An Outcome Evaluation of

4 for Lunch: A Healthy Lunch Challenge

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1.0 Executive Summary

For children and youth, eating patterns can have a significant impact on their future health. It is possible that poor eating habits with low intakes from any of the four food groups may result in deficiencies of essential nutrients. Further, over-consumption of foods with minimum nutritional value—high in calories, sugar, saturated or trans-fat—can have a negative effect on children's health and weight. Much research has been conducted on school-based interventions for nutrition programs and it has been documented that the school years are an influential time in a child's development, a time when life-long eating patterns are established. The purpose of the evaluation was to determine the effectiveness of the 4 for Lunch: A Healthy Lunch Challenge program for positively affecting students knowledge and behaviour related to healthy eating, in particular packing a healthy lunch consisting of foods from the four food groups as recommended by *Eating Well with Canada's Food Guide*. Overall, the 4 for Lunch evaluation highlighted a number of interesting findings. There were significant increases in student knowledge of intervention participants. Further, there were changes in behaviour related to food group consumption. However, there were no changes in who was packing lunches, nor were there any changes in teacher self-efficacy. The 4 for Lunch: A Healthy Lunch Program evaluation highlighted some significant findings and addressed areas of improvement for future iterations of the program. It is important to continue to implement this program as there are a number of significant findings that were identified that will contribute to making positive changes in students eating habits and food consumption patterns. Recommendations for future iterations and school-based nutrition programs include:

1. **Advocating for all elementary schools to create a healthy school nutrition environment**
    - Recommend to senior school board administrators to encourage all elementary schools to participate in the York Region Community and Health Services Healthy Schools Program (i.e., Nutrition Tools for Schools©) to assist in creating a healthy nutrition environment to support classroom learning and behaviour change.
    - Include recommendations in a 4 for Lunch principal recruitment letter to join York Region's Healthy Schools program and use the 4 for Lunch program as one component of a comprehensive approach to create a healthy school nutrition environment
    - Include materials within the program to link 4 for Lunch with the York Region Community and Health Services Healthy Schools Program (e.g., Nutrition Tools for Schools©) to foster a healthy school nutrition environment.
2. **Training and support for implementing the 4 for Lunch program**
    - Develop and include a comprehensive teacher information sheet with program materials to assist teachers with the implementation of the 4 for Lunch program. Topics would include a description of the program, goals, implementation strategies, and best practices for influencing behaviour.
    - Provide new and existing teachers with contact information for direct program support, related to either implementation or content.

- Require participating teachers to implement at least four nutrition lessons prior to the challenge week and encourage opportunities for healthy eating education throughout the school year (e.g., connecting and/or integrating healthy eating education into core subject areas).

3. Revising program materials

- Revise lessons to include both an education and skill-building component that allows for greater application of the material.
- Develop an additional required lesson to address the Meat and Alternative food group to explain what food choices fit in this category and examples of healthy lunch choices.
- Engage parents more throughout the program, by ensuring each of the required lessons has a take-home extension.

2.0 Introduction

Effects of Poor Eating Habits in Children

Eating patterns established at an early age can have a significant impact on the future health of children and youth. It is possible that poor eating habits with low intakes from any of the four food groups may result in deficiencies of essential nutrients. Further, over-consumption of foods with minimum nutrition value that are high in calories, sugar, saturated or trans-fat can have a negative affect on children's health and weight (Ontario Society of Nutrition Professionals in Public Health [OSNPPH], 2004). One increasingly common outcome of poor nutrition intake and decreased physical activity is childhood obesity. Childhood obesity is an increasing public health concern, with an estimated 22 million children under the age of five being overweight worldwide (WHO, 2003). The childhood obesity concern is not only a global phenomenon; it affects the Canadian population as well. Tremblay *et al*. (2002) estimated that the prevalence of childhood obesity among children aged 7 to 13 in Canada rose from approximately 5% to 14% among boys and 5% to 12% among girls between 1981 and 1996. This is almost a three-fold increase among boys and more than two-fold increase among girls. In addition to the chronic disease effects indicated above, children who are overweight or obese have psychosocial health concerns such as poor self-image, lowered self-esteem, eating disorders, and poor quality of life (Strauss, 2000).

There are a number of other negative health impacts that can result from poor eating habits. These are of note, as often nutrition practices that are learned in childhood are carried into adulthood (OSNPPH, 2004). Research indicates that healthy eating habits during childhood and youth can play a role in preventing several adult-onset chronic diseases such as heart disease, diabetes, and several types of cancer (Hearth & Stroke Foundation of Canada, 2002; World Cancer Research Fund, 1997). In particular, poor nutrition habits have been linked to childhood and adolescent dental caries (Ontario Association of Public Health Dentistry, 2003), iron deficiency anaemia (Health Canada, 1997), cardiovascular disease (National Heart Lung and Blood Institute, 2002), overweight and obesity (Tremblay and Willms, 2000), type 2 diabetes (American Diabetes Association, 2000), disordered eating (Jones et al., 2001), and adult osteoporosis (Weaver, 2002), cancer (World Cancer Research Fund, 1997), and cardiovascular disease (Heart and Stroke Foundation of Canada, 2002).

Eating Habits of Canadian Children and Youth

According to results from the 2004 Canadian Community Health Survey on Nutrition (CCHS) (Garriguet, 2006), 70% of children aged 4 to 8 and 50% of adults do not eat the recommended daily minimum of five servings of Vegetables and Fruit per day (using previous Canada Food Guide recommendations). Children between the ages of 4 and 8 consumed fewer Vegetables and Fruit on average than any other age group. Garriguet also found that more than 33% of children aged 4 to 9 do not have the recommended two servings of Milk Products and more than 25% of these children do not meet the recommendations for consumption of Grain Products. Finally, snacks account for 27% of daily

caloric consumption and between 19-32% of children between the ages of 4 and 13 consumed foods prepared at a fast food outlet the day before the survey took place. This trend of unhealthy eating is similar for Ontario. According to Ontario specific results from the CCHS for children between the ages of 6 and 12, 58.1% consumed less than five servings of Vegetables and Fruit per day.

Public Health Interventions in Nutrition

Much research has been conducted on school-based interventions for nutrition programs and it has been documented that the school years are an influential time in a child's development, a time when life-long eating patterns are established (WHO, 1998). The early years are the most appropriate time to establish healthy eating patterns, since the behaviours learned in childhood are often carried forward into adulthood. Children and youth spend a significant amount of time in school and, as such, school-based nutrition interventions might provide the most effective and efficient way to reach almost all children and adolescents as well as school personnel and families (WHO, 1998). Schools not only address the academic learning of children and youth, but they also provide a venue to enhance students' health, self-esteem, and development of life skills and healthy eating behaviours (OSNPPH, 2004).

Research indicates that when planning a school-based health promotion program, it should consider the needs and interests of the students, teachers, and school (Perez-Rodrigo & Aranceta, 2003). A thorough systematic review of the literature by Ciliska (2004) on school-based interventions targeting obesity prevention and improved nutrition indicated that successful interventions had the following characteristics: based on theory (most often social cognitive); included both males and females; were primarily elementary school-based; school teachers were involved; programs provided information on knowledge, attitudes and skill development; use of reliable and valid measures; randomized at the school level; and parent inclusion was relatively small. Perez-Rodrigo and Aranceta (2003) also provided a list of characteristics of successful school-based nutrition programs. The list of characteristics included: behavioural focus; theory-driven strategies; adequate time and intensity; family involvement; multi-component strategies; developmentally appropriate; considers needs of students, teachers, and school; self-assessment elements; self-efficacy; adequate teaching methods; modify school environment; school meals; teaching training opportunities; cultural relevance; and evaluation.

4 for Lunch: A Healthy Lunch Challenge

The program that is the focus of this evaluation is 4 for Lunch: A Healthy Lunch Challenge. This program has been offered by the Regional Public Health Unit for a number of years and has a goal of encouraging children and their families to pack healthy lunches. It is a four-week curriculum-matched program with a challenge week where students are challenged to bring healthy lunches containing four food groups. The challenge is meant to be fun with positive messaging throughout the program. Curriculum-matched lessons that meet the Healthy Eating Expectations from the 1998 Ontario Health and Physical Education Curriculum (Ministry of Education, 1998) are provided to all participating teachers.

Teachers are encouraged to implement these lessons throughout the month leading up to the challenge week. Parent nutrition resources are provided for teachers to send home. Participating classes are entered into a draw to be eligible to win a healthy lunch party. The 4 for Lunch program meets many of the recommendations identified by both Ciliska (2004) and Perez-Rodrigo and Aranceta (2003) for effective school-based nutrition interventions.

Social Cognitive Theory (Self-Efficacy)

From a theoretical perspective, the 4 for Lunch program is centred on Bandura's social cognitive theory (self-efficacy) (Bandura, 1997). According to Bandura, self-efficacy is people's beliefs about their ability to produce certain levels of performance that exercise influence over events that affect their lives. These self-efficacy beliefs determine how people think, feel, motivate themselves, and behave. Self-efficacy can be conceptualized as the confidence to perform a task. There are four different avenues to enhance one's self-efficacy. First, mastery experience is the most influential source of efficacy information as it is based on the performance of a task. Enhanced self-efficacy that is achieved through mastery experiences can be generalized to other situations that are similar. Second, vicarious experience is gained by observing others perform activities successfully. Often referred to as modelling, it can generate heightened expectations in observers that they can improve their own performance by learning from what they have observed. Third, activities using social persuasion lead people through suggestion into believing that they can cope successfully with specific tasks. Finally, physiological and emotional states influence self-efficacy judgements with respect to certain tasks. Emotional reactions (e.g., anxiety) can lead to negative judgements about one's ability to perform a task.

The 4 for Lunch program is based on providing the students with the knowledge and skills needed to successfully introduce a behaviour change. Students participating in the curriculum-based lessons will gain confidence through the enhanced learning and knowledge needed to make positive behaviour changes. Skill-based curriculum-matched lessons will provide students with mastery and vicarious learning experiences by watching others who are similar to them (e.g., other classmates) participate in the same activities and practicing the skill by participating in the challenge. Social persuasion can be affected by both the teachers and the parents of students, as well as classmates. For example, teachers are providing the curriculum-matched lessons, but they also provide educational material for parents. By providing additional learning opportunities to parents, students have the opportunity to be positively impacted in both the classroom and their home. By enhancing self-efficacy through this classroom-based intervention, it is hypothesized that the confidence will be transferable to other nutrition behaviours at breakfast, dinner, and snack-time. Students will have the self-efficacy needed to make these behaviour changes tangible.

Purpose

The purpose of the evaluation was to determine the effectiveness of the 4 for Lunch: A Healthy Lunch Challenge program to positively affect students knowledge and behaviour related to healthy eating, in particular packing a healthy lunch consisting of foods from the four food groups as recommended by *Eating Well with Canada's Food Guide*. A secondary purpose was to evaluate the effectiveness of the program for increasing teacher's confidence related to teaching nutrition curriculum. The following research questions guided this evaluation: (1) what changes in students' knowledge related to healthy eating will be evident after participating in 4 for Lunch?; (2) what changes in students' behaviour related to healthy eating, in particular packing a healthy lunch, will be evident after participating in 4 for Lunch?; (3) will there be any changes in students' other nutrition behaviours (e.g., breakfast or dinner) as a result of participating in 4 for Lunch?; and (4) what changes in teachers' self-efficacy for teaching nutrition will be evident after teaching and participating in the 4 for Lunch program?

3.0 Methods

School-board Review

Since the 4 for Lunch evaluation was to be conducted in public and Catholic elementary schools, permission was needed from both school boards to conduct the research project. A detailed application addressing methodological and ethical considerations was submitted to both the York Region District School Board (YRDSB) and the York Catholic District School Board (YCDSB). Both applications were approved/

Evaluation Design

The study was quasi-experimental in its design. Using a sample size calculation for cluster-randomized trials (Hayes and Bennett, 1999) a total of 25 schools were needed (assuming one grade three class per school with 25 students) for the evaluation. Grade three classes, teachers, and students were recruited to participate in this evaluation via a flyer and letter of invitation that was sent to all public and Catholic elementary school primary lead teachers and principals in York Region. The letter provided background information on the 4 for Lunch program, as well as the scope of the evaluation. Teachers completed and returned a registration form, consent form (both teacher and principal), and brief demographic information form prior to being enrolled in the study. Registered teachers were grouped at the school-level and were randomly assigned into either the intervention or comparison group. Parental consent was obtained for the students to be allowed to participate in the study. Pre-test measures were administered one week prior to the intervention commencing in both the intervention and comparison groups, with post-test measures completed in both groups the week following the intervention. Participating classes were encouraged to follow the schedule that was provided as part of their package to ensure that dates of completion and test dates were the same. With regard to the implementation of the 4 for Lunch program, there was no influence from the public health department or school board. That

is, teachers had no formal training on how to implement the program nor any formal expectations from a program delivery perspective. Rather, the letter of information provided necessary information to implement the program and evaluation timelines and the pre- and post-test measures contained self-directed completion directions.

Procedure

Once classes and schools were registered for the program and schools were assigned into the intervention or comparison group, 4 for Lunch packages were sent to each registered grade three class. The intervention group package included a parent consent form, as well as pre- and post-test measurement tools of: teaching self-efficacy (Nutrition Teaching Self-Efficacy Scale (NTSES)); student nutrition knowledge (Food Fun and Me (FFM)); and 24-hour student food recall questionnaires (A Day in the Life Questionnaire (DILQ)). Intervention group packages also included the 4 for Lunch program materials, while comparison group packages only included the same pre- and post-measures as the intervention group. Both the intervention and comparison groups received a timeline of events and when the various measurement tools should be completed. Following the intervention period post-test, classes that were in the comparison group were provided with the intervention materials.

Measures

To determine the success of the 4 for Lunch program, three previously validated questionnaires were adapted and used: Nutrition Teaching Self-Efficacy Scale (Appendix A; Brenowitz & Tuttle, 2003); Food Fun and Me (Appendix B; Rabe, Ohri-Vachaspati, & Scheer, 2006); and a Day in the Life Questionnaire (Appendix C; Edmunds & Ziebland, 2002).

Nutrition Teaching Self-Efficacy Scale

The Nutrition Teaching Self-Efficacy Scale (NTSES) is a 19-item questionnaire that was adapted from Brenowitz and Tuttle (2003) to reflect the differences between the American and Canadian versions of the Food Guide. This questionnaire addressed teachers' confidence with teaching certain aspects of nutrition with students. For example, teachers were asked to indicate "how confident are you that you can do a good job teaching students which foods belong to each food group in Canada's Food Guide?" Responses to each question were on a 4-point Likert scale where one (1) represented "Not at All Confident" and four (4) represented "Very Confident." Overall efficacy scores were calculated by summing the scores for each of the 19 questions.

Food Fun and Me

Food Fun and Me (FFM) is an 11-item questionnaire that was adapted from Rabe *et al*. (2006) to reflect differences between the American and Canadian versions of the Food Guide. This questionnaire addressed students' knowledge and behaviour about various nutrition topics. Knowledge questions were multiple choice and behaviour questions were categorical and students had to indicate how frequently they performed the specified behaviour. Overall knowledge was determined by calculating the

percentage of correct responses. Behaviour questions were categorized into three possible categories: Never; Sometimes; and Always.

A Day in the Life Questionnaire

A Day in the Life Questionnaire (DILQ) is a nine-item survey that was adapted from Edmunds and Ziebland (2002) by removing the physical activity questions and adding a question related to packing lunches to align the tool with the evaluation questions. The DILQ asked students to recall the previous day's food intake at various time-points throughout the day. Students would indicate if they had something to eat or drink at each of the time periods and indicate by writing and/or drawing, what they had consumed. The completed surveys were then analyzed to categorize the identified foods into each of the four food groups (and "Foods to Limit") with the assistance of a Public Health Nutritionist. The "Foods to Limit" category included items such as other beverages and drinks, water, baked goods or cookies, sweets and sugars, high fat processed meats, and salty snacks. The food group classifications were conservative, especially when considering mixed dishes. For example, if a student indicated that they had consumed "spaghetti" it was assumed to be a two food group meal (i.e., Grain Product and Vegetable and Fruit) when in fact it may have had a meat sauce. Inter-rater reliability was confirmed by randomly selecting 10 completed surveys to determine if both the categorization of food groups was correct as well as check for data entry errors.

4.0 Results

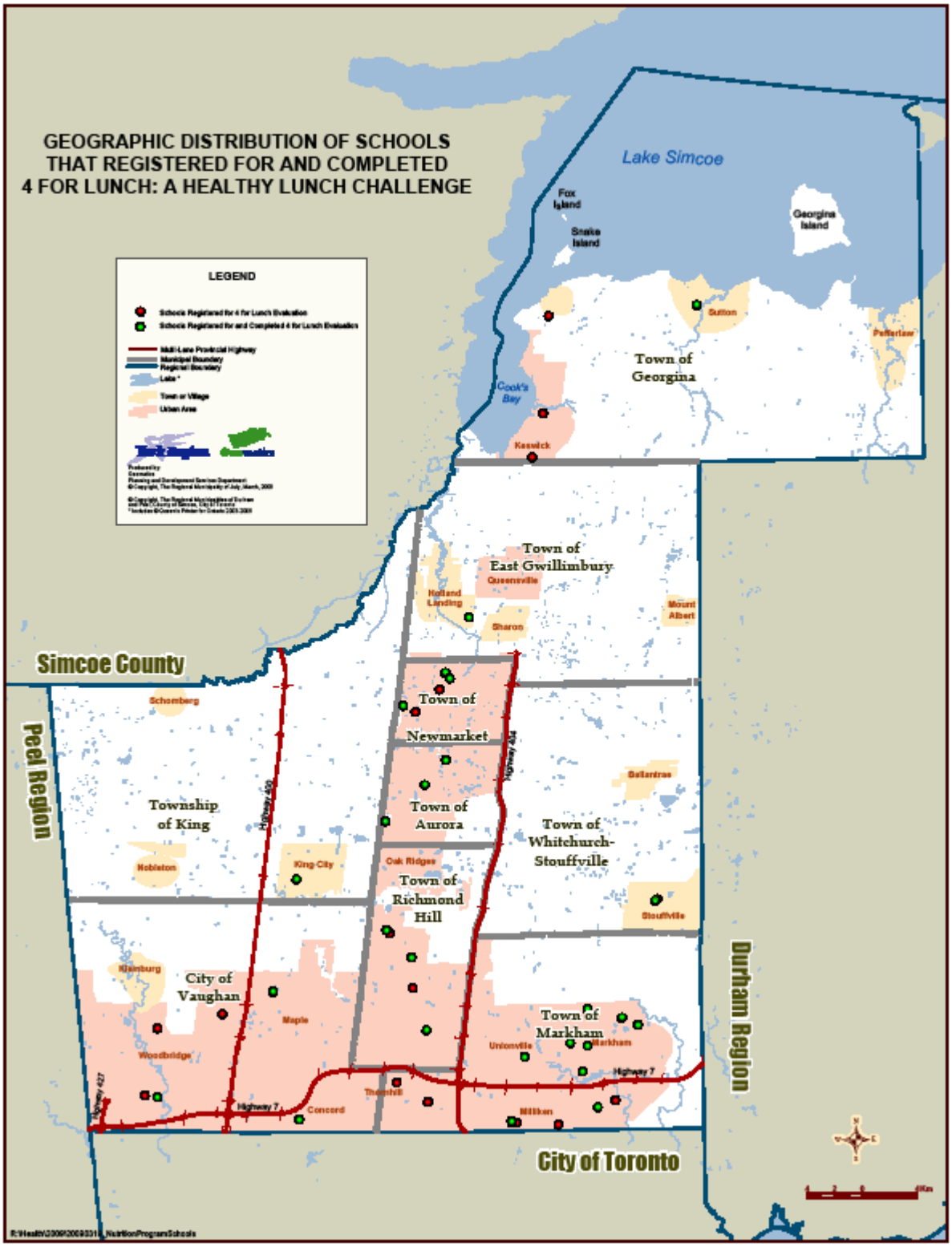
Participation Results

A total of 42 elementary schools from the York Catholic (YCDSB; n = 17) and public (YRDSB; n = 25) school boards registered to participate in 4 for Lunch. This represents 19% of the total elementary schools in York Region. Of these schools, 25 completed all aspects of the 4 for Lunch evaluation, yielding a 60% completion rate. Table 1 presents a summary of descriptive information on registered schools, classrooms and teachers. Figure 1 presents the geographic distribution of completed schools in York Region.

Table 1: Descriptive Information on Registered Schools, Classrooms and Teachers

	Intervention	Comparison	Total
Number of Schools	21	21	42
Number of Classrooms	43	42	85
Average School Student Population	529	425	473
Average Class Size	21	21	21
Average Teaching Experience in Years	10.0	8.4	9.2
Percent of Teachers with Previous Nutrition Teaching Experience	70%	72%	71%
Percent of Teachers with Previous 4 for Lunch Experience	45%	47%	46%

Figure 1: Geographic Distribution of Schools that Registered for and Completed 4 for Lunch: A Healthy Lunch Challenge



Drop-outs

Forty-two (42) schools registered to participate in 4 for Lunch and a total of 17 schools did not complete all aspects of the evaluation. There are a number of reasons for this including: failure to return completed surveys; failure to return signed consent forms; loss to follow-up; and incomplete submissions. Table 2 presents a comparison of schools, classrooms and teachers that completed or dropped out of the evaluation.

Table 2: Comparison of Schools, Classrooms and Teachers that Completed or Dropped Out of the Evaluation

	Completed	Dropped Out
Number of Schools	25	17
Average School Student Population	431	541
Ratio of YCDSB to YRDSB Schools	12 : 13	5 : 12
Number of Classrooms	47	38
Average Class Size	21	21
Ratio of Intervention to Comparison Classes	18 : 29	25 : 13
Average Teaching Experience in Years	10.4	8.0
Percent of Teachers with Previous Nutrition Teaching Experience (Grade 3)	68%	74%
Percent of Teachers with Previous 4 for Lunch Experience	47%	45%

Current 4 for Lunch Participation Compared to Previous Years

Prior to conducting the evaluation, the 4 for Lunch program had been implemented for a number of years reaching approximately 10,000 students. In the 2006/2007 school year a total of 88 schools registered and 60 completed the program. While the numbers for the 2007/2008 iteration of the program were lower (n = 42) there was an increase of 14 schools that had not participated before.

Changes in Students' Knowledge

Students in the intervention group increased their pre-test score by 10.9% (95%CI: 6.3%, 15.6%; Table 1) on the *Food Fun and Me* (FFM) questionnaire. When compared to a 3.4% increase (95%CI: 0.0%, 6.8%) among comparison group students, the increase was statistically significant ($p = 0.011$) (Table 1).

Table 3: Overall Changes in Pre-test and Post-test Scores on Food Fun and Me Questionnaire

Condition/Time Period	Pre-Test Score	Post-Test Score	Change in Score
Intervention	65.7%	76.7%	10.9%*
Comparison	62.2%	65.6%	3.4%

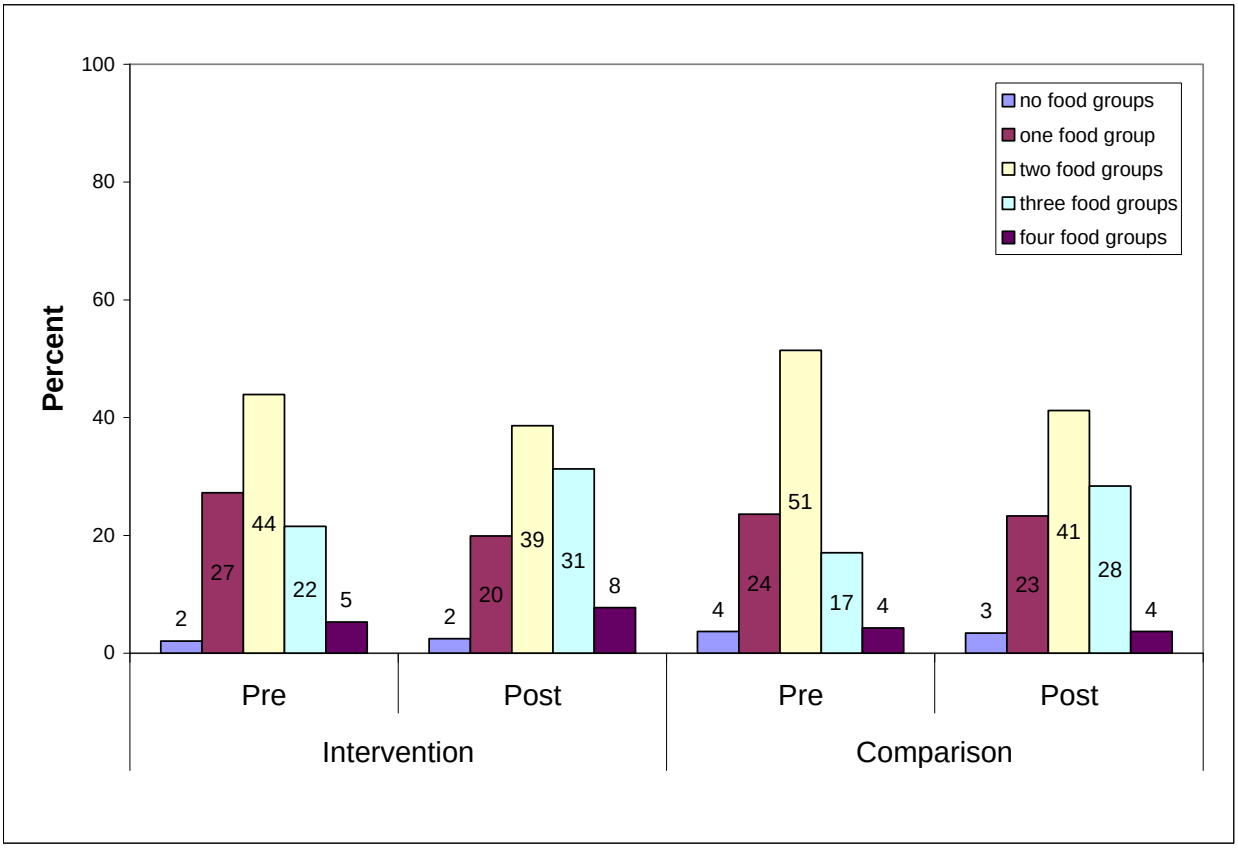
Note: * represents a significant difference, $p < .05$

There were five key questions on the FFM questionnaire that were related to Canada's Food Guide (CFG). In particular, questions one, two, six, and eight were all related to CFG and all had significant increases pre-post for the intervention group relative to the comparison group. In the first question ("Canada's Food Guide tells us…"), students significantly improved (p <.05) their knowledge related to CFG by 10.2%, whereas the comparison students did not improve their knowledge scores. In the second question ("From which food group should you eat the most servings in a day?"), students significantly improved (p <.05) their knowledge regarding the food group to choose foods from most often by 11.4%, whereas the comparison students did not improve their knowledge scores. In the sixth question ("How many Vegetable and Fruit Food Guide servings do you need to eat every day?"), intervention students significantly increased (p <.05) their knowledge related to Vegetable and Fruit servings by 21.3% whereas comparison students only improved their knowledge by 4.2%. Finally, in the eighth question ("What food group do eggs belong to?"), intervention students significantly improved their knowledge (p <.05) regarding the categorization of eggs in CFG by 20.9% whereas comparison students only improved their knowledge by 4.4%.

Changes in Students' Behaviour

There was no difference between pre- and post-tests for students that pack their own lunch, students that pack their lunch with their parents' help, or parents who were packing their lunch on the Day in the Life Questionnaire (DILQ). It is interesting to note that the majority (two-thirds) of students' parents in both the intervention and comparison groups were packing their lunches (intervention: 63.2% (95%CI: 58.4%, 67.9%); comparison: 69.0% (95%CI: 63.3%, 74.1%). With regard to the percentage of students pre-post that were eating lunches that consisted of the four food groups, there was no difference across all time periods and conditions. Chart 1 presents the pre-post distribution of food groups for intervention and comparison students.

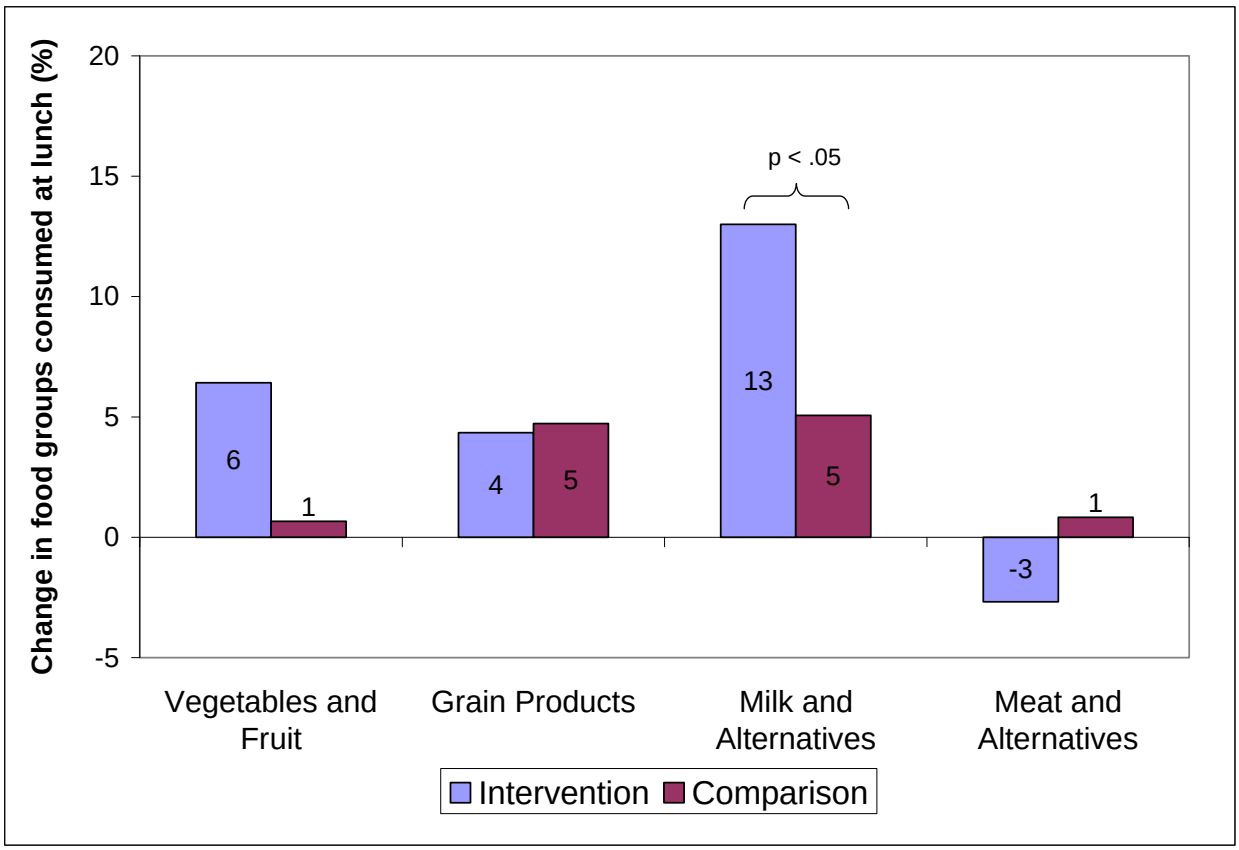
Chart 1: Change in the Distribution of Food Groups at Lunch



While there was no increase in the percentage of students consuming lunches with all four food group, virtually all students (i.e., 90%+) across all conditions and time periods are consuming three meals per day (i.e., breakfast, lunch, and dinner).

There was no difference across all conditions and time periods for consumption patterns for the Vegetables and Fruit and Meat and Alternatives food groups. Interestingly, there was a significant increase (p <.05) from pre- to post-test in the consumption of high fat processed meats (categorized as "Foods to Limit") for the intervention group relative to the comparison group. In addition, relative to the comparison condition, there was a significant increase (p <.05) from pre- to post-test for students in the intervention condition to consume more Milk and Alternatives. Further examination of foods categorized as "Foods to Limit" indicated no difference across all conditions and time periods. Chart 2 presents a summary of the changes in consumption patterns of the four food groups across both intervention and comparison groups over both time periods.

Chart 2: Change in Food Groups Consumed at Lunch



Changes in Teachers Self-Efficacy

There were no changes in the scores on the Nutrition Teaching Self-Efficacy Scale (NTSES) for teachers across all conditions and time periods. Overall, teachers had a very high level of efficacy at pre-test.

Summary of 4 for Lunch Results

The 4 for Lunch evaluation highlighted a number of interesting findings. There were significant increases in student knowledge of intervention participants. Further, there were changes in behaviour related to food group consumption. However, there were no changes in the number of students packing all four food groups or in who was packing lunches, nor were there any changes in teacher self-efficacy. Further, it was interesting to note that 14 new schools were participating in 4 for Lunch this year compared to previous years.

5.0 Discussion

The four research questions that were proposed as part of this evaluation are used to guide the discussion of results in this section.

What changes in students' knowledge related to healthy eating will be evident after participating in 4 for Lunch?

There was a significant increase in knowledge scores for intervention students compared to comparison students. Much of this knowledge increase was focused around key questions related to CFG. This could be attributed to the content of the 4 for Lunch program materials and the focus on learning about CFG. This change in knowledge might also be due to the theoretical nature of the program and student's learning via Bandura's principles of self-efficacy. For example, the link to the nutrition curriculum might have allowed for additional learning experiences or some learning outside of the classroom might have taken place as a result of the parent handouts that might have been sent home.

The intervention was only four weeks long and the number of lessons provided by teachers varied from classroom to classroom. As such it was a positive finding to learn that there was a significant increase in knowledge scores. This provides support for the notion that a short, but intensive, intervention can have an impact on participants' knowledge. It further demonstrates one successful aspect of a well-rounded intervention. The 4 for Lunch program focuses on both changes in knowledge and behaviour for students and it appears as though it is effective at increasing students' knowledge. It would be interesting in future evaluations to identify a suggested number of lessons to be completed and also to add another follow-up data collection point to determine how the changes in knowledge are maintained over time.

What changes in students' behaviour related to healthy eating, in particular packing a healthy lunch, will be evident after participating in 4 for Lunch?

While there was an increase in knowledge, the intervention may not have been long enough in order to allow the students to apply it to making a positive behaviour change. It might be warranted to provide more of an opportunity (e.g., additional challenges) for students to apply what they have learned into making positive shifts in behaviour. This finding of increased knowledge but little change in behaviour isn't surprising given the short duration of the intervention. Research by Dairy Farmers of Canada indicates that there is a discrepancy between improved knowledge and utilization of this knowledge towards making an informed behavioural choice (Dairy Farmers of Ontario, 2003). Furthermore, teachers could choose whether or not to implement 4 for Lunch lessons. The results of the evaluation indicate that all teachers implemented at least one lesson and the majority implemented between one and three. It is possible that additional lessons might have had a possible dose-response affect on students' knowledge and behaviours leading to greater behavioural changes. Research

validates that behaviour change is positively correlated with the amount of nutrition instruction received. For example, in US schools the mean number of hours per school year spent on nutrition education is 13, which is well below the minimum of 50 hours thought necessary to impact behaviour (American Dietetic Association, 2003).

This research did not identify which classes implementing 4 for Lunch were participating in the Healthy Schools (Nutrition Tools for Schools©) program that is led by the York Region District School Board and Public Health. The Healthy Schools program supports schools in creating healthy environments to make the "healthy choice the easy choice" for school community members. Elementary schools may sell or offer foods with minimum nutritional value through a variety of venues including special food days (e.g., pizza day), tuck shops, bake sales, school celebrations and events providing a mixed message to students about healthy eating. When nutritionally inadequate foods are available and promoted to students every day, it is increasingly difficult for them to maintain a healthy diet. As well, this inconsistent message can undermine classroom teaching about nutrition. Wind *et al*. (2007) suggests that it is important to have multi-component interventions that address students' behaviours, parental involvement, and changes in the school environment. Therefore, if a class was from a Healthy School that had identified nutrition as a priority, the school may have a more supportive nutrition environment than those classes situated in schools not participating in the Healthy School's program. Perhaps behaviour change would have been more evident if the 4 for Lunch program was implemented as one component of a comprehensive healthy schools approach to create an environment that supports healthy eating. This environment would also enable students to practically apply new learning in a supportive venue.

In addition, there was no change in the proportion of students that were packing their own lunch or consuming four food group lunches. While these were goals of the program, they may not have been achieved for a number of reasons. Parents may not have been fully aware of the 4 for Lunch program goals and may not have encouraged their child to participate in the preparation of four food group lunches. It may be warranted for future iterations of the 4 for Lunch program to emphasize the need for parents and children to work collaboratively to prepare healthy, four food group lunches which would act as a good teaching moment and may enhance the likelihood that students will eat their lunch.

There are many possible explanations for not including a choice from each of the four food groups. Some cultures do not allow both meat and milk products to be eaten at the same meal. Further, foods from the Meat and Alternative group may be seen as difficult to pack and include in a students lunch. For example, maintaining the texture and food quality while controlling for food safety may have limited the number of students that bring Meat and Alternatives. Due to heightened allergies and restrictions in schools students may not be permitted to bring peanut butter or nut products to schools. Lastly, students may be hesitant to bring unfamiliar foods (e.g., legumes) or cultural foods for lunch from a peer acceptance point of view.

Although there was no significant increase between pre- and post-test in the consumption of Vegetables and Fruit as part of their lunch, approximately 50% of all students were consuming Vegetables and Fruit during lunch. This is an interesting finding as Garriguet found that 70% of Canadian children aged 4 to 8 and 58% of Ontario children aged 6 to 12 do not eat the recommended daily serving of Vegetables and Fruit each day. Our finding is not without limitations though, as the target population in the evaluation is likely not representative of the Canadian youth population because of the sampling techniques employed. Participating schools volunteered to participate in the evaluation and as such they may be different from the overall school population. As an example, the high levels of teacher self-efficacy might highlight this as a distinct possibility. Students do not consume Vegetables and Fruit regularly and this may be for many reasons. For example, students may have eaten the food at other times throughout the day. In addition, lower levels of Vegetables and Fruit consumption might be due to children's tastes, difficulty packing into lunches, or cost of purchasing fresh items. Due to the season that the evaluation was implemented (i.e., winter), it is also possible that the availability of fresh products was diminished.

There was no increase in the consumption of Grain Products and no increase between pre- and post-test in the consumption of Meat and Alternatives; however, there was a significant increase in the proportion of students in the intervention group that were consuming more high fat processed meats (e.g., salami, bologna, and pepperoni). This category of foods was classified as "Foods to Limit" and was not included as one of the four food groups in CFG. It is possible that students were consuming more food that they thought might be considered a Meat or Alternative, but in fact was a high fat processed meat. For example, students and/or their parents may have included salami or bologna sandwiches thinking these foods would be classified as a meat and would contribute to including all four food groups, but according to CFG and the categorization of foods as part of this evaluation, these would be considered "Foods to Limit" due to their high fat and salt content. So, although this food was not categorized as a Meat and Alternative, it is possible that if it was re-categorized as such that there may have been an increase in students consuming four food group lunches and/or significantly increasing their Meat and Alternative consumption. Thus, with revisions to the program to provide further education on healthy Meat and Alternative food products, future iterations of the program might very well see an actual increase in four food group lunches and Meat and Alternative consumption.

Finally, there was a significant increase in Milk and Alternative food group consumption. This is a positive finding given that 33% of children aged four to nine do not meet CFG recommendations for daily consumption (Garriguet, 2006). Milk and Alternatives are readily available and an easy addition to a students' lunches. Including things such as cheese strings, yogurt, or participating in school milk programs are an easy way to increase the frequency of Milk and Alternatives in students' lunches.

Will there be any changes in students' other nutrition behaviours (e.g., breakfast or dinner) as a result of participating in 4 for Lunch?

Overall a very high proportion of students in both the intervention and comparison groups consume breakfast, lunch, and dinner. As such, it is not surprising that there was no significant increase between groups. Research indicates that approximately 20-50% of Grade 6 and 8 students do not eat breakfast (more than a glass of milk or fruit juice) daily (Lee cited in Boyce, 2002). Our results are very promising in that over 90% of participating students consumed breakfast the day prior to completing the survey. However, our target population is likely not representative of Canadian students or of York Region students overall for reasons mentioned previously.

What changes in teachers' self-efficacy for teaching nutrition will be evident after teaching and participating in the 4 for Lunch curriculum and activities?

Participation in 4 for Lunch did not lead to any significant increases in teacher self-efficacy. This may be because teachers already had a high level of efficacy at pre-test. For example, since the average score on the *Nutrition Teaching Self Efficacy* questionnaire was so high initially, further changes are unlikely given there was little room for improvement on overall scores. Many teachers also had experience with 4 for Lunch, and nutrition teaching experience, or a long tenure as a teacher and as a result were already likely comfortable with teaching about nutrition. The teachers also volunteered to participate in the evaluation and might have had a heightened level of self-efficacy compared to other teachers in the Region. These factors might have limited the extent to which an individual was able to improve his/her self-efficacy. The teacher characteristics indicate that the participating teachers were eager, knowledgeable, and confident at teaching nutrition and, as such, this would be a benefit for the implementation of the program.

Summary

The 4 for Lunch program is a multi-component curriculum-matched supplement provided over a short duration of four weeks. There is a difficulty in building the foundation for behaviour change when the program is not sustained outside of the four week intervention. Furthermore, while the intervention provides a curriculum component, a take home component, and a behaviour component, it does not address the school nutrition environment. It is critical to have a supportive nutrition environment to be able to apply what is learned in the classroom. However, while the program may not have met the goal of packing four food groups, the positive changes in knowledge are very important. The school's formal curriculum is a good starting point from which students can learn about nutrition and healthy food choices and these knowledge changes, coupled with the increase in Milk and Alternative consumption are positive findings as they and can provide a foundation to build upon and promote a healthy school nutrition environment. Therefore schools should be encouraged to implement 4 for lunch as one component of a comprehensive Healthy Schools approach to create an environment that supports healthy eating. A

healthy nutrition environment would provide positive messages about healthy eating and nutrition which would reinforce the curricula and knowledge learned and potentially lead to a more successful program.

6.0 Limitations

As with all research and program evaluations there are inevitable limitations that must be acknowledged. There are a number of limitations with the 4 for Lunch program; first, the short duration of the intervention may have limited the extent to which significant findings were obtained. While there were significant increases in knowledge and some behaviour patterns, there was no change in students eating lunches with all four food groups. Second, there was no nutrition training provided to teachers so the degree of implementation from school to school and class to class may have varied. It is unknown as to whether the teacher was utilizing all aspects of the intervention with his/her class. For example, teachers were encouraged to send home parent materials, but it unknown if these were sent home and read and/or understood by the students' parents. Third, participation into the evaluation was voluntary and as such those teachers that volunteered self-selected themselves into the evaluation. As such, there are some biases due to this self-selection (e.g., high level of nutrition teaching self-efficacy). Fourth, due to the way the data was collected and entered, we are unable to ascertain serving sizes and only whether or not the food group was consumed. Thus, we are unable to determine if in fact students were meeting the food guide recommendations with regard to serving sizes. Finally, there were limitations of the survey and categorization used in this evaluation. While the same limits were applied at both pre- and post-test, the categorization of food products was very conservative. For example, if a student indicated that they had a sandwich; it was conservatively categorized as a Grain Product only. As such, these conservative estimates may not have fully captured the actual lunch time eating behaviours of the students.

With regard to the study design there are a few limitations worth noting. There was the lack of training for teachers on how the student surveys were expected to be completed. Students may not have been as descriptive as we would have liked leading to the difficulty in classifying foods. In addition, with survey research and, in particular, recall surveys, there might be a difficulty recalling what was consumed in the previous day. The timing of survey administration (e.g., depending on the time of day the survey was administered, students' ability to recall might be impacted), and the main survey target population (grade 3 students) may have limited the evaluation findings. Further, there was a severe weather event (i.e., snow day) on the post-test data collection day and this may have decreased the number of completed classrooms.

7.0 Recommendations and Conclusion

Overall, the 4 for Lunch program was successful at positively impacting students' knowledge with minor impacts on students' behaviour. Based on the findings of the evaluation, there are a number of revisions to the 4 for Lunch program and actions that are recommended to address the gap between knowledge and behaviour change. These include:

1. **Advocating for all elementary schools to create a healthy school nutrition environment**
    - Recommend to senior school board administrators to encourage all elementary schools to participate in the York Region Community and Health Services Healthy Schools Program (i.e., Nutrition Tools for Schools©) to assist in creating a healthy nutrition environment to support classroom learning and behaviour change.
    - Include recommendations in a 4 for Lunch principal recruitment letter to join York Region's Healthy Schools program and use the 4 for Lunch program as one component of a comprehensive approach to create a healthy school nutrition environment
    - Include materials within the program to link 4 for Lunch with the York Region Community and Health Services Healthy Schools Program (e.g., Nutrition Tools for Schools©) to foster a healthy school nutrition environment.
2. **Training and support for implementing the 4 for Lunch program**
    - Develop and include a comprehensive teacher information sheet with program materials to assist teachers with the implementation of the 4 for Lunch program. Topics would include a description of the program, goals, implementation strategies, and best practices for influencing behaviour.
    - Provide new and existing teachers with contact information for direct program support, related to either implementation or content.
    - Require participating teachers to implement at least four nutrition lessons prior to the challenge week and encourage opportunities for healthy eating education throughout the school year (e.g., connecting and/or integrating healthy eating education into core subject areas).
3. **Revising program materials**
    - Revise lessons to include both an education and skill-building component that allows for greater application of the material.
    - Develop an additional required lesson to address the Meat and Alternative food group to explain what food choices fit in this category and examples of healthy lunch choices.
    - Engage parents more throughout the program, by ensuring each of the required lessons has a take-home extension.

In conclusion, the 4 for Lunch: A Healthy Lunch Program evaluation highlighted a number of significant findings and addressed areas of improvement for future iterations of the program. It is important to continue to implement this program as important findings were identified that will contribute to making positive changes in students eating habits and food consumption patterns. By utilizing and sharing these evidence-based findings it is possible for others to implement similar programming and achieve similar results. Further, the recommendations proposed will be of use to others to ensure their program is as robust and comprehensive as possible.

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Appendix A: Student Questionnaire Package

Food Fun and Me

4 for Lunch: A Healthy Lunch Challenge

First Name: _____ **Last Name:** _____

School: _____ **Teacher:** _____

Age: _____ **What is your grade:** _____ **Are you a:** ☐ Girl ☐ Boy

1. ***Canada's Food Guide*** **tells us** (Choose one)

   a. The cost of different foods
   b. How much to eat of different kinds of food
   c. How to prepare foods we eat
   d. I have never seen *Canada's Food Guide*

2. **From which food group should you eat the most servings in a day?** (Choose one)

   a. Grain Products
   b. Vegetable and Fruit
   c. Milk and Alternatives
   d. Meat and Alternatives

3. **Which food is a lower-fat snack? (Choose one)**

   a. pretzels b. potato chips c. doughnuts

4. **Which one would you choose as the healthiest lunch?** (Choose one)

   a. Bologna sandwich and fruit punch
   b. Pepperoni pizza and pop
   c. Spaghetti with meatball sauce and chocolate milk

5. **We should wash fruits and vegetables before we eat them:** (Choose one)

   a. to keep them fresh
   b. only if they are dirty
   c. to wash off the germs and dirt
   d. to make them juicy

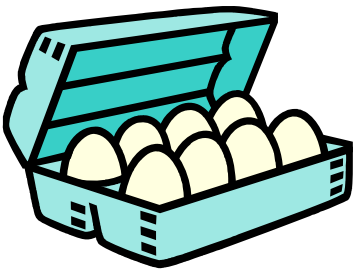
6. **How many Fruit and Vegetable Food Guide Servings do you need to eat every day?** (Choose one)

   a. 7-8 b. 5-6 c. 3-4 d. 1-2

Adapted for use by The Regional Municipality of York, Community and Health Services Department, Public Health Branch from the Ohio Statue University Extension

7. **What important nutrient does the Milk and Alternatives food group have?** (Choose one)

   a. fiber
   b. vitamin C
   c. calcium
   d. iron



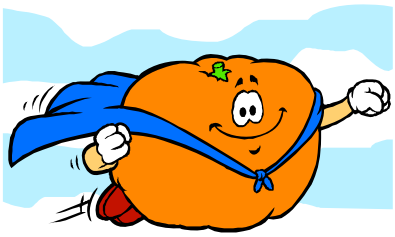
8. **What food group do eggs belong to?** (Choose one)

   a. Grain Products
   b. Vegetable and Fruit
   c. Milk and Alternatives
   d. Meat and Alternatives

9. **Which food does not belong to the Grain Products food group?** (Choose one)

   a. Bread
   b. French fries
   c. Rice
   d. Pasta

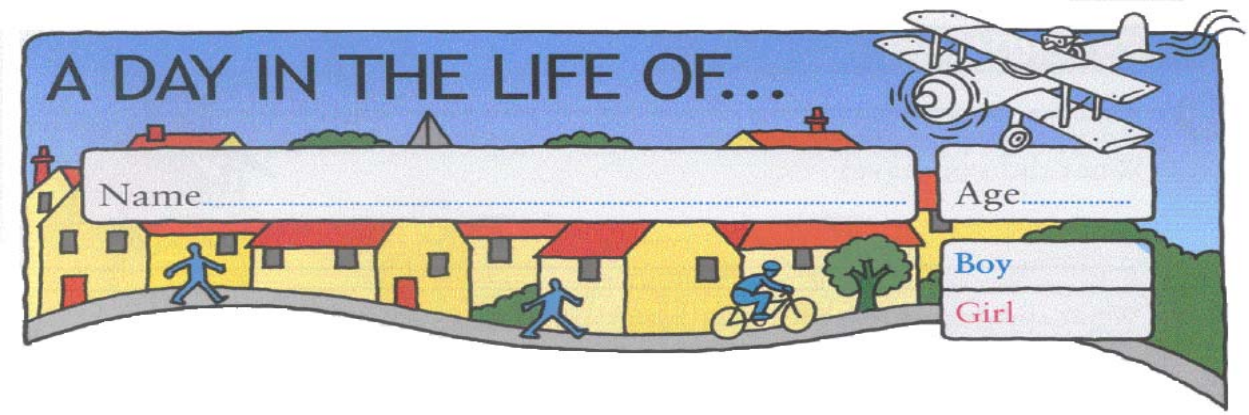
10. **I wash my hands before I eat food:** (Choose one)



   a. never
   b. only if they look dirty
   c. to wash off germs and dirt
   d. to make them look better

11. **Put an X in the box that best describes what you do.**

	Never	Sometimes	Always
I eat vegetables at lunch or dinner.			
I eat breakfast every day.			
I eat candy or chips every day.			
I wash my hands before meals.			
I like to try new foods.			



1. Who packed your lunch yesterday?

☐ I Did
☐ I Did With My Parents Help
☐ My Parents Did

What Did You Do???

YESTERDAY MORNING

2. Did you have something to eat and drink for breakfast?

☐ YES ☐ NO

What Did You Eat?

_____

_____

_____

What Did You Drink?

_____

_____

My Breakfast

Draw your breakfast

3. Did you eat or drink anything on tl

☐ YES ☐ NO

What Did You Eat? _____

_____

What Did You Drink? _____

YESTERDAY AT SCHOOL

4. Did you have anything to eat or drink at recess?

☐ YES ☐ NO

What Did You Eat?

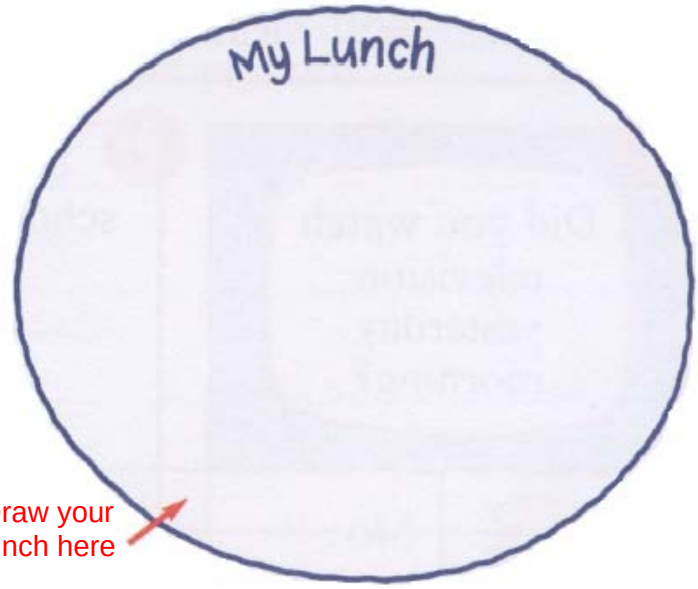
_____

_____

What Did You Drink?

_____

5. Did you have anything to eat or drink for lunch?



☐ YES ☐ NO

What Did You Eat?

_____

_____

_____

What Did You Drink?

_____

AFTER SCHOOL

6. Did you eat or drink anything when you were traveling home?

☐ YES ☐ NO

What Did You Eat?

_____

What Did You Drink?

_____

7. Did you eat or drink anything after school but before dinner?

☐ YES ☐ NO

What Did You Eat?

_____

What Did You Drink?

_____

8. Did you have dinner yesterday?

☐ YES ☐ NO

What Did You Eat?

_____

_____

_____

What Did You Drink?

_____

_____

9. Did you have a snack after dinner or before you went to bed?

☐ YES ☐ NO

What Did You Have?

_____

_____

_____

THANK YOU!!

Appendix B: Teacher Completed Questionnaire Package

Instructions: For each of the following questions, please circle the number that best represents your level of confidence. Please answer honestly.

How confident are you that…	Not at All Confident (1)	Somewhat Confident (2)	Confident (3)	Very Confident (4)
You have adequate training to teach nutrition?	1	2	3	4
You understand nutrition concepts well enough to teach them to your students?	1	2	3	4
You have the skills necessary to teach nutrition concepts effectively?	1	2	3	4
You can answers students' nutrition-related questions?	1	2	3	4
You can do a good job teaching what *Canada's Food Guide* is?	1	2	3	4
You can do a good job teaching students what food groups make up *Canada's Food Guide*?	1	2	3	4
You can do a good job teaching students about eating a balanced diet?	1	2	3	4
You can do a good job teaching students which foods belong to each food group in *Canada's Food Guide*?	1	2	3	4
You can do a good job teaching students which nutrients come from each food group in *Canada's Food Guide*?	1	2	3	4
You can do a good job teaching students about fat, sugar, and salt in fast foods and snack foods?	1	2	3	4
You can do a good job teaching students the Healthy Eating Expectations outlined in the 1998 Health and Physical Education curriculum?	1	2	3	4
You can do a good job teaching students about reducing fat and salt in their diets?	1	2	3	4
You can do a good job teaching students about increasing fruits, vegetables, and grains in their diets?	1	2	3	4
How confident are you that…	**Not at All Confident (1)**	**Somewhat Confident (2)**	**Confident (3)**	**Very Confident (4)**
You can interest students in the subject of nutrition?	1	2	3	4
If you do a good job teaching nutrition, your students will be interested in nutrition?	1	2	3	4
If you do a good job teaching nutrition, your students will increase their nutrition knowledge?	1	2	3	4
If you do a good job teaching nutrition, you students will change their nutrition-related attitudes?	1	2	3	4
If you do a good job teaching nutrition, your students will change their nutrition-related behaviours?	1	2	3	4
If you teach more hours of nutrition, you will have a greater impact on your students' nutrition related knowledge, attitudes, and behaviours?	1	2	3	4