activity levels (physical activity and sedentary behavior) among other things (Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Adolescent and School Health, 2016).

Student Presurvey

At the beginning of lesson 1, students were given a student presurvey to find out what information they already knew or habits they already had. Students were informed that they did not need to put their name on the survey and results would be kept anonymous. Students were instructed to answer the questions to the best of their ability and given as much time as they

needed to complete the survey. After all students had completed the survey, instructors collected them randomly to ensure confidentiality.

The student presurvey contained 15 multiple choice questions. Included were demographic questions, knowledge-based questions, and behavior choice questions. Demographic questions included grade, age, sex, and ethnic origin. Knowledge-based questions were as follows: Fruit should make up about how much of a plate according to recommendations? Vegetables should make up about how much of a plate according to recommendations? How many cups of milk should a boy or girl your age have each day? The remainder of questions were based on behavior and frequency of various healthy choices. Questions asked how many times students ate whole fruit, drank 100% fruit juice and ate vegetables in a day, as well as how many cups of milk and cans of pop students consumed in a day. Additional behavior questions asked how many days in the past week students were physically active for at least 60 minutes and about how many hours per day they spent watching TV or playing video games (Cass County Extension Service, 2016; NDSU Extension Service, 2015).

Student Postsurvey

At the end of lesson 5, students were given a student postsurvey containing 22 multiple choice questions. The first 15 questions were the same as given on the student presurvey. The additional 7 questions regarded students' behavior changes toward healthier choices after being taught the 5-week "On the Move to Better Health" curriculum. They were asked if they increased, decreased or maintained the amount of fruits and vegetables they consumed, as well as increased, decreased or maintained the amount of daily time they were physically active during the past month. They were also asked if they drank more milk and ate more dairy, drank less

pop, drank more water, read food labels more often and chose healthier snacks in the past month. Additionally, students were asked if they would participate in the “On the Move” program again and what they liked or disliked about the program. The same procedure for ensuring confidentiality was followed for the student postsurvey as was implemented for the student presurvey (Cass County Extension Service, 2016; NDSU Extension Service, 2015).

Parent Presurvey

At the end of lesson 1, students were given a parent presurvey to bring home and give to their parent/guardian to complete. Students were informed that completion of the survey was optional. They also were informed that they did not need to put their name on the survey and results would be kept anonymous. They were asked to pass this information on to their parent/guardian who completed the survey. Students who returned a completed parent survey received a special bead. Instructors collected the returned surveys randomly to ensure confidentiality.

The parent presurvey contained 18 multiple choice and true/false questions. Included were a demographic question, knowledge-based questions, and behavior choice questions. The demographic question asked how many adults and children were in the household. Knowledge-based questions were: Fruit should make up about how much of a place according to recommendations? Vegetables should make up about how much of a place according to recommendations? How many cups of milk/dairy products are recommended for your child per day? The remainder of questions were based on behavior and frequency of, as well as thoughts on, various healthy choices. Questions asked parents how many times their child consumed fruit in a day, how many times their child consumed vegetables in a day, and how many cups of milk/dairy products their child consumed in a day. Parents were asked whether their child

consumed more whole fruit or 100% fruit juice, as well as if their family consumed more whole fruit or 100% fruit juice. They were asked if sugary beverages (soda, fruit-flavored beverages, sports drinks, etc.) were offered in their home, and, if so, how many cans/glasses their child drank per day. They also were asked how many times their family ate meals together per week and which meal (breakfast, lunch, dinner) they ate together most frequently. Additional questions asked parents if their child had snack foods available to them, whether their child chose his/her own snack foods, and what snack foods he/she chose for him/herself, as well as what snack foods they (as a parent) chose for their child. Finally, parents were asked to answer true or false to the following statements: Fruits and vegetables take too much time to prepare. Fruits and vegetables cost too much. We don't like fruits. We don't like vegetables. Fruits and vegetables upset our stomachs. Dairy products take too much time to prepare. Dairy products cost too much. We don't like dairy products. Dairy products upset our stomachs (Cass County Extension Service, 2016; NDSU Extension Service, 2015).

Parent Postsurvey

At the end of lesson 4, students were given a parent postsurvey, consisting of 24 multiple choice and true/false questions, to bring home and give to their parent/guardian to complete. The first 18 questions were the same as given on the parent presurvey. The additional 6 questions regarded parents' participation in the family aspect of the "On the Move to Better Health" program, as well as behavior changes towards healthier choices within their family over the past month. Parents were asked if they completed the parent presurvey, read the newsletters that were sent home with their child and whether or not they found the newsletters informative/helpful, and if they set and completed family goals each week. They also were asked if the following behaviors increased, decreased, or stayed the same over the past month: family's consumption of

fruit, family's consumption of vegetables, family's consumption of milk/dairy products, and family's consumption of whole grains. The same procedure for ensuring confidentiality was followed for the parent postsurvey as was implemented for the parent presurvey. Similarly, students who returned a parent postsurvey received a special bead (Cass County Extension Service, 2016; NDSU Extension Service, 2015).

Analysis

Survey data was entered into a secured SPSS Statistics (version 24.0; IBM Corporation, Armonk, NY) spreadsheet by Extension employees trained in data entry. Data was then imported into SAS Analytics (version 9.4; SAS Institute Inc., SAS Campus Drive, Cary, NC) for analysis. Frequencies were reported using mean \pm standard deviation, as well as summary statistics of frequencies and percentages, for overall data. Two-sample t-tests were used to compare mean values between presurvey and postsurvey for both the student and parent surveys. A Cohen's d statistic was used to determine the effect size following the two-sample t-tests. The effect size was interpreted as follows: $d=0.20$ indicated a small effect, $d=0.50$ a medium effect, and $d=0.80$ a large effect. Chi-square tests were used to compare differences in responses from student presurvey to student postsurvey, as well as parent presurvey to parent postsurvey. Significance value was set at $p < 0.05$.

CHAPTER 4: RESULTS

The “On the Move” student pre- and postsurveys were used to determine behavior changes among 4th to 6th grade students over the course of the 5-week “On the Move to Better Health” program. The focus areas include: fruit and vegetable consumption, sugary beverage consumption, and time spent sedentary or physically active. Questions five and eight on the presurvey and postsurvey, as well as question 16 on the postsurvey, assessed changes in fruit and vegetable consumption. Question 12 on the presurvey and postsurvey, as well as question 17 on the postsurvey, were used to determine changes in the consumption of sugary beverages. Questions 13 and 14 on the presurvey and postsurvey, as well as question 18 on the postsurvey, were used to measure differences in time spent participating in sedentary behaviors and time spent participating in physical activities.

An additional interest of this study regarded parental perceptions of the “On the Move” family newsletters and whether or not families made behavior changes over the course of the program. The “On the Move” parent pre- and postsurveys were used to evaluate these factors. Question two on the postsurvey was used to determine if students’ parents read the family newsletters that were sent home with their children and if they found them helpful and informative. Family behavior changes focused on fruit and vegetable consumption, as well as sugary beverage consumption. Questions five and nine on the presurvey and questions four, nine, and 13 on the postsurvey were used to determine changes in families’ fruit and vegetable consumption. Question 14 on the presurvey and question 18 on the postsurvey assessed changes in families’ consumption of sugary beverages.

Changes in Students' Behavior and Lifestyle Choices

Fruit and Vegetable Intake

Both the student pre- and postsurvey asked, “How many times did you eat whole fruit yesterday?” This question was used to assess students’ daily intake of fruits at baseline (N=3124) and at the end of the “On the Move” program (N=2872). According to MyPlate recommendations, children 9-13 years of age should consume at least 1 ½ cups of fruit daily (ChooseMyPlate.gov, 2016). Therefore, the desired response for this question was two times. At baseline, participants reported consuming fruit an average of 1.91 ± 1.36 times daily (Table 1). After the program, the mean times fruit was consumed daily increased to 2.17 ± 1.32 times. There was a significant difference between pre- and postsurvey means ($p < 0.0001$), and the effect size indicated a small effect ($d=0.20$). At baseline, 28.39% (n=887) of participants reported consuming fruit two times daily, and 30.47% (n=875) reported consuming fruit two times daily at the end of the program (Table 2). Further, the number of participants who consumed fruit two or more times per day increased from 58.6% (n=1831) at baseline to 69.22% (n=1988) at the end of the program. There was a significant difference between pre- and postsurvey responses ($p < 0.0001$).

Table 1

Changes in mean values from student presurvey to student postsurvey

| | Units | Presurvey ¹ | Postsurvey ¹ | Change ² | Effect Size ³ |
|--------------------------|----------------|------------------------|-------------------------|---------------------|--------------------------|
| Daily fruit intake | Times eaten | 1.91±1.36 | 2.17±1.32 | 0.27±1.34* | 0.20 |
| Daily vegetable intake | Times eaten | 1.75±1.40 | 1.86±1.35 | 0.11±1.38* | 0.08 |
| Daily soda intake | Sodas consumed | 0.88±1.20 | 0.63±1.04 | -0.22±1.15* | 0.19 |
| Weekly physical activity | Days per week | 4.30±2.20 | 5.14±2.13 | 0.84±2.16* | 0.39 |
| Daily sedentary behavior | Hours | 2.58±1.89 | 2.21±1.74 | -0.37±1.82* | 0.20 |

¹Data presented as mean ± SD²Difference in the mean between presurvey and postsurvey ± pooled SD³Absolute value of difference in the mean divided by pooled SD

*Statistically significant

Table 2

Participants' reported daily intake of fruit

| Times eaten | Presurvey (N=3124) | | Postsurvey (N=2872) | |
|-------------|-----------------------|----------------|------------------------|----------------|
| | Frequency (n) | Percentage (%) | Frequency (n) | Percentage (%) |
| 0 | 511 | 16.36 | 325 | 11.32 |
| 1 | 782 | 25.03 | 559 | 19.46 |
| 2 | 887 | 28.39 | 875 | 30.47 |
| 3 | 549 | 17.57 | 700 | 24.37 |
| 4 | 220 | 7.04 | 233 | 8.11 |
| 5 | 175 | 5.60 | 180 | 6.27 |

The student pre- and postsurvey also asked, “How many times did you eat vegetables yesterday?” This question was used to assess students’ daily intake of vegetables at baseline (N=3131) and at the end of the “On the Move” program (N=2894). MyPlate recommendations state that children between the ages of 9-13 should consume at least two cups of vegetables daily (ChooseMyPlate.gov, 2016). Therefore, two times was the desired answer for this survey question. At baseline, participants reported consuming vegetables a mean of 1.75 ± 1.40 times daily (Table 1). At the end of the program, participants reported consuming vegetables an average of 1.86 ± 1.35 times daily. There was a significant difference between the mean values ($p = .0028$), and the effect size indicated a small effect ($d=0.08$). Participants who reported consuming vegetables two times per day was 24.43% ($n=765$) at baseline and 29.41% ($n=851$) at the end of the program (Table 3). From baseline to the end of the program, participants who consumed vegetables two or more times per day increased from 51.68% ($n=1618$) to 57.26% ($n=1657$). There was a significant difference between pre- and postsurvey responses ($p < 0.0001$).

Table 3

Participants' reported daily intake of vegetables

| Times eaten | Presurvey (N=3131) | | Postsurvey (N=2894) | |
|-------------|-----------------------|----------------|------------------------|----------------|
| | Frequency (n) | Percentage (%) | Frequency (n) | Percentage (%) |
| 0 | 663 | 21.18 | 483 | 16.69 |
| 1 | 850 | 27.15 | 754 | 26.05 |
| 2 | 765 | 24.43 | 851 | 29.41 |
| 3 | 490 | 15.65 | 463 | 16.00 |
| 4 | 178 | 5.69 | 181 | 6.25 |
| 5 | 185 | 5.91 | 162 | 5.60 |

The student postsurvey asked, “During the past month, I did the following...” with the answer options being “increased the amount of fruits and vegetables I ate”, “decreased the amount of fruits and vegetables I ate” or “the amount of fruits and vegetables I ate stayed the same”. This question was used to assess students’ perceived changes in fruits and vegetable consumption over the course of the program. After the program, 51.95% (n=1446) of participants reported increasing their consumption of fruits and vegetables, while 42.98% (n=1213) reported that their fruit and vegetable consumption stayed the same (Table 4).

Table 4

Participants' reported changes in fruit and vegetable consumption over the past month

| | Increased | Decreased | Stayed the same |
|----------------|-----------|-----------|-----------------|
| Frequency (n) | 1446 | 143 | 1213 |
| Percentage (%) | 51.95 | 5.07 | 42.98 |

Sugary Beverage Intake

Both the student pre- and postsurvey asked the question, “How many cans of pop did you drink yesterday? If you did not drink any pop yesterday, how much do you usually drink in a day?” This question was used to assess participants’ daily intake of sugary beverages, specifically soda, at baseline (N=3134) and after the “On the Move” program (N=2888). The desired response was zero cans of pop consumed daily. At baseline, participants reported consuming an average of 0.88 ± 1.20 cans of soda daily (Table 1). At the end of the program, participants reported consuming a mean of 0.63 ± 1.04 cans of soda daily. There was a significant difference between pre- and postsurvey means ($p < 0.0001$), and the effect size showed a small effect ($d=0.19$). The number of participants who reported consuming zero cans of soda daily increased from 48.09% ($n=1507$) at baseline to 60.11% ($n=1736$) at the end of the program (Table 5). There was a significant difference between pre- and postsurvey responses ($p < 0.0001$).

The student postsurvey asked, “During the past month, I did the following: (Circle the letters of all that apply.)” with “drank less soda pop” being one of the options. This question was used to assess participants’ perceived change in soda consumption over the course of the “On the Move” program. At the end of the program, 56.70% ($n=1591$) of participants reported drinking less soda, while 43.40% ($n=1215$) reported drinking the same amount or more soda.

Table 5

Participants' reported daily soda intake

| Sodas consumed | Presurvey (N=3134) | | Postsurvey (N=2888) | |
|----------------|-----------------------|----------------|------------------------|----------------|
| | Frequency (n) | Percentage (%) | Frequency (n) | Percentage (%) |
| 0 | 1507 | 48.09 | 1736 | 60.11 |
| 1 | 1011 | 32.26 | 747 | 25.87 |
| 2 | 369 | 11.77 | 228 | 7.89 |
| 3 | 111 | 3.54 | 91 | 3.15 |
| 4 | 63 | 2.01 | 37 | 1.28 |
| 5 | 21 | 0.67 | 10 | 0.35 |
| 6 | 52 | 1.66 | 39 | 1.35 |

Physical Activity and Sedentary Behavior

The student pre- and postsurvey asked, “During the last week, how many days were you physically active for 60 minutes?” This question was used to assess participants’ weekly physical activity at baseline (N=3129) and at the end of the “On the Move” program (N=2882). The desired response was seven days per week. The mean days per week that participants reported being physically active was 4.30 ± 2.20 days at baseline and increased to 5.14 ± 2.13 days at the end of the program (Table 1). The mean values were statistically significant ($p < 0.0001$) and had a small effect size ($d=0.39$). At baseline, 26.56% ($n=831$) of participants reported being physically active for 60 minutes seven days per week (Table 6). At the end of the program, 45.14% of participants reported being physically active for 60 minutes seven days per week. There was a significant difference between pre- and postsurvey responses ($p < 0.0001$).

The student postsurvey asked, “During the past month, I did the following...” with the response options being “increased the amount of time I am physically active daily”, “decreased the amount of time I am physically active daily” or “the amount of time I was physically active stayed the same”. At the end of the program, 58.87% (n=1669) of participants reported that they increased their daily physical activity, while 35.49% (n=1006) of participants reported that their amount of physical activity stayed the same over the past month (Table 7).

Table 6

Participants’ reported weekly physical activity

| Days per week | Presurvey (N=3129) | | Postsurvey (N=2882) | |
|---------------|-----------------------|----------------|------------------------|----------------|
| | Frequency (n) | Percentage (%) | Frequency (n) | Percentage (%) |
| 0 | 147 | 4.70 | 77 | 2.67 |
| 1 | 244 | 7.80 | 149 | 5.17 |
| 2 | 356 | 11.38 | 223 | 7.74 |
| 3 | 464 | 14.83 | 262 | 9.09 |
| 4 | 419 | 13.39 | 279 | 9.68 |
| 5 | 409 | 13.07 | 338 | 11.73 |
| 6 | 259 | 8.28 | 253 | 8.78 |
| 7 | 831 | 26.56 | 1301 | 45.14 |

Table 7

Participants’ reported changes in daily physical activity over the past month

| | Increased | Decreased | Stayed the same |
|----------------|-----------|-----------|-----------------|
| Frequency (n) | 1669 | 160 | 1006 |
| Percentage (%) | 58.87 | 5.64 | 35.49 |

Both the student pre- and postsurvey asked, “About how many hours, in a usual day, do you spend watching TV and playing computer or video games?” This question was used to assess the amount of time students spend being sedentary daily at baseline (N=3123) and at the end of the program (N=2878). Participants reported spending an average of 2.58 ± 1.89 hours per day watching TV and playing computer/video games at baseline (Table 1). The mean hours per day at the end of the program was 2.21 ± 1.74 hours. There was a significant difference between pre- and postsurvey mean values ($p < 0.0001$), and the effect size indicated a small effect ($d=0.20$). One hour per day was the most commonly reported response in both the pre- and postsurvey, totaling 28.37% (n=886) of participants and 32.84% (n=945) of participants, respectively (Table 8). There was a significant difference between pre- and postsurvey responses ($p < 0.0001$).

Table 8

Participants’ reported daily sedentary behavior (TV, computer or video games)

| Hours | Presurvey (N=3123) | | Postsurvey (N=2878) | |
|-------|-----------------------|----------------|------------------------|----------------|
| | Frequency (n) | Percentage (%) | Frequency (n) | Percentage (%) |
| 0 | 193 | 6.18 | 267 | 9.28 |
| 1 | 886 | 28.37 | 945 | 32.84 |
| 2 | 799 | 25.58 | 743 | 25.82 |
| 3 | 466 | 14.92 | 406 | 14.11 |
| 4 | 279 | 8.93 | 224 | 7.78 |
| 5 | 180 | 5.76 | 96 | 3.34 |
| 6 | 76 | 2.43 | 33 | 1.15 |
| 7 | 244 | 7.81 | 164 | 5.70 |

Parent Participation and Involvement

The parent postsurvey asked, “Did you or another adult in your home read or look over the parent newsletters that were sent home with your fourth- or fifth-grade child?” This question was used to assess parental participation in the “On the Move” program. Of the 1037 participants, 82.84% (n=859) responded “yes” to the question, while 17.16% (n=178) responded “no.” The postsurvey then asked the follow-up question, “If you answered “Yes,” were the parent newsletters helpful in providing new information, ideas and recipes?” Of the 875 participants who responded to the follow-up question, 82.97% (n=726) answered “yes” and 11.43% (n=100) answered “no.” The remaining 5.60% (n=49) answered “doesn’t apply.”

Changes in Family Behavior and Lifestyle Choices

Fruit and Vegetable Intake

The parent pre- and postsurvey asked, “On average, how many times does your child consume fruits per day at home? This would include fruit at meals or snacks.” This question was used to determine children’s consumption of fruits at home or in the family setting at both baseline (N=1683) and at the end of the program (N=1046). The desired response for this question was two times. At baseline, the mean number of times fruit was consumed daily was 1.94 ± 1.13 times (Table 9). At the end of the program, the mean number increased to 2.25 ± 1.15 times. There was a significant difference between pre- and postsurvey means ($p < 0.0001$), and the effect size indicated a small effect ($d=0.28$). At baseline, 36.13% (n=608) of participants reported that their children consumed fruit two times daily, and at the end of the program, 40.63% (n=425) of participants reported that their children consumed fruit two times daily (Table 10). Additionally, the number of responses for consuming fruit two or more times daily

increased from 60.19% (n=1013) at baseline to 75.14% (n=786) at the end of the study. There was a significant difference between pre- and postsurvey responses ($p < 0.0001$).

The parent postsurvey asked, “In the past month, our family’s consumption of fruit...” with the options being “increased,” “decreased,” or “stayed the same.” While 63.29% (n=655) of participants reported that their family’s consumption of fruit stayed the same, 35.36% (n=366) of participants said that there was an increase in their family’s consumption of fruit.

Table 9

Changes in mean values from parent presurvey to parent postsurvey

| | Units | Presurvey ¹ | Postsurvey ¹ | Change ² | Effect Size ³ |
|------------------------|-------------|------------------------|-------------------------|---------------------|--------------------------|
| Daily fruit intake | Times eaten | 1.94±1.13 | 2.25±1.15 | 0.32±1.14* | 0.28 |
| Daily vegetable intake | Times eaten | 1.90±1.16 | 2.02±1.17 | 0.12±1.17* | 0.11 |

¹Data presented as mean ± SD

²Difference in the mean between presurvey and postsurvey ± pooled SD

³Absolute value of difference in the mean divided by pooled SD

*Statistically significant

Table 10

Parents' reported number of children's daily fruit intake

| Times eaten | Presurvey (N=1683) | | Postsurvey (N=1046) | |
|-------------|-----------------------|----------------|------------------------|----------------|
| | Frequency (n) | Percentage (%) | Frequency (n) | Percentage (%) |
| 0 | 56 | 3.33 | 16 | 1.53 |
| 1 | 614 | 36.48 | 244 | 23.33 |
| 2 | 608 | 36.13 | 425 | 40.63 |
| 3 | 276 | 16.40 | 255 | 24.38 |
| 4 | 81 | 4.81 | 67 | 6.41 |
| 5 | 25 | 1.49 | 17 | 1.63 |
| 6 | 8 | 0.48 | 9 | 0.86 |
| 7 | 15 | 0.89 | 13 | 1.24 |

The parent pre- and postsurvey asked, “On average, how many times does your child consume vegetables per day at home? This would include vegetables at meals or snacks.” This question was used to assess children’s consumption of vegetables at home or in the family setting at baseline (N=1687) and at the end of the program (N=1042). Two times was the desired response for this question. The mean amount of times vegetables were consumed was 1.90 ± 1.16 times at baseline and 2.02 ± 1.17 times at the end of the program (Table 9). The means were statistically significant ($p = 0.007$) with a small effect ($d=0.11$). At baseline, 37.05% ($n=625$) of respondents reported that their child consumed vegetables two times per day, and at the end of the program, 40.12% ($n=418$) of participants reported children’s daily vegetable intake was two times per day (Table 11). The percentage of participants who responded two times per day or more increased from baseline to the end of the program, totaling 58.27% ($n=983$) and 65.45%

(n=682), respectively. There was a significant difference between pre- and postsurvey responses ($p = 0.0013$).

The parent postsurvey asked, “In the past month, our family’s consumption of vegetables...” with the options being “increased,” “decreased,” or “stayed the same.” The percentage of participants who reported that their family’s consumption of vegetables stayed the same was 66.34% (n=682), while 31.81% (n=327) stated that there was an increase in their family’s consumption of vegetables.

Table 11

Parents’ reported number of children’s daily vegetable intake

| Times eaten | Presurvey (N=1687) | | Postsurvey (N=1042) | |
|-------------|-----------------------|----------------|------------------------|----------------|
| | Frequency (n) | Percentage (%) | Frequency (n) | Percentage (%) |
| 0 | 56 | 3.32 | 37 | 3.55 |
| 1 | 648 | 38.41 | 323 | 31.00 |
| 2 | 625 | 37.05 | 418 | 40.12 |
| 3 | 231 | 13.69 | 172 | 16.51 |
| 4 | 67 | 3.97 | 54 | 5.18 |
| 5 | 35 | 2.07 | 20 | 1.92 |
| 6 | 2 | 0.12 | 7 | 0.67 |
| 7 | 23 | 1.36 | 11 | 1.06 |

Sugary Beverage Intake

The parent presurvey asked, “Are soda (pop), fruit-flavored beverages and/or energy drinks offered as a beverage choice in the household?” and the parent postsurvey asked, “Is soda (pop) offered as a beverage of choice in the household?” This question was used to evaluate

sugary beverage availability and consumption in the home. At baseline, 58.43% (n=963) of participants answered “no,” while 41.57% (n=685) of participants answered “yes.” At the end of the program, 65.97% (n=665) of participants answered “no,” and 34.03% (n=343) of participants answered “yes.” The parent presurvey then asked the follow-up question, “If yes, approximately how many cans/glasses of soda (pop), fruit-flavored beverages and/or energy drinks per day does your child drink?” and the parent postsurvey asked the follow-up question, “If yes, approximately how many cans of soda (pop) per day does your child drink?” The desired response was zero sugary beverages. At baseline, the mean number of sugary beverages consumed was 0.59 ± 0.79 beverages. At the end of the program, the mean decreased to 0.49 ± 0.76 beverages. The percentage of participants who responded that their child consumes zero sugary beverages daily was 54.68% (n=678) at baseline and 61.41% (n=428) at the end of the program (Table 12).

Table 12

Parents’ reported number of children’s daily sugary beverage intake

| Sugary beverages consumed | Presurvey (N=1240) | | Postsurvey (N=697) | |
|---------------------------------|-----------------------|----------------|-----------------------|----------------|
| | Frequency (n) | Percentage (%) | Frequency (n) | Percentage (%) |
| 0 | 678 | 54.68 | 428 | 61.41 |
| 1 | 448 | 36.13 | 219 | 31.42 |
| 2 | 79 | 6.37 | 39 | 5.60 |
| 3 | 26 | 2.10 | 5 | 0.72 |
| 4 | 5 | 0.40 | 3 | 0.43 |
| 5 | 2 | 0.16 | 1 | 0.14 |
| 6 | 2 | 0.16 | 2 | 0.29 |

CHAPTER 5: DISCUSSION

The purpose of this study was to assess the effectiveness of the “On the Move to Better Health” program, specifically whether it promoted 4th to 6th grade students across the state of North Dakota, as well as their families, to make healthier lifestyle choices. Additionally, this study aimed to assess parental involvement in the “On the Move” program and whether parents found the “On the Move” family newsletters helpful and informative. Several studies suggested that effective public health intervention programs should focus on promoting healthy eating habits and reducing the consumption of fats, sugars, and empty calories (Boumtje et al., 2005; Reedy & Krebs-Smith, 2010; Troiano et al., 2000). Further, Boumtje et al. (2005) and Troiano et al. (2000) suggested that educating on sugary beverages and replacing these drinks with nutrient-dense alternatives was especially important to highlight. Previous studies also suggested that public health interventions targeted at young age groups should focus on increasing physical activity and reducing sedentary activities that children partake in (Boumtje et al., 2005; Epstein et al., 1995; Herman et al., 2014; Troiano et al., 2000). According to Janssen et al. (2005), Reedy and Krebs-Smith (2010) and Troiano et al. (2000), implementing public health interventions in a school setting could increase effectiveness of the program. Boumtje et al. (2005) also suggested that effective programs should contain a parental component that encourages parental involvement.

The “On the Move to Better Health” program met many of these recommendations for program success. The “On the Move” program was implemented in a school setting, having been taught in 211 public and private elementary school classrooms across the state of North Dakota. The “On the Move” curriculum focused on the importance of nutrition and physical activity and encouraged increasing the consumption of healthful foods, decreasing the consumption of

unhealthful foods, increasing daily physical activity, and decreasing sedentary behaviors. Lesson 2 of the “On the Move” curriculum focused on fruits and vegetables, including the importance of these healthful foods, what vitamins and minerals they contain, and how many cups children their age should consume each day. Lesson 3 of the program highlighted physical activity, including what it is and why it is essential to a healthy lifestyle. This lesson also discussed sedentary behavior, including its definition and how sedentary behaviors can be replaced with physical activities. The topic of lesson 4 was healthy snacks and beverages (with specific emphasis on sugary beverages) and explained the difference between nutrient dense foods and empty calorie foods. The “On the Move” program also contained a parental component to educate parents and encourage parental involvement. Following each lesson, parent newsletters regarding the lesson’s topic were sent home to educate parents as well. These newsletters also contained a spot for families to set a family goal and work towards healthful lifestyle changes together.

Student pre- and postsurveys were used to analyze changes in children’s dietary habits from the beginning of the program to the end of the program. There was a significant difference between pre- and postsurvey means and responses for fruit intake, vegetable intake, and sugary beverage intake. At both baseline and at the end of the study, participants reported consuming fruit an average of more than one and a half times per day. Assuming one time is approximately one serving, these results imply that participants consumed more than the one and a half cups of fruit per day recommended for their age group by MyPlate at both baseline and at the end of the study (ChooseMyPlate.gov, 2016). There also was an increase of 0.26 times eaten for fruit between pre- and postsurvey averages. While there was a slight increase in average vegetable intake from baseline to the end of the study, both mean values fell below vegetable consumption

being two times per day. Again, assuming one time is about one serving, these values fall below the MyPlate recommendation of two cups of vegetables for children between the ages of nine and thirteen (ChooseMyPlate.gov, 2016). Despite the small increases in mean times eaten for both fruits and vegetables between pre- and postsurvey, over half of participants reported increasing their intake of fruits and vegetables over the past month. One explanation for this may be the reporting bias associated with self-report surveys. Students may have reported that they consumed more fruits and vegetables because, after being encouraged throughout the 5-week “On the Move” program to consume more fruits and veggies, they knew this was the desired response or behavior change they should have made. The results of this study supported a previous meta-analysis that found increases in fruit and vegetable consumption between intervention and control groups in six out of seven studies, which included a 0.45 serving increase of fruits and vegetables among intervention groups (Howerton et al., 2007). However, a previous analysis of the “On the Move” program found a slight decrease in vegetable consumption and a significant decrease in fruit consumption (although still above recommendations) from baseline to the end of the study (Wry, 2008), which were contradictory to the findings of this study. These results may suggest that the “On the Move” program has become more effective in promoting fruit and vegetable consumption over the years. This also could be due to a revision in the “On the Move” curriculum following Wry’s analysis. The curriculum was previously based on the United States Department of Agriculture’s (USDA) MyPyramid system during Wry’s study, but underwent a revision in 2012 to reflect the USDA’s MyPlate system. It is possible that students understood the MyPlate system better than the MyPyramid system, which led to greater dietary knowledge and healthful dietary changes.

The mean cans of soda consumed per day decreased from baseline to the end of the study, although minimally. Despite the slight change in average values between pre- and postsurvey, over half of participants reported drinking less soda over the past month. As with fruits and vegetables, report bias may be a potential explanation. Another factor may be that reported soda intake was relatively low to begin with. Nearly half of participants reported drinking zero cans of soda per day at baseline, and well over half reported drinking zero cans of soda per day at the end of the program. The results of this study regarding consumption of sugary beverages were consistent with those found in Wry's previous "On the Move" analysis (Wry, 2008).

There was a significant difference between pre- and postsurvey means and responses for both physical activity and sedentary behavior. From baseline to the end of the program, the mean number of days per week participants reported getting at least 60 minutes of physical activity increased by nearly one day. Additionally, at the end of the program, nearly 45% of subjects reported being active for 60 minutes per day seven days per week. A study by Herman et al. (2014) had similar findings among boys, but not girls. However, contrary to the findings of this study, a previous study found that only 5.7% of children were active for 60 minutes or more per day (Basterfield et al., 2011). Many of the schools involved in the "On the Move" program had a physical education class, as well as a daily recess period, which may have contributed to a higher amount of daily physical activity. Additionally, schools may have had extracurricular athletic programs available for students to participate in, which may have increased daily activity as well. There was no significant change in the number of days participants were physically active in the previous analysis of the "On the Move" program (Wry, 2008), which was also contrary to the results of this study.

The mean number of reported hours spent being sedentary decreased from baseline to the end of the study. On average, participants reported spending about two hours and fifteen minutes each day participating in sedentary behaviors such as watching television or playing computer/video. Herman et al. (2014) found that children spent approximately six hours per day engaging in sedentary behaviors, which contradicted the findings of this study. The “On the Move” survey question regarding sedentary behavior only considered time spent watching television or playing computer/video games. Time spent sitting in school, doing homework, or reading for pleasure were not considered, which may account for lower reported levels of sedentary behavior with the current study.

An additional area of interest for this study involved parental participation and family behavior changes. As mentioned previously, Boumtje et al. (2005) suggested that successful public health intervention programs aimed at children should have a parental component to increase parental involvement. The “On the Move” program incorporated a parental component in the form of parent newsletters and parent pre- and postsurveys. Nearly 83% of survey participants reported that they read the parent newsletters that were sent home with their child. Further, of those who read the newsletters, about 83% reported that they found the newsletters helpful and informative. However, while there was just shy of 3,000 students who completed the student postsurvey, only about 1,000 parents completed the parent postsurvey. Therefore, while the results of the study showed success in the “On the Move” parental component, the lack of parental surveys completed and returned suggests otherwise. Because the newsletters and parent surveys were sent home with the students, it is possible that some parents may not have received these items. Using an alternate delivery method, such as sending the newsletters and surveys to parents via email, may help to eliminate this issue in the future.

The mean number of times parents reported that their child consumed fruit at home increased from baseline to the end of the program. Additionally, the number of parent responses for children consuming fruit two or more times per day increased by about 15% from baseline to the end of the program. The mean number of times parents reported that their child consumed vegetables at home also slightly increased from baseline to the end of the program. The number of responses for children consuming vegetables two or more times daily increased as well, although not as much as fruits (7% vs. 15%). These findings supported a previous study by Perry et al. (1998), which found that both fruit and vegetable consumption increased when a behavior change curriculum, which included parental involvement and making healthful foods more readily available, was implemented in elementary school classrooms. Other studies have also found that altering accessibility may influence both activity and eating behaviors (Epstein et al., 1991; Hanks, Just, & Wansink, 2013). For example, increasing the availability of healthful foods and decreasing the availability of unhealthful foods. Because parents typically purchase the food their children consume, they could influence their children to eat more healthful foods by purchasing these foods and not purchasing unhealthful foods.

Despite increases in parent reported times eaten per day for both fruit and vegetable consumption from baseline to the end of the study, the majority of participants reported that their family's fruit and vegetable consumption stayed the same over the past month. Because reported values of children consuming fruits and vegetables two or more times per day were fairly high at baseline (60% and 58%, respectively), these findings may suggest that those parents who completed the parent surveys were serving recommended amounts of fruits and vegetables prior to the "On the Move" intervention.

The number of parents who responded that sugary sweetened beverages (soda/pop, fruit-flavored beverages, energy drinks) were offered in their household decreased from baseline to the end of the program. The mean number of sugary beverages consumed daily also slightly decreased. However, the question regarding sugary beverages on the parent presurvey differed from that on the postsurvey. The presurvey question included soda/pop, fruit-flavored beverages, and energy drinks, while the postsurvey question only included soda/pop. Therefore, the decrease in sugary beverage intake may have been due to parents reporting only soda consumption on the postsurvey rather than consumption of several types of sugary beverages. Additionally, the means and responses for this question could not be tested for statistical significance due to the variation between the question on the presurvey and the postsurvey.

While the overall results indicate that the “On the Move” program was successful in implementing short-term behavior changes over the 5-week program, the design of this program doesn’t incorporate a follow-up survey to monitor long-term behavior changes. However, a follow-up survey is currently being developed with hopes of implementing it to the “On the Move” curriculum in the future. This addition would enable researchers to evaluate if the “On the Move” curriculum is successful in establishing lifelong behavior changes for both students and families.

CHAPTER 6: SUMMARY AND CONCLUSIONS

Overall, the “On the Move to Better Health” program was successful in promoting healthful behavior changes among students. Results showed significant changes between student presurvey and student postsurvey responses for fruit intake, vegetable intake, sugary beverage intake, physical activity levels, and sedentary behavior levels. There was an increase in healthful behaviors, such as eating fruits and vegetables and being physically active, over the course of the 5-week intervention program. Results also showed a decrease in unhealthful behaviors, such as consuming sugary beverages and participating in sedentary activities, from baseline to the end of the program. Although results found these desirable behavior changes, students’ perceived behavior changes were much greater than those observed with reported intake and activity levels. These differences between reported values and perceived values suggest recall bias issues, which should be taken into consideration when examining results.

The data collected from parent surveys indicated that the parental component of the “On the Move to Better Health” program was successful as well. The majority of parents reported that they found the “On the Move” family newsletters helpful and informative. Results showed increases in children’s intake of both fruits and vegetables from baseline to the end of the study as reported by parents. However, most parents reported that their family’s fruit and vegetable consumption remained the same over the course of the 5-week program. These differences in reported intake values and perceived changes may have been due to recall bias or an adequate intake of fruits and vegetables at baseline. While parent survey results found high parental involvement in the parental component of the “On the Move” program, over half of the parent surveys were not completed or returned, suggesting that survey data may not have been fully representative of parental involvement in the program.

Overall, this study found the “On the Move to Better Health” nutrition and physical activity-based intervention program successful in promoting healthful lifestyle choices among North Dakota students and their families. Recommendations for future research include expanding the time period of the study or incorporating a follow-up survey to examine whether the “On the Move” curriculum promoted long-term behavior changes. In the future, implementing technology-based delivery methods for parent newsletters and surveys to see if a different delivery method increases parental involvement may be beneficial. Further, differences among the various North Dakota counties that utilize the “On the Move” curriculum (urban vs. rural, food desserts) would be a valuable area for future research to examine.

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APPENDIX A. IRB EXEMPTION



INSTITUTIONAL REVIEW BOARD

office: Research 1, 1735 NDSU Research Park Drive, Fargo, ND 58102

mail: NDSU Dept. #4000, PO Box 6050, Fargo, ND 58108-6050

p: 701.231.8995 f: 701.231.8098 e: ndsu.ibr@ndsu.edu w: www.ndsu.edu/ibr

Date Received

3/18/2016

Exempt Recertification Form

Currently active exempt protocols that will continue beyond the expiration date must be re-certified by the IRB. Submit this form several weeks prior to expiration to avoid a lapse in IRB approval. Refer to SOP 7.1 Exempt Determinations for additional information.

Protocol Information

Protocol #: HE07199 Title: On the Move to Better Health

Principal investigator: Julie Garden-Robinson

Co-investigator:

Department: HNES

Department:

E-Mail/Campus Address: julie.garden-robinson@ndsu.edu

E-Mail/Campus Address:

Project Status

Project is currently active (mark all applicable):

Expected end date of research: ongoing, 2020+

- ☒ recruiting participants
- ☒ ongoing data collection
- ☐ ongoing analysis of identifiable data

Source of current funding: Walmart/Nat'l 4-H Council FAR# 0025117

☐ Not funded

Current Funding period: Start date: 9/1/15 End Date: 8/31/16

Has a progress report been filed with the funding agency since last review?

☐ No ☒ Yes, ☒ Attach copy of final grant application(s), and/or recent report to funding agency.

Research team: List all individuals currently involved in the human subjects research (project design/oversight, recruiting participants, obtaining informed consent, intervening or interacting with participants to obtain information/data, and/or handling identifiable information for research purposes). May provide as a separate attachment.

Name, dept. or affiliation:

Specify role in research:

Training date: (IRB Use only)

| | | |
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| | | |
| | | |
| | | |

Project Summary

1. Research site(s):

See attached list of counties involved.

2. Total # of participants:

16,850 children plus their parents plus their classroom teachers have participated.

3. Will additional participants be recruited?

☐ No

☒ Yes* - Indicate approximately how many: 4,000 per year

☒ Attach a copy of current consent form(s), and any recruitment materials

4. Have any potential participants declined to participate, or withdrawn from the research?

☒ No

☐ Yes - explain:

the participants do not have to complete the surveys, but none have refused to participate in the classroom education.

5. Have there been any complaints or unanticipated problems?

☒ No

☐ Yes - explain:

Investigator's Assurance

- The approved protocol on file with the IRB (which I have reviewed), accurately represents current procedures for the project.
- Changes to the protocol will receive IRB approval prior to implementation, unless necessary to prevent immediate serious harm to participants
- All unanticipated problems involving risks to participants or others will be promptly reported to the IRB.

Quic Harris Peterson 3/18/16
Principal Investigator signature, date

-----FOR IRB USE ONLY-----

| | | | |
|----------------|--|---|---|
| Project is: | <input checked="" type="checkbox"/> Certified for Continuation | <input checked="" type="checkbox"/> Category # <u>1</u> | <input checked="" type="checkbox"/> Expires <u>4/1/2019</u> |
| IRB Signature: | <u>Kristy Shuley</u> | Date: | <u>3/24/2016</u> |

**Approved with waiver of active parent permission per documentation /
protocol approved 4/1/2017.*

APPENDIX B. IRB PROTOCOL AMENDMENT FORM TO ADD PERSONNEL

Date Received



INSTITUTIONAL REVIEW BOARD

office: Research 1, 1735 NDSU Research Park Drive, Fargo, ND 58102

mail: NDSU Dept. #4000, PO Box 6050, Fargo, ND 58108-6050

p: 701.231.8995 f: 701.231.8098 e: ndsuirb@ndsu.edu w: www.ndsu.edu/irb

Add, Remove or Change Personnel

Use this form to request to add, remove or change the role of personnel on an approved IRB application. This request must be submitted by the current PI. Include with this form any updated consent forms, recruitment documents, or any other previously approved materials which will reflect the personnel change.

Protocol Information

Protocol #: HE07199

Title: On the Move to Better Health

Principal investigator: Julie Garden-Robinson

Co-investigator:

Department: HNES

Department:

E-Mail/Campus Address: julie.garden-robinson@ndsu.edu

E-Mail/Campus Address:

Does the change involve a change in principal or co-investigator?

☐ No

☒ Yes.

Please list the new PI/Co-Investigator and departmental affiliation:

This request should be submitted by the current PI, copying the new principal and co-investigators and the relevant department chair, dean, or director.

Research Team:

| Name, Dept. | Email address | Role in research | IRB Training date (office use) | Add/Delete |
|----------------|--|------------------|--------------------------------|---|
| Alyssa Carlson | alyssa.carlson@ndsu.edu | data analysis | 11/10/2015 | <input checked="" type="checkbox"/> Add <input type="checkbox"/> Delete |
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Conflict of Interest disclosure.

Does any investigator responsible for the design, conduct or reporting of the project (including their immediate family members) have a financial, personal or political interest that may conflict with their responsibility for protecting human participants in NDSU research?
(SOP 6.2 Conflict of Interest in Human Research, Investigator and Research Team)


- ☒ No - As PI, I attest that I have conferred with my co-investigators and key personnel and confirmed that no financial, personal or political interests currently exist related to this research.
- ☐ Yes - Describe the related financial, personal or political interests, and attach documentation of COI disclosure and review (as applicable).

Financial, personal or political interests related to the research (the sponsor, product or service being tested, or a competing product or service) may include:

- compensation (e.g., salary, payment for services, consulting fees)
- intellectual property rights or equity interests
- board memberships or executive positions
- enrollment or recruitment bonus payments

(Refer to NDSU Policy 151.1, External Activities and Conflicts of Interest, and NDSU Policy 823, Financial Disclosure - Sponsored Projects for specific disclosure requirements.)

Julie Harden Hansen 11/9/16
Principal Investigator signature, date

 In lieu of a written signature, submission of this report via the Principal Investigator's NDSU email constitutes an acceptable electronic signature.

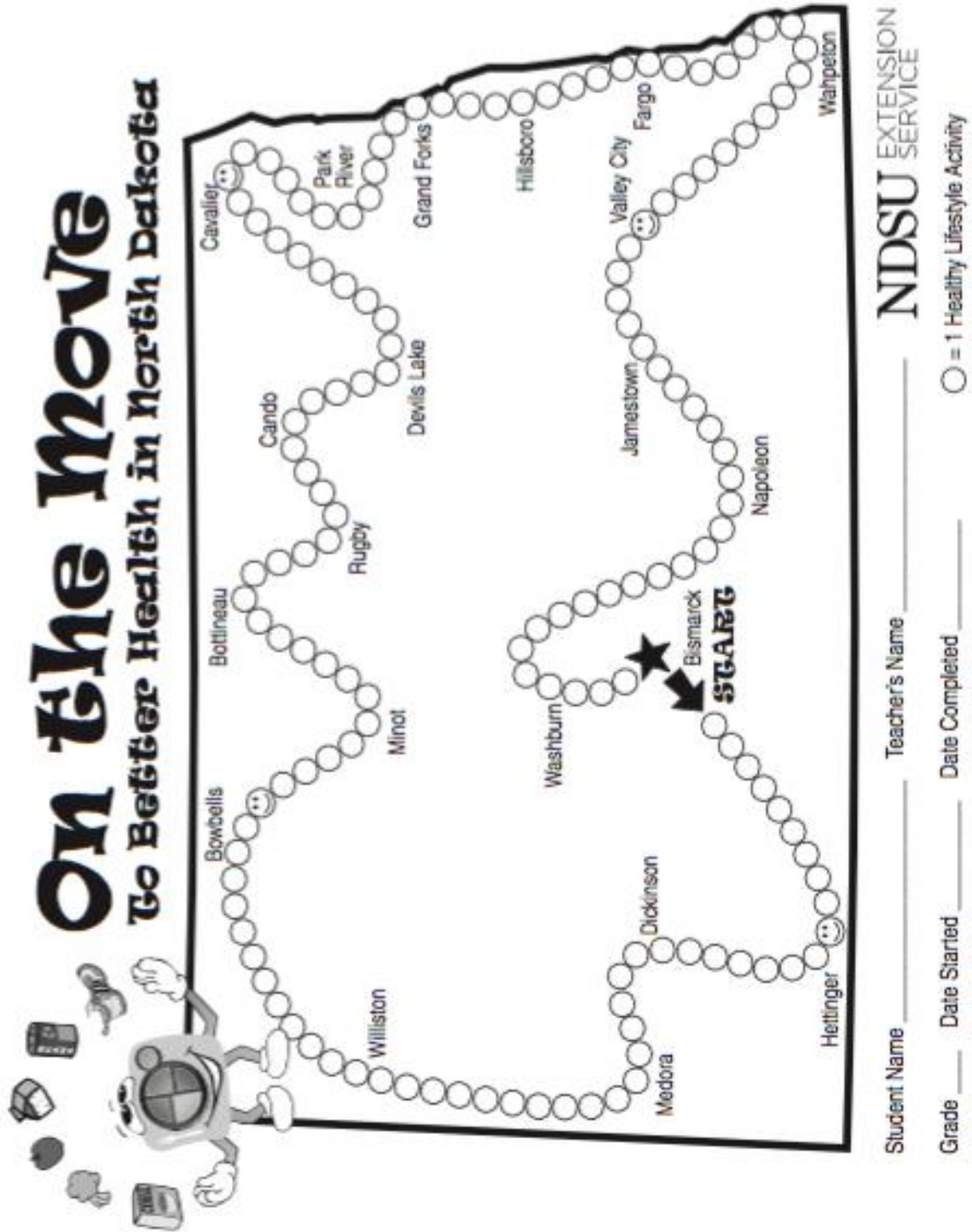
----- FOR IRB USE ONLY -----

☒ Approved

IRB Signature: Kristy Shulay

Date: 11/17/2016

APPENDIX C. ON THE MOVE MAP OF NORTH DAKOTA



[illegible]

Name _____

School _____

Week _____

[illegible]

NDSTI EXTENSION SERVICE
North Dakota State University, Fargo, North Dakota
Revised 2012

Parent/Guardian Signature:

County commissions, North Dakota State University does not discriminate on the basis of age, color, disability, gender expression/identity, genetic information, marital status, national origin, public assistance status, race, religion or sex, sexual orientation, or status as a U.S. veteran. Direct inquiries to the Vice President for Equity, Diversity and Global Outreach, 205 Old Main, 701) 231-7708. This publication will be made available in alternative formats for people with disabilities upon request, 701) 231-7881.

APPENDIX E. ON THE MOVE STUDENT PRESURVEY



Presurvey

Lesson 1 • Student

County _____ Date ____/____/____

Teacher's Name _____

Please circle your answer or write it in the blank.

1. Your grade: 4 5 6

2. Your age:
 8 9 10 11 12 13

3. Are you a: boy girl

4. Fruit should make up about ____ of a plate,
according to the latest recommendations.
 $\frac{1}{8}$ $\frac{1}{4}$ $\frac{1}{2}$ $\frac{3}{4}$

5. How many **times** did you eat whole fruit yesterday?
 0 1 2 3 4 5

6. How many times did you drink 100 percent fruit juice
yesterday?
 0 1 2 3 4 5

7. Vegetables should make up about _____ of a plate,
according to the latest nutrition recommendations.
 $\frac{1}{16}$ $\frac{1}{8}$ $\frac{1}{4}$ $\frac{1}{2}$ $\frac{3}{4}$

8. How many **times** did you eat vegetables yesterday?
 0 1 2 3 4 5

9. Which is true of your family? (Circle one letter.)
a. We drink more juice than whole fruit.
b. We eat more whole fruit than fruit juice.

10. How many **cups** of milk should a boy or girl your
age have each day?
 0 1 2 3 4 5

11. How many **cups** of milk (or yogurt, other dairy
products) did you consume yesterday? If you did
not drink milk yesterday, how many **cups** do you
usually drink each day? (Include the milk you
drank in a glass or cup, from a carton or with
cereal. The carton of milk served at lunch in
school is equal to 1 cup.)
 0 1 2 3 4 5

12. How many **cans** of pop did you drink yesterday?
If you did not drink any pop yesterday, how much
do you usually drink in a day? (Count 20-ounce
bottles of pop as two cans or $2\frac{1}{2}$ glasses; count
a glass of pop as a can.)
 0 1 2 3 4 5 6

13. During the last week, how many **days** were you
physically active for 60 minutes? (Circle one)
 0 1 2 3 4 5 6 7

14. About how many **hours**, in a usual day, do you spend
watching TV and playing computer or video games?
(Circle one)
 0 1 2 3 4 5 6 7

APPENDIX F. ON THE MOVE STUDENT POSTSURVEY



Post-survey

Lesson 5 • Student

County _____ Date ____/____/____

Teacher's Name _____

Please circle your answer or write it in the blank.

1. Your grade: 4 5 6
2. Your age:
 8 9 10 11 12 13
3. Are you a: boy girl
4. Fruit should make up about ____ of a plate,
according to the latest recommendations.
 $\frac{1}{8}$ $\frac{1}{4}$ $\frac{1}{2}$ $\frac{3}{4}$
5. How many **times** did you eat whole fruit yesterday?
 0 1 2 3 4 5
6. How many times did you drink 100 percent fruit juice
yesterday?
 0 1 2 3 4 5
7. Vegetables should make up about _____ of a plate,
according to the latest nutrition recommendations.
 $\frac{1}{16}$ $\frac{1}{8}$ $\frac{1}{4}$ $\frac{1}{2}$ $\frac{3}{4}$
8. How many **times** did you eat vegetables yesterday?
 0 1 2 3 4 5
9. Which is true of your family? (Circle one letter.)
 - a. We drink more juice than whole fruit.
 - b. We eat more whole fruit than fruit juice.
10. How many **cups** of milk should a boy or girl your
age have each day?
 0 1 2 3 4 5
11. How many **cups** of milk (or yogurt, other dairy
products) did you consume yesterday? If you did
not drink milk yesterday, how many **cups** do you
usually drink each day? (Include the milk you
drank in a glass or cup, from a carton or with
cereal. The carton of milk served at lunch in
school is equal to 1 cup.)
 0 1 2 3 4 5
12. How many **cans** of pop did you drink yesterday?
If you did not drink any pop yesterday, how much
do you usually drink in a day? (Count 20-ounce
bottles of pop as two cans or $2\frac{1}{2}$ glasses; count
a glass of pop as a can.)
 0 1 2 3 4 5 6
13. During the last week, how many **days** were you
physically active for 60 minutes? (Circle one)
 0 1 2 3 4 5 6 7
14. About how many **hours**, in a usual day, do you spend
watching TV and playing computer or video games?
(Circle one)
 0 1 2 3 4 5 6 7

continued

15. During the past month while I participated in the On the Move program, I did the following:
(check all that apply)

Mark N/A (Not Applicable) if this wasn't part of your program.

- _____ Read the bulletin board display in the hall
- _____ Earned **double** circles for eating fruits and vegetables
- _____ Earned **double** circles for giving up TV, video games and computer for a day
- _____ Earned **double** circles for giving up pop and sweetened beverages for a day
- _____ Tried one or more of the special snacks (if applicable)
- _____ Set at least one family goal with my parents

16. During the past month, I did the following:
(Circle **one** letter.)

- a. **Increased** the amount of fruits and vegetables I ate
- b. **Decreased** the amount of fruits and vegetables I ate
- c. The amount of fruits and vegetables I ate **stayed the same**

17. During the past month, I did the following:
(Circle the letters of **all** that apply.)

- a. Drank more milk and ate more dairy foods
- b. Drank less soda pop
- c. Drank more water
- d. Read food labels on snacks
- e. Chose healthier snacks

18. During the past month, I did the following:
(Circle **one** letter)

- a. **Increased** the amount of time I am physically active daily.
- b. **Decreased** the amount of time I am physically active daily.
- c. The amount of time I was physically active **stayed the same.**

19. Did you meet the goals you set at the beginning of the month?

- a. Yes
- b. No

20. Would you like to see a program like "On the Move" in your school again?

- a. Yes
- b. No
- c. I don't know

21. What did you like or dislike about the "On the Move" program?

APPENDIX G. ON THE MOVE PARENT PRESURVEY



Presurvey

Lesson 1 • Parent

County _____ Date ____/____/____

These questions pertain to your child participating in the "On the Move to Better Health" program at school.

1. What is the size of your household?
_____ Adults _____ Children
2. During the last seven days, about how many times did your family eat meals together with all family members present?
0 1 2 3 4 5 6 7 8 9 10+
3. Which meal does your family eat together the majority of the time? (Mark with an X.)
_____ Breakfast (any day)
_____ Noon meal/lunch (weekends)
_____ Evening meal/dinner/supper (any day)
4. Fruit should make up about _____ of a plate, according to the latest recommendations. (Circle one.)
1/16 1/8 1/4 1/2 3/4
5. On average, how many times does your child consume fruit per day at home? This would include fruit at meals or snacks. (Circle one.)
0 1 2 3 4 5 6 7
6. Comparing **whole fruit** (canned, fresh, frozen) and **fruit juice**, which is true of your **child**? (Circle the letter of your selection.)
 - a. My child eats more whole fruit.
 - b. My child drinks more 100 percent fruit juice
7. Comparing **whole fruit** (canned, fresh, frozen) and **fruit juice**, which is true of your **family**? (Circle the letter of your selection.)
 - a. Our family eats more whole fruit.
 - b. Our family drinks more 100 percent fruit juice
8. Vegetables should make up about _____ of a plate, according to the latest recommendations. (Circle one.)
1/16 1/8 1/4 1/2 3/4
9. On average, how many **times** does your child consume vegetables per day at home? This would include vegetables at meals or snacks (Circle one.)
0 1 2 3 4 5 6 7
10. Are these statements true or false for your family? Circle your answer.
 - True or False: Fruits and vegetables take too much time to prepare.
 - True or False: Fruits and vegetables cost too much.
 - True or False: We don't like fruits.
 - True or False: We don't like vegetables.
 - True or False: Fruits and vegetables upset our stomachs.

continued

11. How many cups of milk/dairy products are recommended for your child per day? A cup is 8 ounces of milk or yogurt or two slices of cheese. (Circle your answer.)

0 ½ 1 2 3 4 5

12. How many cups of milk or yogurt does your child consume at home?

0 ½ 1 2 3 4 5

13. Are these statements true or false for your family? Circle your answer.

True or False: Dairy products take too much time to prepare.

True or False: Dairy products cost too much.

True or False: We don't like dairy products.

True or False: Dairy products upset our stomachs.

14. Are soda (pop), fruit-flavored beverages and/or energy drinks offered as a beverage choice in the household?

Yes No

If yes, approximately how many cans/glasses of soda (pop), fruit-flavored beverages and/or energy drinks per day does your child drink? Count 20-ounce bottles as two cans.

0 1 2 3 4 5 6 7+

15. Are snack foods available to your grade-school child at home?

Yes No

16. Does your child choose his/her own snack foods?

Yes No (If no, skip to question 18)

17. If your child chooses his/her own snacks at least some time, circle the **top two** he/she chooses:

| | |
|---------------|-----------------------------|
| Fruits | Vegetables |
| Cheese/yogurt | Whole-grain cereal/crackers |
| Chips | Fruit-flavored snacks |
| Candy | Granola bars |
| Cookies | Popcorn |
| Other | _____ |

18. If you choose your child's snack foods, circle the **top two** you choose for him/her:

| | |
|---------------|-----------------------------|
| Fruits | Vegetables |
| Cheese/yogurt | Whole-grain cereal/crackers |
| Chips | Fruit-flavored snacks |
| Candy | Granola bars |
| Cookies | Popcorn |
| Other | _____ |

APPENDIX H. ON THE MOVE PARENT POSTSURVEY



Post-survey

Lesson 4 • Parent

County _____ Date ____/____/____

**Thank you for helping your child with the “On the Move to Better Health” program.
Please complete this survey to help us know if this program was effective.**

1. Did you or another adult in your home complete the presurvey brought home by your child?
Yes No
2. Did you or another adult in your home read or look over the parent newsletters that were sent home with your fourth- or fifth-grade child?
Yes No
If you answered “Yes,” were the parent newsletters helpful in providing new information, ideas and recipes?
Yes No Doesn't apply
3. Did you set family goals each week?
Yes No
If your answer is “yes,” were the family goals completed?
Yes No
If you were unable to set family goals, what interfered?

4. Check the word(s) that best finishes the statement.
In the past month, our family's consumption of
 - a. Fruit
Increased Decreased Stayed the same
 - b. Vegetables
Increased Decreased Stayed the same
 - c. Milk/dairy
Increased Decreased Stayed the same
 - d. Whole grains
Increased Decreased Stayed the same
5. What is the size of your household?
_____ Adults _____ Children
6. During the week (Sunday through Saturday), about how many times does your family eat meals together with all family members present?
0 1 2 3 4 5 6 7 8 9 10+
7. Mark with an “X” the meal your family eats together the majority of the time.
_____ Breakfast (any day)
_____ Noon meal/lunch (weekends)
_____ Evening meal/dinner/supper (any day)
8. Fruit should make up about _____ of a plate, according to the latest recommendations. (Circle one.)
1/16 1/8 1/4 1/2 3/4
9. On average, how many times does your child consume fruit per day at home? This would include fruit at meals or snacks. (Circle one.)
0 1 2 3 4 5 6 7
10. Comparing **whole fruit** (canned, fresh, frozen) and **fruit juice**, which is true of your child? (Circle the letter of your selection.)
 - a. My child eats more whole fruit.
 - b. My child drinks more 100 percent fruit juice
11. Comparing **whole fruit** (canned, fresh, frozen) and **fruit juice**, which is true of your family? (Circle the letter of your selection.)
 - a. Our family eats more whole fruit.
 - b. Our family drinks more 100 percent fruit juice

continued

12. Vegetables should make up about _____ of a plate, according to the latest recommendations. (Circle one.)

1/16 1/8 1/4 1/2 3/4

13. On average, how many times does your child consume vegetables per day at home? This would include vegetables at meals or snacks (Circle one.)

0 1 2 3 4 5 6 7

14. Are these statements true or false for your family? (Circle one.)

True or False: Fruits and vegetables take too much time to prepare.

True or False: Fruits and vegetables cost too much.

True or False: We don't like fruits.

True or False: We don't like vegetables.

True or False: Fruits and vegetables upset our stomachs.

15. Circle the number of cups of milk/dairy products recommended for your child per day. One cup is 8 ounces of milk or yogurt or two slices of cheese.

0 ½ 1 2 3 4 5

16. How many cups of milk or yogurt does your child consume at home?

0 1 2 3 4 5

17. Are these statements true or false (F) for your family? Circle your answer.

True or False: Dairy products take too much time to prepare.

True or False: Dairy products cost too much.

True or False: We don't like dairy products.

True or False: Dairy products upset our stomachs.

18. Is soda (pop) offered as a beverage choice in the household?

Yes No

If yes, approximately how many cans of soda (pop) per day does your child drink? Count 20-ounce bottles as two cans.

0 1 2 3 4 5 6

19. Are snack foods available to your grade-school child at home?

Yes No

20. Does your child choose his/her own snack foods?

Yes No (If no, skip to question 22)

21. If your child chooses his/her own snacks at least some time, circle the **top two** he/she chooses:

| | |
|---------------|-----------------------------|
| Fruits | Vegetables |
| Cheese/yogurt | Whole-grain cereal/crackers |
| Chips | Fruit-flavored snacks |
| Candy | Granola bars |
| Cookies | Popcorn |
| Other _____ | |

22. If you choose your child's snack foods, circle the **top two** you choose for him/her?

| | |
|---------------|-----------------------------|
| Fruits | Vegetables |
| Cheese/yogurt | Whole-grain cereal/crackers |
| Chips | Fruit-flavored snacks |
| Candy | Granola bars |
| Cookies | Popcorn |
| Other _____ | |

Please have your child return this survey by

and he/she will receive a student incentive.

Thank you for taking the time to complete the survey and making "On the Move to Better Health" a successful program.