Diabetes Prevention in Primary School-Age Children

Angie Fast

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Abstract

The increasing incidence of type 2 diabetes among primary school-age children is a rapidly growing problem throughout the world. This project was designed to explore the research question; in primary school-age children, does an alternative nutritional education intervention reduce the incidence of type 2 diabetes? A review of literature related to nutritional education for this age group yielded three research studies, one systematic review, and two evidence-based practice guidelines to corroborate alternative nutritional education as a means for potentially reducing the incidence of diabetes among school-age children. As part of this project, Pender's Health Promotion Model was examined to determine if it would be a useful framework for implementing an alternative nutritional educational program within the primary school system in an effort to decrease primary school-age onset of type 2 diabetes. Based on findings from this project, there is evidence that an alternative nutritional education intervention does reduce the incidence and risk of type 2 diabetes in primary school-age children.

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GLOSSARY OF TERMS

Alternative nutritional education: Education that focuses on healthy nutrition and has the goal of decreasing type 2 diabetes. Children will learn about diabetes and how unhealthy eating and sedentary lifestyles can contribute to developing diabetes. The education program is designed specifically to promote learning through lecture, discussion, and visual triggers.

Australasia: A term used to describe Australia and S.W. Pacific Islands.

Cross-sectional study design: "A study designed to observe an outcome or variable at a single point in time" (Melnyk & Fineholt-Overholt, 2005, p. 586).

Evidence-based practice: "A problem solving approach to practice that involves conscientious use of current best evidence in making decisions about patient care" (Melnyk & Fineholt-Overholt, 2005, p. 587).

Evidence-based clinical practice guidelines: "Specific practice recommendations that are based on a methodologically rigorous review of best evidence on a specific topic" (Melnyk & Fineholt-Overholt, 2005, p. 587).

Lower Mainland: This is a term used to describe portion of land in British Columbia that is located between Vancouver and Hope.

Participatory approach: "Research that is participatory in nature" (Melnyk & Fineholt-Overholt, 2005, p. 591).

Primary school-age children: Children in grades one through seven.

Standardized nutritional education: Nutritional education that is provided to students as part of the required school curriculum. Nutritional education that is offered to primary school-age children in British Columbia is titled "healthy eating" and teaches the four basic food groups (B.C. Ministry of education, 2006).

Systematic review: "A summary of evidence that uses a rigorous process for identifying, appraising, and synthesizing studies to answer questions and draw conclusions about the data gathered" (Melnyk & Fineholt-Overholt, 2005, p. 594).

Chapter One

BACKGROUND & NEED

Incidence & prevalence of type 2 diabetes

Type 2 diabetes among primary school children is a problem that is rapidly growing throughout the world. Rosenbloom (2002) states that until the past decade, type 2 diabetes in childhood was an unexpected occurrence. There are two main factors that contribute to pediatric type 2 diabetes: obesity and weight gain (Holt, 2006). "The increased prevalence of childhood obesity has reached epidemic proportions in both the developed and developing world" (Reilly, 2004, p. 6). The most effective way to deal with type 2 diabetes in primary school-age children is to prevent it and evidence suggests that the best means for doing this is to provide "intensive lifestyle guidance" (Ritchie, L., Ganapathy, S., Woodward-Lopez, G., Gerstein, D., Fleming, S., 2003, p. 192). Ritchie et al. (2003) further state that intensive nutritional programs should be incorporated into the school system and the interventions should begin with the young in an attempt to prevent poor eating habits from forming.

Researchers have documented that "type 2 diabetes accounts for 8 to 45 percent of new childhood diabetes cases" (Peterson, Silverstein, Kaufman, & Boulton, 2007, p. 658). There are a number of reasons that might account for the broad range of cases, although the author suspects that location, ethnicity, and increased levels of poverty in some geographic regions might account for many of these cases. Peterson et al. (2007) indicate that type 1 diabetes has been more common than type 2 diabetes in the pediatric population in the past, but type 2 diabetes is emerging as a significant disease in this population. Huang & Goran (2003) found that 30 percent of newly diagnosed diabetic youth between the ages of 12 and 14 have type 2 diabetes.

Risk factors, pathophysiology and prevention of diabetes

Huang & Goran (2003) describe the "increasing prevalence of obesity in young people" (p. 39) and subsequent increase in type 2 diabetes in pediatric populations, as an epidemic in the United States; it was also noted that this epidemic is disproportionately higher in youth with an ethnic background that is Asian, Indian, or European decent. Early detection and prevention of type 2 diabetes in the pediatric population is imperative in order to minimize the potential for a severe public health burden; untreated prediabetes and diabetic medical complications at a young age, may lead to further complications including chronic disease at a young age (Huang & Goran, 2003). Screening children for type 2 diabetes leads to both early detection and prevention. Screening recommendations apply to both prevention of diabetes and follow-up once a diagnosis of diabetes is determined (Peterson et al., 2007).

Huang & Goran (2003) further suggest that prevention of behavioral risk factors such as poor diet and lack of physical activity through intensified lifestyle training will reduce diabetic incidence. Through interactive and intensified nutritional education in primary school classrooms, there will hopefully be a significant decrease in type 2 diabetes in the primary school-age population. Education and knowledge are tools toward healthy living; when individuals are provided with the proper tools they may become healthier.

Cramer (2008) states "in less than a decade, the Canadian diabetic population has increased by about 60% to 1.3 million people" (p. 45) and further identifies the growing concern with the number of children that are being diagnosed with both type 2 diabetes and prediabetic conditions. Jensen (2004) states the biggest risk factor for diabetes is obesity and Canada has seen a significant increase in pediatric obesity in the past 10 years, a 20% increase in boys and a 14% increase amongst girls. Cramer identifies that the increases in both

diabetes and prediabetic conditions, including obesity are related to lack of exercise and poor diet. He indicates the parents of these children are to blame for the chronic illnesses in their children related to, and including, type 2 diabetes.

Obesity has a significant role in type 2 diabetes development and it has been identified that "insulin as the key metabolic hormone of the body. High levels of insulin can lead to excess body fat. When insulin levels become chronically high the body often develops a resistance to the hormone. This leads to even higher insulin levels and, eventually, full-blown diabetes" (King, 2006, p. 34). Health issues that can occur in children may be linked to the diagnosis of type 2 diabetes that include: high blood pressure, liver disease, sleep apnea, heart disease, renal disorders, vision problems, circulation failure related amputations, stroke and nerve damage (Amschler, 2002; Evans, 2003; Landauro, 2005).

Amschler (2002) describes type 2 diabetes as a "condition that occurs when either the cells in the body become resistant to insulin, when the body does not produce enough insulin or both. In children, the condition appears related to inappropriate insulin action that leads to failure of cells to produce insulin. Individuals are often overweight, have little or no thirst, no increased urination, and have a strong family history of diabetes" (p. 39).

Amschler (2002) suggests that girls have a slightly higher risk for type 2 diabetes than boys related to an increased resistance to insulin action occurring mid-puberty which is thought to be caused by increased levels of growth hormones. Obesity is not the only cause of type 2 diabetes, as genetics and ethnicity also contribute to the disease (Kiess, Bottner, Raile, Kapellen, Muller, Galler, Paschke, & Wabitsch, 2003). Furthermore, "lower susceptibility in Caucasians and higher susceptibility in Asians, Hispanics, and blacks have been noted. There is a high hidden prevalence and a lack of exact data on the epidemiology of the disease in

Europe. In Australasia, the prevalence of type 2 diabetes is reportedly high in some ethnic groups and again is linked very closely to the obesity epidemic" (p. 77). Finally, it has been suggested that obesity usually occurs hand in hand with type 2 diabetes and state that worldwide "approximately 22 million children under the age of 5 years are overweight and the prevalence of overweight in the young is increasing" (Kiess et al. 2003, p. 78).

Family history is a contributing factor for the development of type 2 diabetes in children. Landauro (2005) states that "childhood obesity is a family problem; children that have obese parents are more likely to be obese themselves" (p. 6). Brooks (2004) states "most children with type 2 diabetes have a family history of type 2 diabetes and insulin resistance" (p. 70).

Intrinsic and extrinsic motivational techniques for reducing obesity

Basdevant, Boute & Borys (1999) identify schools as key players in helping to prevent obesity, which in turn may lead to a decrease in the occurrence of type 2 diabetes in children. They conclude that school-based nutritional education is an important part of preventing type 2 diabetes. "An increasing proportion of a child's eating and physical activity is carried out at school; school doctors may play a key role in identifying individuals at risk for obesity; and education could keep in check the powers of the commercial world. Importantly, some programs that include classroom lessons on nutrition and physical health have been successful" (Basdevant et al., 1999, p. 10). Most schools in Canada do not have a school doctor, some have a school nurse, but most rely on public health nursing to meet the needs of the children as a group; individual care of the children is the responsibility of the family physician. Public health nurses do not have the time or resources to monitor obesity in the schools and family physicians do not generally see children on yearly visits, which may make it difficult to monitor and identify risk factors for childhood obesity.

Westenhoefer (2002) states that children are interested in nutritional education; however, to ensure that the nutritional education is effective, the correct stage of cognitive development according to the child's age must be considered. Educational strategies should concentrate on the importance of eating a balanced diet, along with encouraging children to trial a variety of new foods. Children from 7 to 16 years of age are interested in "nutrition and better exercise performance, nutrition and better learning, and nutrition related to different aspects of beauty" (Westenhoefer, 2002, p. 22).

Furthermore, Matheson & Springer (2001) identified styles that motivate learning as intrinsic and extrinsic. Intrinsic motivation is engaging in a behavior that brings internal pleasure, whereas extrinsic motivation is engaging in a behavior that brings external pleasure or rewards. Individuals that improve their well-being because of personal desires to do so are said to be intrinsic, and individuals that improve their health behaviors to earn praise or non-health related rewards are said to be extrinsic.

Children are not often motivated by personal desires to improve their wellbeing rather they are motivated by the intrinsic reward of having fun; motivating a child to attend nutritional activities with an element of fun (e.g. puzzles, computer games, or fantasy play) will provide an intrinsic pleasure desired by the child (Matheson & Springer, 2001). Rewarding children with external praise or physical prizes is motivating the child extrinsically; for example giving out stickers for correct answers to a nutritional question game.

Standardized nutritional education in BC

Standardized nutritional education is included in the primary school curriculum that every child attending public or private school receives in British Columbia. Nutritional education is included under the curriculum heading titled "Health" and includes the following topics: Healthy Living, Healthy Relationships, Safety and Injury Prevention, and Substance Misuse Prevention (B.C. Ministry of Education, 2006, p. 12). Between 30 & 35 hours per year is dedicated to Health education. Nutritional teaching falls under the category titled healthy living, which includes "physical and emotional health, healthy eating practice, physical, emotional & social changes, human reproductive system, and ways to help prevent spread of diseases, including life-threatening diseases such as HIV/AIDS" (B.C. Ministry of Education, 2006, p. 13). Frequently nutritional education takes the form of discussing the four food groups with little time to more fully discuss healthy food choices. Due to the amount of subjects, content required, and the limited amount of time allotted to Health education, the standardized nutritional education provided is not adequate to make significant lifestyle changes in primary school-age children.

Unfortunately, the standardized nutritional education that is included in the BC curriculum for primary school-age children is lacking as it does not sufficiently emphasize nutritional education that could potentially decrease the incidence and prevalence of type 2 diabetes. Based on background information obtained for this project, the author asserts the following: 1) there is no emphasis on obesity reduction, 2) there is no nutritional teaching (and counseling) beyond basic food group information provided in the current nutritional curriculum and, 3) there is no emphasis on the consequences of poor nutrition such as the development of type 2 diabetes. There is clearly the need for alternative nutritional education

that places greater emphasis on establishing healthy eating habits, increasing physical activity, and identifying foods that increase the risk for developing type 2 diabetes.

The author believes that the growing incidence of type 2 diabetes among primary school-age children can be decreased through the alternative nutritional education discussed throughout this paper. Alternative nutritional education is defined as education that focuses on healthy nutrition with the goal of decreasing type 2 diabetes. Children will learn about diabetes and how unhealthy eating and sedentary lifestyles can contribute to the development of diabetes. The education program is designed specifically to promote learning through lecture, discussion, and visual triggers. If successful, this intervention could be implemented throughout the region in an effort to decrease this growing, potentially deadly and debilitating disease.

Research Question

The purpose of this project is to address the following research question:

1) In primary school-age children, does an alternative nutritional education intervention reduce the incidence of type 2 diabetes?

Significance of the Project

There is significant evidence to suggest that the problem of pediatric type 2 diabetes is rapidly increasing around the world. Some countries have begun to take steps towards slowing the current trends in the number of children affected by the disease (Ritchie et al., 2003). More importantly, it is unclear whether Canada has begun to take steps toward reversing this crisis in its own pediatric populations. As a new nurse practitioner, the author sees a great need to explore steps towards preventing this disease in primary health care settings. Chapter 2 will provide the reader with relevant literature related to the research question and this project.

Chapter Two

REVIEW OF LITERATURE

There is limited research and information regarding type 2 diabetes in children in Canada; although in Eastern Canada work has been done specifically dealing with the First Nations populations. More importantly, there was little research identified that discussed the impact of nutritional education and/or counseling to reduce the incidence of type 2 diabetes in school-age children, particularly in the Lower Mainland where this author's nurse practitioner practice will be located.

Search criteria and processes

A systematic and thorough literature review was completed utilizing the databases of CINAHL, ERIC, Health Source, and Medline. These databases were utilized to glean information in order to respond to the research question. The keywords utilized in the search were ***nutrition, education,*** and ***diabetes.*** The search identified 166 potential resources and was then further narrowed by adding the keyword ***child*** to the search, which resulted in 21 potential articles for review. Of those 21 resources, 6 were selected based on their relationship to the research question. Those 6 resources included 4 research articles and 2 evidence-based practice guidelines. The search was limited by inclusion criteria only identifying full-text articles.

Studies highlighting diabetes risk factors and interventions to reduce them

Libman & Arslanian (2007) identified the following as risk factors for type 2 diabetes in children: high-risk ethnicity, sedentary lifestyle, insulin resistance genotype, obesity, and family history of type 2 diabetes. They also identified guidelines from the American Diabetic Association recommending screening high-risk children for type 2 diabetes beginning at ten

years of age, and every two years thereafter. High-risk is defined as "children with obesity and 2 of the following risk factors: First and second degree relatives with type 2 diabetes; having American-Indian, African-American, Hispanic, Asian/Pacific Islander in ethnic background; signs or symptoms of insulin resistance including acanthosis nigricans, hypertension, dyslipidemia, and polycystic ovary syndrome" (Libman & Arslanian, 2007, p. 25). The latest US guidelines for screening children and adolescents were also addressed and these suggest that prevention of type 2 diabetes in children is a difficult goal to achieve. Factors to facilitate prevention in children include family-centered programs involving lifestyle modification, education, stress management, emotional assessment, and increased physical activities. The strength of Libman & Arslanian's (2007) work is that it accesses and presents guidelines and up to date information regarding type 2 diabetes from the American Diabetic Association. The study identified changing the environment as the key area to target when attempting to decrease the incidence of type 2 diabetes in children. The authors indicated that wide-reaching change must include participation of families of the targeted children, schools, the food industry and government. Limitations included the lack of a clear research question, the methods used, and results other than the statement indicating more research is required. Further limitations included the lack of details and recommendations on how to proceed within the guidelines, and that the guidelines are from the United States. Some of the findings from the guidelines included in the article are applicable to the research question posed for this project, although the detail regarding nutrition and education was limited. The concept of participation of families and schools in decreasing the incidence of type 2 diabetes in children is applicable to the research question, however there were no specific recommendations provided for how to accomplish this.

Macaulay, Paradis, Potvin, Cross, Saad-Haddad, McComber, Desrosiers, Kirby, Montour, Lamping, Leduc, & Rivard (1997) conducted a mixed longitudinal and cross-sectional study addressing the impact and possibility of a community-based type 2 diabetes prevention program in the Kahnawake schools, which are located in a Mohawk community near Montreal, Canada. The purpose of the program was to "improve healthy eating and encourage more physical activity among elementary school children" (p. 779). The study occurred over a 3-year period in which the students received health education including information regarding "nutrition, fitness, diabetes, understanding the human body, and healthy lifestyles" (p. 781). Students between the ages of 6 and 12 received ten 45-minute sessions per year of health education. The short-term goal of the program was to reduce high-calorie and high-fat diets, obesity, and sedentary lifestyles among Kahnawake children. The long-term goal was to decrease the occurrence of type 2 diabetes in the future. The authors directed the participants to complete 2 questionnaires at the beginning of the study and then again at the completion of the study; one specifically questioned the children regarding their physical and sedentary activities within the previous week, while the other questionnaire contained questions about food consumption for the previous week. Although no statistics were reported in the article, results of the study demonstrated that the education intervention increased healthy eating and decreased sedentary activities in the Kahnawake children; it was reported that girls between the ages of 6 and 9 and boys between the ages of 7 and 11 demonstrated improved outcomes as the result of the intervention. The research presented by Macaulay et al. (1997) is applicable to this project because the main components of the program were health education classes contributing to the school's current curriculum, specifically promoting healthy nutrition and type 2 diabetes. The study suggested that

improved participation in physical activities and eating habits followed healthy lifestyle training when compared to participation following traditional health education offered in the current curriculum. The limitation of this study is that there is no discussion or follow-up regarding the long-term goal of decreasing the occurrence of type 2 diabetes in Kahnawake primary school children. This would be an important aspect of the research that more fully supports alternative nutritional education and its impact on type 2 diabetes in this age group.

In a separate but related study, Paradis, Levesque, Macaulay, Cargo, McComber, Kirby, Receveur, Kishchuk, & Potvin (2005) addressed the impact of a diabetes prevention program on body size, physical activity, and diet among Kanien'keka:ka (Mohawk) children ages 6 to 11 years within the Kahnawake schools. Elementary students in grades 1 through 6 in two Kahnawake communities received ten 45-minute specialized health lessons each year for an 8-year period. The lessons focused on healthy nutrition, type 2 diabetes, healthy lifestyle, and physical activity. The authors used a participatory research approach to conduct this prospective, longitudinal, quasi-experimental study. The purpose of the study was to determine if implementing a nutritional education program in the school system would decrease both the risk factors and the occurrence of diabetes in Aboriginal children. Data was collected five times throughout the study. Results throughout the study were not statistically significant ($p=0.1$), although there was a reduction in sedentary lifestyle, less television viewing, and increased physical activity; and there was a decrease in high-fat, high-sugar food consumption in the first 5 years of the study. Unfortunately, these changes were not sustained at the end of the 8-year study. The short-term results accomplished the goal of reducing risk factors for type 2 diabetes in the Mohawk children, but this reduction of risk factors was not maintained throughout the study. The study suggested that the introduction of satellite

television and new fast food restaurants during the study may have contributed to failure. The study suggests that nutritional education is a component that reduces risk factors for type 2 diabetes, but increasing temptations in the community may have contributed to poor results over time. The authors suggest that more research studying the long-term effects of this type of nutritional education intervention must be conducted. The ideas presented by Paradis et al. (2005) are applicable to the research question posed in this project because the main variables being studied included healthy nutrition and type 2 diabetes reduction as aspects of a nutritional education program.

Christensen, King, & Prestwich (2000) conducted a cross-sectional study to evaluate 68 children at a 2-week summer camp for diabetes. The purpose of the study was to determine whether improvements to diet and nutritional knowledge through time-limited education sessions would occur in young children and whether or not the education sessions were correlated with good diabetes control. During the 2-week camp, children attended 4 education classes on self-care management; specifically, education about meal planning, food contents, and groupings of foods. At the conclusion of the camp, each child was given a written and clinical exam covering the topics discussed in the education classes. Exam results suggested that only 25% of the participants improved their knowledge regarding nutrition. More importantly, it was determined that "correlation calculation between the diabetes knowledge and the skill to appropriately load portion sizes for a meal was not statistically significant" (p. 35-36). Specifically, results of the written exam demonstrated that the education classes over a 2-week period did not statistically ($p=0.132$) improve the nutrition knowledge in most of the children. The amount of education provided in the 4 short sessions was not sufficient for change. The author of this project believes that a small amount of

education introduced over a significant period of time rather than a large amount of information provided in four short sessions might be more effective and could potentially benefit the nutritional education interventions being proposed in a later section of this project. This study is applicable to the research question although it demonstrated that a compact and condensed approach to increasing pediatric knowledge was not an effective method for change in the specified population. The study uses children that already have diabetes as a diagnosis and have been given some form of diabetes education, although the article does not indicate how much knowledge each child has, or the length of time each child has had diabetes as a diagnosis.

In a study by Trevino, Pugh, Hernandez, Menchaca, Ramirez, and Mendoza (2007), the Bienestar diabetes risk factor prevention project was implemented to grade-4 students of Mexican –American decent living in San Antonio, Texas, in order to increase their knowledge of diabetes health. The Bienestar program consisted of a series of lessons to be implemented once per week for 28 weeks. The program was school-based and its primary goal was to ultimately decrease both dietary intake of fat and decrease physical body fat (Trevino et al., 2007). The lessons focused on "nutrition, wellness, and noncommunicable disease" (p. 63). Two grade-4 classes (n=71) and their teachers were involved in the study. The teachers evaluated the progress of the students in the following categories: environmental factors, personal factors, behaviors, and outcomes. Questionnaires, written, and physical exams were administered to determine the efficacy of the program. Students were divided into two groups: 46 students who attended greater than 50 percent of the classes; and 56 students who attended less than 50 percent of the classes. The students who attended greater than 50 percent of the classes had a higher knowledge level than those with poorer attendance. The

program operated for 2 years and results demonstrated that "the program significantly ($p<0.05$) decreased dietary fat servings and percent fat total kilocalories, and, significantly ($p<0.05$) increased dietary fruit and vegetable servings and diabetes health knowledge" (p.1). At the completion of the program, however, it was also determined that there was no decrease in body fat or an increase in exercise among participants. Limitations of the study include a lack of information available regarding body fat values for Mexican-American youth and the difficulty in finding a way to reduce the cost of the program for the children involved (Trevino et al., 2007). In addition, the specific focus on one culture in the study versus a study of North American children may be problematic, as findings may not be generalizeable to this author's population of interest. The results of this program are important to the research question being evaluated for this project because the study by Trevino et al. (2007) supports the implementation of a nutritional program in the school system. The fact that a decrease in body fat was not evident is important to consider as nutritional education alone in this study was not enough to decrease the participants' body fat. A combination of nutrition and physical fitness in an education plan may be beneficial.

Best practices and treatment guidelines

Peterson, Silverstein, Kaufman & Boulton (2007) offered prevention and education strategies for addressing type 2 diabetes in youth. The authors discussed the most up-to-date recommendations for screening youth for type 2 diabetes and recommended monitoring at-risk children for co-morbid conditions. Recommendations included screening every 2 years beginning at 10 years of age, weight management, increasing physical activity, providing psychosocial support, and incorporating nutritional education in educational programs. The risk factors identified by the authors were youth 10 years and older with a BMI of greater than

the 85th percentile, as well as any two of the following: high-risk ethnicity, family history, hypertension, dyslipidemia, polycystic ovary syndrome, or acanthosis nigricans (Peterson et al., 2007). Healthy eating, increasing exercise, and decreasing obesity and impaired glucose tolerance will decrease the effects of risk factors. The nutritional education interventions discussed within the guidelines for food modification were: developing a meal plan for the participants to follow; and teaching by dieticians and diabetes educators for the at-risk youth. One limitation of the guidelines is the focus on treatment as opposed to prevention. Peterson and colleagues (2007) suggest that prevention of type 2 diabetes through education of young people is beneficial, however the guidelines they discuss did not focus on specific nutritional education in schools. According to the Canadian Diabetes Association (2009), the current best practice guidelines for type 2 diabetes in children and adolescents are:

1) Education regarding active lifestyles and healthy eating to prevent obesity is recommended (proposed as alternative nutritional education in this paper).
2) Children at risk for type 2 diabetes should receive regular screening (the frequency of screening is not identified).
3) Consultation with an interdisciplinary pediatric healthcare team should occur with every type 2 diabetes diagnosis in children.
4) "Early screening, intervention, and optimization of glycemic control are essential, as onset of type 2 diabetes during childhood is associated with sever and early onset of microvascular complications" (p. 13).

Implications & summary

All the articles reviewed for this project have a similar theme: they emphasize the importance of nutritional education as a means for decreasing obesity and risk factors for type

2 diabetes in school-aged children. Evidence from each article has been presented to establish that best practice guidelines for prevention of type 2 diabetes in children should include interventions that address healthy nutrition. Trevino et al. (2007) indicated that nutritional education decreases the dietary fat of grade 4 students, which then decreased the risk of diabetes. Macaulay et al. (1997) indicated that increased nutritional education decreases the risk for type 2 diabetes. Paradis et al. (2005) found that nutritional education decreased the risk factors for pediatric diabetes in the short term; however, the decrease in risk factors was not maintained over the entire 8-year period. The 2-week study by Christensen et al. (2000) indicated that intensive short-term nutritional education is not beneficial in increasing nutritional knowledge in the pediatric population. Further, all the articles reviewed for this project support the notion that additional education is required to fight the current worldwide epidemic known as pediatric type 2 diabetes. Although each study did not utilize the same educational intervention, they all support the need for nutritional education to decrease the occurrence of type 2 diabetes in children. Standard nutritional education within the school system is not adequate as evidenced by rapidly increasing cases of type 2 diabetes presenting in the pediatric population.

It is critical to ensure that nutritional education addressing type 2 diabetes and foods that are associated with its cause is presented to targeted pediatric populations. Christensen et al. (2000) provided nutritional education in a classroom setting at a diabetes summer camp. Paradis et al. (2005) provided nutritional education in school classrooms consistently every year for 8 years. Macaulay et al. (1997) found that primary school instructors were teaching specific nutritional education regarding diabetes in their classrooms. Trevino et al. (2007) provided nutritional education in school classrooms for a 9 month period; the curriculum was

broken into 28 lessons over the 9 month period. Both Petersen et al. (2007) and Libman & Arslanian (2007) discuss the importance of educating the primary school-age children on nutritional topics. Libman & Arslanian (2007) identify the direct need for school involvement in education; Petersen et al. (2007) did not directly address who should be involved in educating the children, but were clear in the fact the children needed to be educated to prevent type 2 diabetes. The one location common to all primary school-age children is the classroom.

The risk of type 2 diabetes is reduced when primary school-age children receive alternative nutritional education when compared with more standardized nutrition curricula (Christensen et al., 2000; Macaulay et al., 1997; Paradis et al., 2005; & Trevino et al., 2007). Based on the evidence reviewed for this project, the best practice to address the research question is to implement an interactive education intervention in the primary schools that would include content on health food choices, foods that cause type 2 diabetes, and lifestyle choices and how they may influence the incidence of diabetes.

Currently, the British Columbia curriculum encourages teaching primary school-age children about health using the following learning resources when available: print items, videos, computer software (B.C. Ministry of Education, 2006). Resources are limited and apply to all areas of health, not specifically referring to nutrition. More importantly, standardized nutritional education focusing on the four food groups is insufficient to reduce the risk of type 2 diabetes in school-age children. The review of literature for this project was helpful in identifying which methods of educating primary school-age children were effective and which were less effective. Reviewing articles that used similar approaches to answer similar types of research questions was useful in providing direction for this author's own

nurse practitioner primary care practice. The most successful programs were those that increased healthy dietary patterns in the children and decreased occurrence of obesity and risk of type 2 diabetes. Chapter 3 discusses Pender's Health Promotion Model as one possible approach for beginning the important work of revising nutritional education in BC as a means for reducing type 2 diabetes for school-age children.

Chapter Three

THEORETICAL FRAMEWORK

Overview of conceptual framework

The conceptual framework forming the foundation for this project is Pender's Health Promotion Model (HPM). Pender's model "explores the biopsychosocial process that motivates individuals to engage in behaviors directed toward health enhancement" (McEwan & Wills, 2007, p. 247). The main concepts addressed in this model are: individual experiences and characteristics, behavioral outcomes, and behavior-specific cognitions and affect (McEwan & Wills, 2007). In order to improve the health of a population, health promotion is a required component. This model uses health-promoting behaviors to bring about change.

Pender's HPM identifies that people from all age categories can benefit from health promotion, including primary school-age children. Health promotion is best delivered in a place where the target population spends a significant amount of time. Primary school children spend a significant amount of their time in school classrooms, thus suggesting school is a logical location to implement health promotion interventions. Pender's model is an appropriate framework in which to assess the effectiveness of alternative nutritional education versus standardized nutritional education in the prevention of type 2 diabetes in primary school children.

Sources and search process

A literature search was undertaken to examine Pender's HPM. The initial search was conducted on Medline. The keywords "***health promotion***" and "***model***" were used which resulted in 305 articles. The word "***Pender***" was added to the search, which narrowed results to 16 articles. The search was further narrowed by including a combination of keywords "***models,***" "***psychological,***" "***health promotion,***" and "***Pender,***" which then narrowed the search to 3 articles. A separate search was then conducted within CINAHL. Initially, "***Pender***" and "***health promotion model***" keywords resulted in 304 articles. The search was narrowed to include "***Pender's health promotion model***" which narrowed the field to 78 articles. The search was further refined to include only full-text studies resulting in 19 articles.

A separate search was conducted on the Cochrane database in which "***Pender's health promotion model***" resulted in zero articles found. The search was expanded to "***health promotion model***"; again no articles were found. The search was then changed to "***Pender***"; 1 article was found. The search was expanded to use the phrase "***health promotion***" and 120 articles were found. The search was narrowed again to combine "***Pender and health promotion***;" resulting in no articles found. The search was expanded to included "***health promotion and models***" which provided 43 articles. To complete the process, a search was completed using Social Sciences full text, "***Health promotion models***" triggered 82 articles. A search of Electronic Journal Services with the phrase "***Pender***" yielded 13 articles. A search of the Clayton State University: Department of Nursing – Nursing Theory database found 3 articles using the word "***Pender.***" The articles for this project were included because they disseminate the most up-to-date information regarding Pender's health promotion model;

the articles were identified by including as many keywords into the search as possible. Most importantly, concepts from the HPM are consistent general health promotion trends occurring in Canada including motivation, self-care, and self-awareness.

Pender's HPM

Pender's HPM uses behavioral change to positively impact health. Srof & Velsor-Friedrich (2006) describe the health promotion model as "a theoretical perspective that explores the factors and relationships contributing to health-promoting behavior and therefore enhancement of health and quality of life" (p. 366). Pender (1996) describes the model as "a framework that serves as a guide for exploration of the complex biopsychosocial processes that motivate individuals to engage in health behaviors directed towards the enhancement of health" (p. 1).

Pender, Murdaugh, & Parsons (2002) stated that the HPM was created based on assumptions from both behavioral and nursing sciences. It is assumed that individuals seek to express their unique human health potential through the living conditions they have created. Humans have the ability for reflective self-awareness and individuals yearn to regulate their own behavior. People value positive growth and strive for balance between stability and change. Health professionals compose a part of the interpersonal environment: self-initiated changes to ones personal environment are essential for behavior change.

Primary school children meet the assumptions put forward by Pender, Murdaugh, & Parsons (2002). They are beginning to develop some of these characteristics, such as expressing their unique human health potential through living conditions they have created. Children can change the living conditions within their own environment such as their own bedroom by keeping the room tidy and free of garbage, thus promoting health. Primary

school-aged children are self-aware; they yearn to regulate their own behavior and they strive for balance. Pender, Murdaugh, & Parsons (2002) further stated that the HPM was based on the following constructs: prior behaviors and acquired characteristics influence beliefs and engagement; thereby affecting health-promoting behaviors. People engage in behaviors they feel will benefit them. Perceived barriers will impact an individual's commitment to behavior changes. Perceived competence in a new behavior will increase commitment to action and decrease perceived barriers. Positive emotions toward a behavior will increase commitment to action. There is an increase in commitment when individuals model behavior; family, peers, and health care providers exhibiting the behavior will increase the commitment to action. Situational influences in the external environment can increase or decrease commitment to action. Primary school children are easily influenced by the constructs discussed by Pender, Murdaugh, & Parsons (2002). Children's behavior is based on their upbringing, viewed examples, and the belief system that they have developed. In order to bring about behavioral change in primary children support, behavioral examples, and external environmental factors are required for positive results.

Tillet (1994) found that the HPM cues individuals to engage in health-promoting behaviors by specific cognitive-perceptual components that are transformed by personal, situational, and interpersonal factors. Pender (1987) describes the importance of health, perceived self-efficacy, and perceived control of health, health definition, perceived status of health, and the perceived benefits and barriers of health-promoting behaviors as cognitive-perceptual factors.

Clark (1992) places the health modifying factors into three categories: demographic characteristics, interpersonal influences, and situational factors. Demographic characteristics include the influences of race, age, gender, ethnicity, income level, and education on health promoting behaviors. Interpersonal influences include expectations of family members, past experiences with health care workers, and family health patterns. Situational factors include all options that are available to the client or in this instance the child.

Galloway (2003) expanded upon HPM modifying factors. Galloway states that demographic characteristics blend with the concept of self-actualization within the HPM. For example a child from a wealthy family is more likely to engage in preventative services than a child from a poor family. Galloway recognizes that interpersonal influences can either encourage or discourage behavioral change. For example, being raised in a family that eats healthy food will encourage a child to change their eating habits towards healthy choices, as compared to being raised in a family that consumes unhealthy foods. The child living with the family eating unhealthy food will have a very difficult time making the transition to healthy choices. Finally, Galloway (2003) describes situational factors as those influenced by the surrounding environment resulting in behavior changes. For example, lack of access to healthy food will negatively impact a child's behavior even if the child wanted to add fruit twice a day. Primary school children's health is affected significantly by demographic characteristics, interpersonal influences, and situational factors. These can impact the child's health in either a positive or negative way. Several groups of researchers agree that commitment to a plan of action leads to engagement in actual health promotion behaviors (Pender, Murdaugh, & Parsons, 2002; Pender et al., 2002).

Pender, Murdaugh, and Parsons (2002) described the HPM as useful in developing strategies for behavioral change. Pender's health promotion model is applicable to primary school children and health promotion. Health education is beneficial in the school system. An educational intervention grounded in the HPM will reflect its basic trend. Health professionals can assist primary children to facilitate their unique health potential by assisting them to regulate their own behavior through reflective self awareness of their demographic characteristics, interpersonal influences, and situational factors.

Conceptual framework concept & formats

Pender's HPM has been used in three different formats: as a conceptual framework for studies, as an outcome to describe health promotion, and as a predictor of behavior (McEwan & Wills, 2007). For the purpose of this project the HPM will be used both as a conceptual framework and as an outcome indicator. Pender's HPM has three major concepts: individual experiences and characteristics, behavior-specific cognitions and affect, and behavioral outcomes (McEwan & Wills, 2007). All three of these major concepts are applicable to this project.

The first major concept is individual experiences and characteristics. Primary school-age children are individuals; they come with their own personal characteristics and experiences. These include prior related behavior and personal factors: biological, psychological, and sociocultural (McEwan & Wills, 2007). Prior related behaviors include their eating habits, frequency of meals and snacks, type of food or drink consumed, and any other activity going on during the snack or meal time. Personal factors for primary school-age children are their genetics, sex, ethnicity, race, gender, household income, and past education on health promoting behaviors.

The second major concept includes behavior-specific conditions and affect. These include perceived benefits of action, perceived barriers to action, perceived self-efficacy, and activity related to the affect. Also included are interpersonal influences and situational influences (McEwan & Wills, 2007). A child's perceived benefits, barriers, self-efficacy and activity related affect will be very different than those an adult would identify. A primary school-age child's interpersonal influences and situational influences are also much different than an adult would experience. For example a child is being influenced by peers, siblings, and parents. It would be very difficult for a child to make a significant change in their eating habits if parents were not supportive. Situational influences can also be a challenge for a child to overcome. If the family is unable to afford a healthier diet, it will be difficult for the child to change behavior. Partnerships between local grocery stores and dieticians could be considered to problem solve with the families and determine healthy choices that are available within the families budget.

The third major concept is defined as a behavioral outcome. This concept addresses commitment to a plan of action and health promoting behavior. A child first must commit to a plan of action; in this case, a child must commit to receiving nutritional education. Following the commitment to the plan of action, the desired outcome or the health promoting change should occur. Here, the desired outcome is prevention of type 2 diabetes in primary school-age children through an alternative nutritional intervention.

Individual characteristics are inborn features (genetics, gender, age) individuals have, and along with experience factors can enlighten future behavior (Srof & Velsor-Friedrich, 2006). These background factors (characteristics and experiences) are generally not transformable. However, it is important to be aware of them as a plan of action is developed.

Srof & Velsor-Friedrich (2006) describe the category of behavior-specific cognitions and affect as "the target of most HPM research to date" (p. 367). This category includes perceived barriers and benefits to behavior, affect cues to behavior, and perceived self-efficacy. Health behavior that is influenced by social and environmental factors is situational and based on interpersonal influences (Pender, Murdaugh, & Parsons, 2005).

Information about an individual's interpersonal and situational influences is required prior to making a plan of action. It is important to know which influences will impact a child's ability to be successful. Knowing what these influences are and how to address them will promote an action plan that will be beneficial to participants in the project. Exploring barriers and benefits, along with perceived self-efficacy, and activity related affect are all essential when developing a plan of action. For example, children who have a large number of barriers to a given planned intervention will not be successful and the plan will ultimately require a different plan of action than those children with a limited number of perceived barriers. Pender (1987) identifies the behavior-specific cognitions and affect as "the primary motivational mechanisms for acquisition and maintenance of health" (p. 1).

The degree of commitment to the plan of action can be affected by peers, families, and health care workers. Individuals are more likely to commit to an action plan if other individuals in their social network are modeling the behavior, expect the behavior to occur, or support the individual trying to commit to a behavior change (Pender et al, 2002). The higher the commitment to the action plan, the greater the chance of maintaining health-promoting behavior change over the long-term.

Two important factors play a role in deterring individuals from reaching the goal of the health promoting behavior. These are immediate competing demands and preferences.

Immediate competing demands are factors over which individuals have little or no control. Preferences are those factors demonstrated when other actions are more desirable than the planned action (Pender et al, 2002). These factors require immediate attention if they develop during a study.

Applying Pender's model to this project

Any alternative nutritional education should combine elements previously discussed and outlined in the articles reviewed. A thorough evaluation component needs to be integrated into any intervention, in order to determine its effectiveness. For example, pre- and post-education questionnaires were implemented by several of the researchers cited in this project (Christensen et al., 2000; Macaulay et al., 1997, Trevino et al., 2007). In each study information defining the nutritional knowledge of each child was collected; following completion of the education intervention, a second questionnaire was completed by each student to evaluate if there was an increase in nutritional knowledge.

For this project, the author proposes incorporating alternative nutritional education (healthy food choices, foods that cause type 2 diabetes, and reduction of risk factors associated with diabetes) into the curriculum for primary school- age children with the intention of increasing the students' nutritional knowledge specifically related to type 2 diabetes. By incorporating concepts from Pender's HPM into an alternative nutritional education intervention, the proposed project may help to reduce the incidence and prevalence of type 2 diabetes in school-age children.

Potential obstacles and corrective measures

Obstacles that could prevent positive outcomes from occurring with an alternative nutritional education intervention include: lack of support from the school district, lack of

support and cooperation from family members, and inadequate finances to fund the project. There will be costs associated with printing the required questionnaires, hiring a nurse educator or dietician, as well as costs associated with the training of classroom teachers to provide the education to the students. Additional financial and human resource costs may include time required for compiling and evaluating the completed questionnaires; without some form of funding the project may not move forward. Other potential obstacles that may be encountered are resistance from parents, children, and the school system. Parents may feel that the study is investigating or pointing fingers at them. Children may feel that the way they eat or enjoy eating is being threatened. The teachers may not feel they are able to provide additional classroom time to the alternative nutritional education intervention without omitting one of the School Board's required curriculum components. The school system may perceive the investigator as an outsider. Studies from a perceived outsider can be threatening to a community. Thus, support from the school board, the principals, and the teachers would be required to ensure the nurse educator is able to enter the school and educate the students. Support and commitment from the parents is necessary, as the children will continue their learning away from school through discussion with parents and attempting to eat a healthy diet with food provided by parents; without parental support and participation this would not be possible. Family support is also critical because children with obesity and / or type 2 diabetes may have parents that are obese and / or have type 2 diabetes. Supportive and involved families may chose to embrace the changes as a family rather than simply support the child. Commitment from the students is also necessary to have a successful outcome; without the students embracing the project, attending the classes, and participating in the educational sessions the outcome will not be positive. Commitment from the children may

lead to positive changes in families of the participating children. As the children learn and share nutritional knowledge with their families, healthy lifestyle changes may occur in the home with family members as well.

Benefits of the project

The anticipated outcomes will be that that the students receiving the alternative nutritional education intervention will have increased nutrition knowledge compared to the students who received only the standardized nutritional education provided by the education system. With increased knowledge of nutritional education specifically intended to reduce type 2 diabetes, this project may assist with decreasing both the risk for and occurrence of type 2 diabetes in primary school-age children. The anticipated long-term outcomes are potential decreases in childhood obesity and type 2 diabetes, and a decreased risk for developing childhood diseases such as hypertension, cholelithiasis, and atherosclerosis as the result of type 2 diabetes. If the proposed project was successful even with a small group of children, the author would like to have the alternative nutritional education intervention implemented as a required component of the curriculum for primary school-age children in the Lower Mainland and, eventually, throughout the province of British Columbia.

Chapter Four

CONCLUSIONS

Implications of project to nurse practitioner practice

Pediatric type 2 diabetes is a significant problem. The prevalence of childhood obesity has been described as "reaching epidemic proportions in both the developed and developing world" (Reilly, 2004, p. 6); childhood obesity is the major contributing factor to type 2 diabetes in children. The most effective way to deal with pediatric type 2 diabetes in primary school-age children is to prevent it. A significant and large part of prevention is education. The easiest and most effective way to educate children is to reach out and meet them in a place where they spend most of their time. Children spend the majority of their daytime hours in school. School is an effective place to teach children about nutrition and health.

This project will contribute to nursing knowledge by potentially demonstrating an effective intervention to type 2 diabetes prevention in primary school-age children. It may also impact the role of school nurses and enable them to provide nutritional education in schools contributing to disease prevention and improved health. Success of such an educational intervention could provide a precedent to enable nurses to educate students within the school system about drugs, smoking, proper hygiene, dental care, sex education, safe sexual practices, safety around the community, and many other necessary topics that children often do not learn of in their traditional primary curriculum. If the project proves to be successful it may open doors to further educate primary school children about healthy living in circumstances where the traditional curriculum does not have the time or funding to provide information; for example a nurse practitioner in Agassi, BC has been able to attend the local high school at the beginning of each school year to speak with all the grade 9

students about sexual health and give information regarding the free weekly youth clinic offered to the high school children in Agassi.

Family nurse practitioners encounter primary school-age children in their practice. Unfortunately, many primary school-aged children only see their practitioner when there is a health concern or an acute illness. For these reasons it is difficult for a practitioner to incorporate continuous teaching and education throughout the primary school-age years. A primary school-age child may become obese or develop risk factors for type 2 diabetes without their practitioner's knowledge. The proposed project permits the nurse practitioner another mechanism to ensure the primary school-age children in their practice have access to additional nutritional education that can contribute to decreasing the occurrence of childhood obesity, type 2 diabetes and potential risk factors for developing chronic disease related to type 2 diabetes.

Nurse Practitioners can create the opportunity for learning while their clients wait to be seen. Nutritional and fitness information can be presented in the form of brochures, posters, and reading material displayed in the waiting area. Parents can take home brochures to learn more about proper nutrition and the importance of physical activity. Children can be given take home activity workbooks that have activities promoting healthy eating and physical fitness. The Nurse Practitioner can set a goal to discuss one health choice with every client visit. Examples of healthy choices are: smoking cessation, food choices, exercise, decreasing alcohol consumption, immunizations, proper care and monitoring of blood sugars if the client is at risk for or has diabetes.

Nurse Practitioners can use this project as a tool to move forward into the community and create partnerships to battle pediatric obesity, risk factors for both obesity and type 2

diabetes, and the occurrence of type 2 diabetes in children. Nurse Practitioners can come together with stakeholders in the community and work towards developing programs that combat both obesity and type 2 diabetes. Involving dieticians, fitness facilities, school boards, community leaders and community practitioners in planning programs for healthy children in their community is essential for successful outcomes.

Summary and Conclusions

In the past decade type 2 diabetes has been infiltrating the pediatric population, including primary school-age children. An increase in childhood obesity has contributed to an alarmingly large pediatric population with type 2 diabetes. One method used in prevention of pediatric type 2 diabetes is education. This project addresses whether educating primary school-age children is an effective way to prevent type 2 diabetes in children.

Based on Pender's HPM, this project has explored whether alternative interactive nutrition education increases the nutritional knowledge of primary school-age children and decreases the risk factors for type 2 diabetes. Long-term evidence supporting alternative interactive nutritional education suggests this intervention may help decrease the occurrence of obesity and reduce the risk factors for type 2 diabetes in primary school-age children. It is believed that well-informed individuals can make informed healthy choices. More importantly, children need information to make well-informed decisions.

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