The Barriers and Facilitators of the Kateri Memorial Hospital Center Health Education Curriculum

Kahnawake Schools Diabetes Prevention Project

Maedeh Khayyat Kholghi, MSc Candidate
Department of Family Medicine, Division of Experimental Medicine,
McGill University, Montreal

June 2013

A thesis submitted to McGill University in partial fulfillment of the requirements of the degree of Master of Science in Experimental Medicine-Family Medicine Option

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

ACKNOWLEDGEMENTS

The success of any project depends largely on the encouragement and guidance of certain individuals. I would like to take this opportunity to express my gratitude to the people who have been instrumental in the successful completion of this thesis. I would like to show my greatest appreciation to my supervisor, Dr. Gillian Bartlett for her exceptional assistance and support throughout the planning and execution of my thesis project. The mentorship of Dr. Bartlett has been invaluable on both an academic and a personal level, for which I am extremely grateful. It was only through her guidance that I gained the opportunity to collaborate with various researchers at both national and international levels. Without Dr. Bartlett's supervision and encouragement this thesis would not have been possible. I would like to also thank my co-supervisor, Dr. Ann Macaulay for introducing me to the community of Kahnawake, and supporting me in every possible way throughout this journey. It was an honour for me to work with Dr. Macaulay and her advice and guidance were vital to the completion of this thesis. Furthermore, I would like to thank the community of Kahnawake, Kahnawake Schools Diabetes Prevention Project (KSDPP) research team members, and Community Advisory Board members for welcoming me in their community and working alongside me throughout all stages of this project. A special thanks to Morgan Phillips for her significant contributions and assistance in the preparation and execution of this project. Additionally, I would like to express my gratitude to all the study participants for their contributions and valuable input. This was a community-based participatory research project, and I am humbled and honored to have been part of this team working with KSDPP and community members. I would like to thank other members of my thesis committee, Mr. Jonathan Salsberg for sharing his expertise on participatory research with me, and providing me with invaluable suggestions throughout this process, and Dr. Sarah Ahmed for providing me with key tools to conduct the quantitative portion of my project.

The student awards and grants I was awarded throughout the pursuit of my MSc degree were essential in my thesis progress and research training experience. I

extend my gratitude to the Aboriginal Diabetes Initiative (ADI) Quebec Regional Evaluation and Innovation Fund for funding this project as well as the Fonds de Recherche en Santé Quebec for providing me with a student award. Furthermore, I would like to thank the CIHR and the department of Experimental Medicine for their travel awards as this gave me the opportunity to present the preliminary findings in the North American Primary Care Research Group conference, and the Primary Health Care Partnership Forum.

My deepest gratitude goes to my family for their love and support throughout my life. To my lovely mother whose love, faith and support gives me confidence and power to explore, grow and develop, and to my father who motivates me to work hard by his own endeavours and ambitions.

ABSTRACT

Introduction: In years 1994 to 1997, the Kateri Memorial Hospital Center in conjunction with the Kahnawake Education Center, and the Kahnawake Schools Diabetes Prevention Project developed an elementary school diabetes prevention curriculum. The curriculum aimed to increase knowledge of type 2 diabetes, healthy eating and active lifestyles of the children with the long term goal of preventing obesity and diabetes among the Kanien'kehá:ka (Mohawk) population of Kahnawake, Quebec. The curriculum consisted of three units: nutrition, fitness, and lifestyles and diabetes, divided into 10, 45-minute lessons for grades 1 through 6. The Kahnawake Diabetes Prevention Project has been involved with one of the longest diabetes prevention school based curricula; it has been implemented in Kahnawake elementary schools for 15 years.

Objectives: To evaluate the implementation of the Kateri Memorial Hospital Center health education curriculum in the years 2010/2011 and 2011/2012, and to further explore the barriers and the facilitators of the health education curriculum from the perspectives of teachers, parents, curriculum authors and school administrators.

Subjects and Methods: This study adopted a community-based participatory approach. The participants of this study were selected from four groups of people including teachers, parents, curriculum authors and school administrators. The design of this study was qualitative descriptive combined with a cross-sectional survey. Questionnaires were distributed to classroom teachers in the Kahnawake elementary schools. The qualitative portion was undertaken using talking circles with parents, curriculum authors and teachers. Semi-structured interviews were conducted with school principals to understand current issues with the curriculum and to develop recommendations for future changes and implementation. Descriptive statistics were applied to analyze the questionnaire results such as the number of curriculum lessons taught, the number of teachers who implemented the curriculum and the number of students who received the curriculum. The talking circles and the semi-structured interviews were audio-recorded, and transcribed verbatim. Thematic textual analysis was performed to identify emerging themes.

Results: The findings showed that participants perceived the health education curriculum as important to the children to increase knowledge regarding health behaviours to prevent Type 2 diabetes. The strengths of the curriculum included factors involving a positive school environment and certain aspects of delivery and curriculum content. Weaknesses included lack of administrative support, instructional time and time management issues, a lack of Mohawk cultural representation, and outdated or missing resource materials. Recommendations addressed curriculum content, cultural integration, methodology development and administrative support to revitalize the curriculum and its delivery.

Conclusion: To our knowledge, this project was the first study exploring the barriers and facilitators of this 15-year-old diabetes prevention curriculum. The results obtained from this project provide knowledge on the challenges and the strengths faced with a health education curriculum from different perspectives. The findings will be used to make recommendations for revision, development and implementation of a new health education curriculum.

RÉSUMÉ

Introduction: Dans les années 1994 à 1997, le Centre Hospitalier de Kateri Memorial en collaboration avec le Centre de l'Education de Kahnawake ont développé un cursus de la prévention de diabète pour les écoles élémentaire. L'intervention vise à augmenter les connaissances et changer l'environnement physique et les normes sociales des écoles et de la communauté par la promotion de l'alimentation de bonne santé et la mode actif de vie avec l'objectif de longue durée de prévenir l'obésité et le diabète chez la population de Kanien'kehá:ka. Le programme consiste de trois unités: la nutrition, le fitness et les modes de vie, et le diabète, divisé de cours en 10 et 45 minutes pour chaque classe de 1 à 6. Le projet de prévention du diabète de Kahnawake a été impliqué dans un des plus anciens programmes de prévention du diabète en milieu scolaire; il a été mis en œuvre dans les écoles élémentaire de Kahnawake pour 15 ans.

Objectifs: D'évaluer la mise en œuvre du programme d'éducation à la santé de l'hôpital de Kateri Memorial dans les années 2010/2011 et 2011/2012, et d'explorer les obstacles et les facilitateurs de la programme du point de vue des enseignants, des parents, des auteurs du programme et les administrateurs scolaires.

Objets et méthodes: Cette étude adopte une approche communautaire participative. La population cible de cette étude est sélectionné parmi les trois sous-groupes de personnes dont les enseignants, les parents, les auteurs du programme et les administrateurs scolaires. Le design de cette étude était descriptive qualitative combinée avec une enquête transversale. Les questionnaires ont été distribués aux enseignants d'écoles élémentaires à Kahnawake. La partie qualitative a été menée à l'aide des cercles de discussion avec les parents, les auteurs et les enseignants. Les entrevues semi-structurées ont été réalisées avec les administrateurs des écoles pour mieux comprendre les enjeux actuels avec le programme d'études et d'élaborer des recommandations pour des futurs changements. Les statistiques descriptives ont été appliquées pour analyser les résultats du questionnaire, comme le nombre de leçons du programme enseigné, le nombre d'enseignants qui a implémenté le programme et le nombre d'étudiants qui ont reçu le curriculum. Les cercles de discussion et les

entrevues semi-structurées ont été audio-enregistrées et transcrites textuellement. L'analyse textuelle thématique a été réalisée afin d'identifier les thèmes émergents.

Résultats: Les résultats ont démontré que les participants perçoivent le programme d'éducation à la santé important pour les enfants à accroître les connaissances sur les comportements de santé pour prévenir le diabète de type 2. Les points forts du programme comprenaient des facteurs impliquant un environnement scolaire positif et certains aspects de la prestation et le contenu du programme. Faiblesses comprenaient le manque de soutien administratif, le temps d'enseignement et les problèmes de gestion du temps, un manque de représentation culturelle Mohawk, et des ressources obsolètes ou manquantes. Recommandations adressées contenu du programme l'intégration culturelle, le développement de la méthodologie et de soutien administratif afin de revitaliser le programme et sa livraison.

Conclusion: À notre connaissance, ce projet a été la première étude à explorer les obstacles et les facilitateurs de ce programme de 15 ans de prévention du diabète. Les résultats obtenus à partir de ce projet apportent des connaissances sur les défis et les atouts face à un programme d'éducation sanitaire à partir de perspectives différentes. Les résultats serviront à formuler des recommandations pour la révision ou l'élaboration d'un nouveau programme d'éducation sanitaire.

1.0 INTRODUCTION

1.1 BACKGROUND

Diabetes mellitus is a group of metabolic diseases characterized by high blood glucose levels (Shoback, 2011). There are three main types of diabetes mellitus. Type 1 diabetes results from autoimmune destruction of insulin producing beta cells of the pancreas. Type 2 diabetes, also previously referred to as non insulin-dependent diabetes mellitus (NIDDM), is a condition in which the pancreas produces insulin but the cells do not respond to insulin and are therefore insulin resistant (American Diabetes Association, 2006). The third type of diabetes is known as gestational diabetes, which is characterized as glucose intolerance with the onset during pregnancy (Shoback, 2011). The development of type 2 diabetes is caused by combination of lifestyle and genetic factors (Shoback, 2011). One of the most important risk factors for the development of type 2 diabetes is obesity. There is a direct association between increased body mass index (BMI) and the development of type 2 diabetes among all populations including the Indigenous population (Knowler et al., 2002; Harris et al., 1996). In addition, physical inactivity, and dietary factors such as high fat consumption are strong predictors of obesity and type 2 diabetes (Krishka et al., 2006; Feskens, 1992).

Approximately 285 million people worldwide are affected by type 2 diabetes. An estimated 7 million people develop type 2 diabetes each year, for a total of 438 million by 2030 (Canadian Diabetes Association, 2012). Currently, more than 9 million Canadians live with diabetes or pre-diabetes and approximately 90% of people with diabetes have type 2 diabetes. Type 2 diabetes can negatively affect quality of life and reduce life expectancy by 5 to 10 years (Canadian Diabetes Association, 2012). An estimated 80% of people with diabetes will die as a result of heart disease or stroke. The Indigenous population is significantly more likely than the general Canadian population to develop type 2 diabetes (Feskens, 1992).

Diabetes was once unknown to Canada's Indigenous Peoples, and now, likely due to effects of colonization, stress and major changes in lifestyle with decreasing physical activity, changing eating habits and increasing obesity, it has become one of their

most prevalent chronic diseases (Feskens, 1992). Diabetes has devastating impact on Indigenous people living with the disease, their families, and communities. It can lead to complications such as heart disease, stroke, kidney failure, peripheral neuropathy and retinopathy. Diabetes complication rates are much higher among Indigenous peoples compared to other population groups (Harris et al., 1996). Diabetes is so common among the Indigenous population that a sense of the inevitability of developing the disease pervades their communities (Stewart, 2005). In fact, the notion that diabetes is in their genes has been widely accepted among Indigenous people, and they believe that if their parents and grandparents had diabetes, they will also be affected by the disease (Stewart, 2005). Nevertheless, diabetes prevention programs targeted at modifying lifestyle and dietary habits are highly effective at reducing the incidence of type 2 diabetes (Montonen et al., 2010; Biuso et al., 2007; Lindström et al., 2006; Ramachandran et al., 2006; Ratner, 2006; Herman et al., 2005; Hu et al., 2003; WHO, 2003; Buchanan et al., 2002; Chiasson et al., 2002; Knowler et al., 2002; Tuomilehto et al., 2001; The Diabetes Prevention Research Group, 1999, 2000, 2002; Pan et al., 1997).

1.1.1 The Kahnawake Schools Diabetes Prevention Project

Kahnawake is a Kanien'kehá:ka (Mohawk) community with an estimated population size of 8,000 in 2012. It is located 15 kilometers south of Montreal, Quebec, Canada. In Kahnawake, 12 percent of adults aged 45 to 64 years old have documented type 2 diabetes; this represents twice the rate of the general population of the same age (Montour & Macaulay, 1985). A study has reported that from 1986-88 to 2001-03, in Kahnawake, the prevalence rates of type 2 diabetes increased from 6.0% to 8.4% in males, and 6.4% to 7.1% in females (Montour et al., 1989).

The results of studies showing the high prevalence of type 2 diabetes and the associated macrovascular complications in the community prompted the development of the Kahnawake Schools Diabetes Prevention Project (KSDPP) (Montour & Macaulay 1988). KSDPP is an ongoing community-based participatory research project that aims to increase knowledge and change the physical environment and social norms of the schools and community by promoting healthy

eating and active lifestyles with the long term goal of preventing obesity and diabetes among the Kanien'kehá:ka population (Macaulay et al., 1999).

In the years 1994 to 1997, KSDPP in conjunction with the Kateri Memorial Hospital Center (KMHC), which is a community owned health care facility in Kahnawake (Bisset et al., 2004), and the Kahnawake Education Center (KEC) developed an elementary school diabetes prevention curriculum. The Kateri Memorial Hospital Center (KMHC) health education curriculum consisted of three units of nutrition, fitness, and lifestyles and diabetes, divided into 10, forty-five minute lessons for grades one through six. The aim of the curriculum was to increase students' knowledge of type 2 diabetes, and teach healthy lifestyle habits to reduce the incidence of diabetes in the community. Students' health curriculum knowledge was evaluated as part of the 1997, 1998, 2002 and 2004 comprehensive evaluations of the school-based intervention program (unpublished data). Teachers were also interviewed in 1995, 1996, 1997, and 1999 to better understand their perspectives on the curriculum (Cargo et al., 2006). The findings demonstrated that teachers adopted to varying degrees the roles of teaching the health education curriculum, enforcing the school nutrition policy, modeling and encouraging healthy lifestyles (Cargo et al., 2006). The main barriers reported were at organizational and personal levels such as time, priority setting, perceived lack of resources, and lack of adequate health related knowledge that influenced curriculum implementation (Cargo et al., 2006). Moreover, children in different classrooms were exposed to different intervention doses based on the extent to which the teachers applied each role. While the results of this study highlighted some of the barriers to curriculum implementation; however, the curriculum was not adjusted or modified.

The health education curriculum developed by KSDPP, KEC, and KMHC, is one of the longest lasting school-based diabetes prevention curricula as it has been implemented in Kahnawake elementary schools for 15 years. Most published studies have only evaluated short-term curricula, and no studies including that by Cargo et al (2006) have focused on exploring the barriers and the facilitators of a diabetes prevention curriculum from the perspectives of parents. Studies have shown that evaluating health programs using community-based participatory research approach

while including perspectives of various stakeholders increases the effectiveness, appropriateness, and relevance of the outcomes (Brown et al., 2010; Feather et al., 1993). Hence, the assessment of the health education curriculum using a community-based participatory approach was necessary as it provided a better and more up-to-date understanding of how the curriculum was being implemented within the community, and the factors that contributed to or hindered its success.

1.2 STUDY OBJECTIVES

The objectives of this study were:

1) To evaluate the delivery and implementation of the KMHC health education curriculum in the years 2010/2011 and 2011/2012.
2) To explore the barriers and the facilitators of the health education curriculum from the perspectives of teachers, parents, curriculum authors and school administrators.

[*] Due to the preference of community members, the term Indigenous is used to refer to original inhabitants of North and South America and their descendants. In Canada, Indigenous peoples include First Nations, Metis, and Inuit.

2.0 LITERATURE REVIEW

2.1 DIABETES

Diabetes mellitus is a group of metabolic diseases characterized by high blood glucose levels. It is mainly classified into prediabetes, type 1 diabetes, type 2 diabetes, and gestational diabetes (Shoback, 2011). Several pathogenic processes lead to the development of different types of diabetes. Prediabetes is a condition in which the blood glucose level is higher than normal, but has not yet reached the diabetic levels (American Diabetes Association, 2006). Type 1 diabetes results from a cellular mediated autoimmune destruction of pancreatic β-cells causing little or no insulin secretion. The rate of β-cells destruction is usually rapid in children and slow in adults. Genetic predispositions are among the risk factors for the development of type 1 diabetes. Gestational diabetes is defined as any degree of glucose intolerance with onset or first recognition during pregnancy. It represents nearly 90% of all pregnancies complicated by diabetes. In type 2 diabetes there are normal or reduced levels of insulin produced but the cells are insulin resistant leading to reduced uptake of glucose by the cells and resulting high levels of circulating blood glucose. The risk of developing this form of diabetes increases with age, obesity, excessive eating and lack of physical activity. Although type 2 diabetes is the most common form of diabetes, it often goes undiagnosed for a long period of time because the symptoms may not be manifested at the earlier stages of the disease (ADA, 2006). In patients with type 2 diabetes, good glycemic control can usually be achieved with weight reduction, physical activity, improved eating habits and/or oral glucose lowering agents (ADA, 2006).

The International Diabetes Federation has estimated that the prevalence of diabetes among adults aged 20-79 years old is 285 million people worldwide (Shaw et al., 2010; International Diabetes Federation, 2009;). In Canada, 2.7 million people, 7.6% of the total population, are diagnosed with diabetes, and this number is predicted to rise to 4.2 million people, 10.8% of the population, by 2020. In addition, one million are estimated to have undiagnosed diabetes. Overall, in 2010, prediabetes and diabetes combined constituted 8 million Canadians. Currently, one in four Canadians

lives with diabetes, undiagnosed diabetes, or prediabetes, and if the current trends continue, the number will rise to one in three by 2020 (Colagiuri et al., 2011).

The chronic hyperglycemia of diabetes is associated with long-term complications and failure of various organs including the eyes, kidneys, nerves, heart, and blood vessels (ADA, 2006). Almost 80% of Canadians with diabetes die from heart attack or stroke, and diabetic retinopathy is the single leading cause of blindness in Canada (Canadian Diabetes Association, 2012). Canada has the third-highest diabetes related mortality rate among peer countries, with 18 deaths per 100,000 population (Colagiuri et al., 2011). Life expectancy of people with type 2 diabetes may be shortened by five to 10 years (CDA, 2005). The burdens imposed by diabetes include reduced life expectancy, poor quality of life as well as increased health care costs.

2.2 DIABETES PREVENTION

It is estimated that over 50% of type 2 diabetes could be prevented or delayed with an increase in physical activity and healthier diet. Intensive multifactorial interventions significantly reduced diabetes-related complications and mortality by nearly 60% (Colagiuri et al., 2011). Recent successes in major randomized controlled trials suggest that individuals at high risk for type 2 diabetes can be identified, and diabetes can be delayed or prevented (Diabetes Prevention Program, 2000). The major complications arising from diabetes, and high rates of diabetes related mortality suggest that it is worthwhile to put efforts in developing interventions or programs to prevent diabetes (ADA, 2004).

2.2.1 Lifestyle Interventions

Diabetes prevention strategies and health promotion are effective at reducing or eliminating the onset of type 2 diabetes in individuals with prediabetes (Ramachandran et al., 2006; Ratner, 2006; Buchanan et al., 2002; Chiasson et al., 2002; Knowler et al., 2002; Tuomilehto et al., 2001; The Diabetes Prevention Research Group, 1999, 2000, 2002; Pan et al., 1997). Prediabetes is defined as having an impaired fasting glucose (fasting plasma glucose of 6.1-6.9 mmol/L) or impaired glucose tolerance (two-hour postprandial glucose of 7.8-11.0 mmol/L) or

both. The Diabetes Prevention Program (DPP), a randomized clinical trial of diabetes prevention, showed that after 2.8 years, in 3234 overweight individuals with elevated fasting glucose levels and impaired glucose tolerance, the relative reduction in progression to diabetes was higher (58%) in the lifestyle intervention group than the reduction in the medication (metformin) group (31%) (Kriska et al., 2006; Knowler et al., 2002; DPP, 1999). Biuso et al have further reported lifestyle changes such as reduction in energy intake and increase in physical activity are inversely associated with insulin resistance; thus interventions targeting lifestyle changes can prevent the development of type 2 diabetes (Biuso et al., 2007).

The most important lifestyle related risk factors for type 2 diabetes are obesity, a sedentary lifestyle with low physical activity, and a dietary pattern with high saturated fat, refined carbohydrate and low fiber content (Hu et al., 2003, 2004; WHO, 2003). Therefore, the implementation of lifestyle interventions has shown to be effective in reducing the risk of type 2 diabetes and its complications such as renal failure, retinopathy, cardiovascular disease, and limb amputations (Gerstein, 1997). Lindström et al, conducted the Finnish Diabetes Prevention Study (DPS) which was the first controlled individually randomized trial conducted to explore the possibility of type 2 diabetes prevention by lifestyle interventions (Lindström et al., 2010; Tuomilehto et al., 2001). The lifestyle intervention goals were to reduce body weight, limit dietary fat, and saturated fat, and to increase both dietary fiber intake and physical activity. After 1 and 3 years, the mean weight reductions were 4.5 and 3.5 kg in the intervention group while in the control group the mean weight reductions were 1.0 and 0.9 kg respectively (Tuomilehto et al., 2001). Additionally, after a mean follow up of 3.2 years, the risk of diabetes was reduced by 58% in the intervention group, and participants who consumed moderate fat, high-fiber diet achieved the largest weight reduction and had the lowest diabetes risk (Lindström et al., 2006). Apart from the efficacy of the lifestyle interventions, the cost-efficiency of the interventions as opposed to glucose lowering medications have also been reported (Herman et al., 2005).

2.2.2 Lifestyle Interventions in Primary Care

Even though lifestyle interventions have a positive impact on reduction of type 2 diabetes, translating these interventions into primary care is perceived as a challenging and complex mission (Cardona-Morrell et al., 2010; Amundson et al., 2009; Ackermann et al., 2008; Absetz et al., 2007; Laatikainen et al., 2007). Commissioned by the Dutch Ministry of Health, Welfare and Sports (VWS), a nationwide program was developed to improve physical activity and dietary behaviours in patients with prediabetes and type 2 diabetes (Helmink et al., 2010). Linmans et al, evaluated the observed effects of the Dutch lifestyle program in a real-world primary care setting. The lifestyle intervention group (n=186) was compared with a matched group of patients who received the usual care (n=2632). Although, the reduction in the fasting glucose was positive in the intervention group, the difference between the intervention and the control groups was not statistically significant (Linmans et al., 2011). Therefore, thorough evaluation of the barriers and facilitators for lifestyle interventions in primary care settings was suggested.

2.3 DIABETES AND CHILDREN

About two decades ago, diabetes in children was usually type 1 diabetes caused by insulinopenia resulting from destruction of pancreatic insulin producing beta cells. Today, more and more children and adolescents are being diagnosed with type 2 diabetes with the mean age being 12-14 years old (Mauvais-Jarvis et al., 2000; Arslanian & Suprasongsin, 1996). The reported risk factors for pediatric-age onset of type 2 diabetes include 1) a history of type 2 diabetes in a first or second degree family member; 2) having a higher risk of developing type 2 diabetes by belonging to population with risk factors such as Indigenous, Hispanic, South Asian, Asian or African; 3) being overweight with a body mass index (BMI) of 85-95th percentile for age and gender or obese with a BMI> 95th percentile for age and gender; 4) being exposed to maternal diabetes in utero; and 5) having symptoms or signs of insulin resistance (Amed et al., 2010). Among the risk factors, diet, physical activity and inactivity are the most modifiable risk factors in the prevention of type 2 diabetes among children. In fact, diet plays a significant role in increasing obesity, thus

raising insulin resistance, and glucose intolerance. In addition, the prevalence of type 2 diabetes is significantly lower in population with higher levels of habitual physical activity (Huang & Goran, 2003).

2.3.1 Diabetes Prevention Interventions for Children

In children and adolescents between the ages of 10 and 19 years old who are diagnosed with diabetes, 33% to 46% of cases have been reported to be type 2 diabetes (Ludwig & Ebbeling, 2001; Rosenbloom et al., 1998). The high prevalence of type 2 diabetes in children motivated researchers to explore the prevention and treatment possibilities available. Usually interventions that are designed for diabetes prevention contain nutrition and physical education components. The nutrition component is characterized by a combination of dietetic counseling, or basic nutritional knowledge such as reading food labels, and determining proper portion sizes (Huang & Goran, 2003). The physical activity component is promoting activities with trained personnel, and encouraging children to engage in physical activities. A study conducted by Ditmyer et al, assessed pediatrician's perceptions on prevention strategies for type 2 diabetes in children and adolescents. From the 550 pediatricians who filled out the questionnaire, every 1 in 9 respondents referred their patients for exercise, 62.3% referred their patients for dietary interventions, and 62.6% for educational services (Ditmyer et al., 2003). This indicates that pediatricians seem to put a higher emphasize on educational and dietary interventions as oppose to exercise interventions. Some of the recommendations offered by pediatricians were to develop primary prevention activities including physician counseling on diet and exercise, and to investigate school-based primary prevention programs to increase knowledge and behavioural changes (Ditmyer et al., 2003).

2.3.2 School-Based Interventions

In response to the growing number of children and adolescents diagnosed with type 2 diabetes, a number of school-based primary interventions have been developed. School-based learning activities can provide the knowledge and rationale for change. Well-designed and implemented programs are effective in promoting beneficial

health behaviours among adolescents such as reduction in drug use, and inappropriate nutrition habits (Elliot et al., 2004; Gottsfredson & Wilson, 2003; Story et al., 2002; Goldberg et al., 2000; Mellanby et al., 2000). HEALTHY was a middle school-based primary prevention trial conducted in 42 schools over three school years from 2006 to 2009 (Hirst et al., 2009). Middle school children were chosen because generally in the age group of 11 to 14 years old, children are emotionally, physically, mentally, and metabolically developing. Thus, this is an optimal phase to encourage healthy behaviours, as students at this age are capable of increasing and assuming personal responsibility for behaviour change and choices. Components such as physical activity, nutrition, behavioural, and communication interventions were assigned randomly to half of the participating schools. The HEALTHY program significantly changed the quality of foods and beverages served in schools, and the engagement of trained physical education teachers ensured the delivery of physical education interventions (Gillis et al., 2000; McMurray et al., 2000).

Arising from the belief that interventions leading to lifestyle changes for improvement of health behaviours are more likely to succeed when there is a personal stake in the lifestyle change, the Banishing Obesity and Diabetes in Youth (BODY) project was developed (Sweat et al., 2012; Keenan, 2009). BODY was a school-based intervention that screened overweight and obese high school students to provide personalized feedback and appropriate health care for them. Among 1,526 students of one of the New York high schools with a School-Based Health Center (SBHC), overweight and obese students received a personalized report detailing medical results as well as specific recommendations to improve health. Investigators concluded that BODY was a feasible program for effective prevention of type 2 diabetes in schools with health centers (Sweat et al., 2012).

The Heart-Healthy Children program was a primary prevention program implemented in Atlantic Canada. A multidisciplinary team involving nurses, dietitians and physicians developed this program and implemented it in an urban elementary school in grades 4, 5 and 6. The educational component of the program included nutrition, smoking prevention, risk factor education, and heart anatomy and physiology. Education sessions were composed of interactive power point

presentations, in-class activities, and a curriculum in a form of binder containing information on activities. Results from the first year of this project indicated that children responded well under a competitive environment created by the program. Children were enthusiastic to learn about healthy living, and parental and community support were key for the success of the primary prevention program (Yates et al., 2009).

The Sports Play and Active Recreation for Kids (SPARK) program was a unique program in which it included self-management lessons as part of a comprehensive physical activity promotion program for elementary schools (Sallis et al., 1997). Self-management taught children cognitive and behavioural skills necessary for developing and maintaining an active lifestyle (Marcoux et al., 1999). The program was implemented in eight elementary schools, and evaluations showed that most children were enthusiastic about the program with 80% of the teachers, and 32% of the parents perceiving an increase in children's physical activity levels (Cardon et al., 2009).

2.3.3 Coping Skills Training in School-Based Interventions

A Cochrane review of 64 randomized clinical interventions to treat obesity in youth reported that interventions combining dietary, physical activity and behavioural changes have significant effect on reducing the body mass index in adolescents for up to one year post-intervention (Luttikhuis et al., 2009). Nevertheless, providing education on basics of nutrition and physical activity are not sufficient to produce behaviour changes. Since obese youth are at an increased risk for depression, coping skills training focusing on social problem solving, communication skills, stress reduction and conflict resolution can increase self-efficacy resulting in positive behaviour change (Davidson et al., 1997; Bandura, 1986). The study conducted by Grey et al, assessed the impact of adding coping skills training to the health education intervention for diabetes prevention. There were no significant differences between students who received the educational intervention alone, and those who were exposed to educational and coping skills training. Nevertheless, students in the coping skills training group showed greater improvement on some indicators of

metabolic risk suggesting that interventions with educational components complemented with coping skills training can have an impact on reducing risk factors of type 2 diabetes in youth (Grey et al., 2009). Another study that also assessed the incorporation of coping skills training in nutrition education and exercise training demonstrated that after a 16 week afterschool program significant improvement was seen for clinical outcomes of adolescents and their health behaviours. In fact, there was a trend in improved usual food choice, increased dietary knowledge, and lower glucose and insulin levels (Grey et al., 2004).

2.3.4 Primary Intervention Programs for High Risk Population

Among primary interventions programs developed, two focused on the minority group of Mexican American children who have a higher prevalence of becoming diagnosed with type 2 diabetes than non-Hispanic whites (Haffner et al., 1991). One of these diabetes prevention programs was an age and culturally appropriate educational intervention program for Mexican American children at risk of developing type 2 diabetes. Children at risk were identified based on the fact that a close family member was diagnosed with diabetes. The eight-session activity oriented education program focused on nutrition, exercise and diabetes knowledge; each session was characterized by a presentation followed by an activity that reinforced the concepts of presentation. Even though the program was designed for children, parents were to accompany their children throughout all sessions. Many of the parents and children have changed eating and exercise habits, and there was a significant increase in their knowledge on diabetes and its complications (McKenzie et al., 1998). Another program targeting Mexican-American children was Jump Into Action, a culturally appropriate program to reduce the risk of type 2 diabetes in school children on the Texas-Mexico border. The goal was to encourage healthier lifestyles and to enable students to take responsibility for their own health by enhancing knowledge and decision-making skills. A total of 1,114 fifth-grade students in 14 schools participated in this program. Investigators concluded that Jump Into Action was effective in increasing the knowledge and self-efficacy levels of children, and improving diet and exercise related behaviours. These changes in

health behaviour were maintained for up to four weeks after the intervention (Holcomb et al., 1998). These two programs were directed at Mexican-Americans, which are among high-risk populations. They demonstrated that cultural adaptation could be a significant factor in ensuring positive outcomes of a health education program.

2.3.5 Clinical Outcomes of Diabetes Prevention

While some studies focus on understanding the changes in health behaviours initiated by interventions, others focus on analyzing the clinical outcomes of diabetes prevention. A study conducted by Rosenbaum et al, examined the effect of a 4-month school based intervention comprised of health, nutrition and exercise classes on diabetes risk. The participants were 73 eighth grade students in a predominantly Hispanic New York City school. The results indicated that intervention significantly reduced body fat, insulin resistance, circulating concentration of C-reactive proteins, and interleukin 6, concluding that a school intervention with nutrition and exercise component can reduce multiple risk factors for type 2 diabetes (Rosenbaum et al., 2007). In the following sections, a detailed discussion on diabetes prevention strategies and school-based interventions for Indigenous peoples, who represent a high-risk population, is provided.

2.4 DIABETES IN INDIGENOUS POPULATION

The Indigenous population used to have a rich history of healthy food systems and agriculture economies; Indigenous farmers cultivated crops appropriate for the growing season. Nevertheless, a drastic change in eating habits has resulted due to colonization, residential schools and other circumstances including wars (Keoke & Porterfield, 2003). The lack of access to traditional foods has contributed to the reliance of Indigenous population on less healthy food, high-calorie processed foods and culturally inappropriate diet (Bell-Sheeter, 2004). In 1940, diabetes was unknown to Native American population, and the increased prevalence of diabetes began to be seen around 1960 (Szathmary, 1994). Many Indigenous populations believed that diabetes is a “white man’s illness” and that it resulted from the adoption of modern foods and the reduction in hunting and fishing.

Prediabetes as well as high obesity rates is now common among Indigenous communities. The prevalence of diabetes among Indigenous populations has been reported to be three to five times higher than the general population (Harris et al., 1996,1997). Indigenous peoples are diagnosed with type 2 diabetes at a younger age, and women are more vulnerable to diabetes (CDA, 2008). The prevalence of type 2 diabetes among Indigenous women is four times higher than non-Indigenous women (20.3% versus 5.5%) (Dyck et al.,2010). Throughout a 30-year period the prevalence of type 2 diabetes in Pima Indian adolescents increased from 2.4% to 2.8% in males and from 2.7% to 5.3% in females. In Canadian Indigenous adolescents, the estimated prevalence of type 2 diabetes is 1.1% in children aged 4-19, and 2.5% in 15-19 year olds (Amed et al., 2010; Dabelea et al., 1998; Dean et al., 1998). Between years 1990 to 1998, there was a 46% increased in the prevalence of type 2 diabetes among American Indians and Alaska Natives younger than 35 years old (Acton et al., 2002). Therefore, researchers and communities realized the need to develop interventions to reduce type 2 diabetes risk factors among Indigenous peoples particularly in the youth.

2.4.1 Diabetes Prevention for Indigenous Population

Even though the prevalence of type 2 diabetes has been rising among the Indigenous communities, interventions for diabetes prevention are still limited; nevertheless, the outcomes are encouraging (Edwards & Patchell, 2009). A primary prevention program for diabetes involves the promotion of healthy behaviours such as maintaining a healthy body weight through a balanced diet, and an increase in physical activity (Edwards & Patchell, 2009). One of these interventions conducted by Thompson et al, assessed the effectiveness of a culturally appropriate 5-month lifestyle intervention. Participants were 200 urban Native American females aged 18 to 40 years old. The intervention included monthly discussion on healthy eating, physical activity while providing social support and setting goals. Results indicated that participants who have received the intervention showed a significant increase in consumption of vegetable and fruit, and a decrease in waist circumference, insulin sensitivity, total blood cholesterol, fat and sugar intake (Thompson et al, 2008).

Cherokee Choices was a culturally relevant community based intervention implemented for the Eastern Band of Cherokee Indians (ECBI) (Bachar et al., 2006). Approximately 1 in 3 ECBI men and approximately 1 in 4 ECBI women are diagnosed with type 2 diabetes (Liao et al., 2011). The intervention included an elementary school mentoring program, an adult worksite wellness intervention, and a church-based health promotion. A reduction in BMI, and an increase in physical activity were observed throughout the intervention (Bachar et al., 2006). Furthermore, a 6-month Medicine Wheel nutrition intervention developed for Northern Plains Indians of the Cheyenne River Sioux Tribe educated 114 Indians aged 18 to 65 on the Medicine Wheel Model for Nutrition and diet. Although, the effect of the intervention on weight change was small, it was still positive, and longer-termed interventions might be promising in reducing BMI, and blood glucose parameters (Kattelmann et al., 2010).

The Native Diabetes Program, which was a cross-cultural model for diabetes education, was offered to urban Indigenous population of Ojibway and Cree heritage to change their negative attitudes towards diabetes using flip-chart format, and slide presentations and to engage the communities to take steps in reducing diabetes risk factors (LeMaster & Connell, 1994; Hagey, 1989). A nutrition education program was also offered to 5,000 Winnebago and Omaha Indians. It included food displays, test kitchen and recipes. Results have shown that reduction in weight was observed as well as short-term improvements in fasting glucose levels (Stegmayer et al., 1988).

In addition to interventions for diabetes prevention, there has been an effort to increase awareness of the behaviours associated with diabetes prevention and control (Bell, 2011). A model diabetes control project was implemented at Fort-Totten to improve diabetes care for Native American Indians and increase awareness for diabetes. There was an average loss of 3.7 kg among participants (Newman et al., 1993). The National Diabetes Education Program (NDEP), was a diabetes education campaign targeting Native American Indians. Participants were interested in having more diabetes education materials, and culturally relevant dietary recipes available in their communities and schools (Roubideaux et al., 2000). Other campaigns such as

the Move It and the Power to Prevent were also involved in increasing diabetes awareness, encouraging increased exercise, healthy eating, and healthy body weight for Native American Indian youths and adults (Knowler et al., 2002). These campaigns have provided important evidence that has been the basis for the development of interventions targeting Indigenous youth.

2.5 DIABETES IN INDIGENOUS CHILDREN

In Indigenous communities, the onset of type 2 diabetes has shifted towards children and adolescents raising serious concerns due to the increased duration of the disease and the microvascular and macrovascular complications during young adulthood. With effective preventive strategies, the demand for treatment, care and support as well as the prevalence of type 2 diabetes among Indigenous population can be significantly reduced (Dean, 1998; Dean et al., 1992, 1998).

2.5.1 Diabetes Prevention Program for Indigenous Children

In 2005, the HoChunk Youth Fitness program was developed that consisted of supervised classes in nutrition and exercise. It was a 24-week intervention including both native and non-native American youth ages 6 to 18. For the evaluation of the program, the outcomes measured were biological variables, and the results indicated that the mean fasting plasma insulin levels decreased significantly. The results led to the conclusion that supervised nutrition and exercise classes are effective in reducing the risk for type 2-diabetes in youth (Carrel et al., 2005).

Another education model for Native American adolescents to prevent diabetes was the STOP Diabetes workshop. Four adolescents developed a half a day workshop; the knowledge of the participants and their experience of participating in the workshop were evaluated through questionnaires. The results had indicated that the knowledge of diabetes increased post workshop compared to pre-workshop, and 90% had a positive workshop experience (Marlow et al., 1998). The following section details some of the more notable intervention attempts in Indigenous youth that have been based in school systems.

2.5.2 School-Based Interventions for Indigenous Children

Sandy Lake school-based diabetes prevention intervention is known as one of the major diabetes prevention interventions for an Indigenous community in Canada. The duration of the intervention was 16 weeks and it focused on knowledge and skills development related to healthy eating, physical activity, and diabetes education for Indigenous children of age 7 to 14 year old. Exposure to the intervention was significantly associated with being more knowledgeable about foods low in fat, and having higher scores on the dietary self-efficacy, and curriculum knowledge scales while significantly reducing the mean plasma insulin levels (Saksvig et al., 2005).

The Zuni Diabetes Prevention Program was a three-year multiple cross sectional design subjected to high-school aged Native American Indians. It was designed to reduce the prevalence of diabetes risk factors by improving dietary habits, increasing physical activity and knowledge of diabetes risk factors. The program was evaluated by collecting data on physiological and behavioural change of the high school students. The results have indicated a significant reduction in soft drink consumption and an increase in glucose/insulin ratios (Teufel & Ritenbaugh, 1998).

The Pathways was a three years randomized controlled trial implemented in 7 Native American Indian Communities to the third to fifth grade students from 40 distinct schools with the aim of preventing obesity in Native American Indian children. The Pathways intervention was based on social learning theory involving individual behaviour change and environmental support. It had four components including a culturally appropriate classroom curriculum to promote healthy eating behaviours and increased physical activity, a physical activity component increasing energy expenditure, food service intervention to reduce the amount of fat in school meals, and a family program to encourage parents to adopt healthy behaviours. Assessment of teacher's attendance at each training session, and evaluation of the training program was performed via questionnaires, attendance logs, and interviews. The results indicated that the number of teachers teaching the curriculum, and the number of students receiving the intervention were high, and that the curriculum was successfully implemented in schools (Caballero et al., 2003; Steckler et al., 2003).

Action Schools! BC was a school-based intervention designed to address childhood inactivity and unhealthy eating patterns during the school day. The program was implemented in 3 remote Indigenous communities in Northern British Columbia, and it provided tools for teachers and schools to increase opportunities for physical activity and healthy eating. Information about implementation was obtained via weekly 'classroom logs' completed by teachers, and focus groups with the school staff. The results have shown that the program was well received and well delivered (Naylor et al., 2010).

In 2007, Rosecrans et al conducted teaching to prevent diabetes program based in schools, food stores and health offices in seven First Nations in northwestern Ontario. The school curriculum was a one-year intervention implemented to Grade 3 and 4 students; it used story telling and participatory activities to teach and reinforce healthier eating habits, and to promote physical activity as well as educating students on the risk factors of diabetes. The evaluation of the program was done via a mixed method approach using quantitative surveys to assess the extent to which the program was implemented, followed by teacher interviews. The results have indicated that the interventions were moderately (about 70%) implemented. In addition, one of the main barriers reported was that teachers have expressed difficulties fitting lessons into their teaching schedules (Rosecrans et al., 2008).

Most of these school-based interventions aimed to prevent diabetes by educating and promoting healthy eating and physical activity in schools. A significant number of these interventions were successfully implemented in schools and showed promising results in reducing the risks factors of type 2 diabetes. Nevertheless, in order to make school-based interventions for diabetes prevention more effective, and sustainable, and in-depth understanding of the barriers and facilitators of these programs are necessary. To achieve this understanding, there is adequate evidence that suggest participatory research approaches would provide optimal results.

2.6 PARTICIPATORY APPROACHES IN DIABETES PREVENTION

This section details the rational behind participatory research approaches to diabetes prevention. In order to generate the broadest impact on diabetes, academic

researchers should partner with communities to translate findings from diabetes prevention and control research studies to the population (Bell, 2011). There are indeed two major approaches for primary prevention of type 2 diabetes, which include a population-based approach and a high-risk approach. The population based approach aims to reduce diabetes risk factors over the entire community, while the high risk approach targets only individuals with highest risk of developing diabetes (Simmons et al., 1997). The population-based approach has been observed to have better outcomes in terms of reducing the incidence of diabetes type 2 as opposed to the high-risk approach. Moreover, among the population-based approaches, community development strategies, which are defined as the approach taken to organize and support community groups in identifying their health issue, empowering the community to plan and act upon the health issues, has been shown to be well suited for Indigenous people and minority ethnic groups (Feather et al., 1993).

2.6.1 Community-Based Interventions for Diabetes Prevention

Developing community-based approaches for diabetes prevention is complex because eating behaviours, and exercise habits are deeply rooted in culture, social relationships and experience. Therefore, promoting changes in health behaviours and encouraging adoption of new skills is a difficult process. Nevertheless, many community-based diabetes prevention programs have shown to be successful in reducing type 2 diabetes. One of these community-based diabetes prevention program was the South Auckland Diabetes Project (SADP) targeting 300,000 people in New Zealand. It included stakeholders such as family physicians, local community representatives, and diabetes service members. The program offered a range of modules namely exercise activities, diabetes support groups, diabetes awareness, nutrition and cooking session and diabetes education. As an evaluated program, it showed promising results in improving healthy behaviours among the targeted population with the possibility of being adapted to other communities with slight modifications (Simmons et al., 1997).

Another community-based health program targeted the Mexican agricultural worker communities in Southeast (SE) Idaho. Hispanic farmworkers in United States are at high risks of developing type 2 diabetes (Villarejo & Baron, 1999). Cartwright et al, have reported that throughout their experience of developing a community-based diabetes prevention health program for Mexican farmworkers, it was not uncommon to encounter farmworkers who did not have sufficient information on diabetes, or glucose levels, and the health complications associated with diabetes. Therefore, working closely with the community and exploring their cultures while providing them with biometric data in a culturally relevant and understandable manner were factors leading to the success of the program (Cartwright et al., 2006).

In North Carolina, El Centro Hispano was a community-based organization that developed a diabetes prevention program for the Latino community living in Durham, Carrboro, and Chapel Hill. The program was implemented with the help of promotores, who were community health workers trained to promote diabetes prevention messages. The program engaged community leaders to become promotores to promote diabetes prevention education, outreach and referral to local Latinos. Based on their experiences, the promotores enjoyed participating in the program as it allowed them to enrich their lives by helping and learning from community (Bryant & Rocha-Goldberg, 2011).

Another diabetes prevention program that used a community-based approach was targeted at African-Americans. In fact, this population is at 1.8 times higher risk of developing type 2 diabetes than Caucasians (National Diabetes, 2012). In this program, investigators also trained lay community members known as Community Health Advisors (CHA) as an approach to enhance community engagement and involvement in the research (Mock et al., 2006). The program was developed to enhance healthy lifestyle practices, self-efficacy and diabetes knowledge in the New Haven and Bridgeport African-American community (Faridi et al., 2010). Although, there were barriers present to implementation of a community based diabetes prevention program using CHAs, the authors concluded that effective health education in the community relies on the community acting as a system of health resources and social relationships. Harnessing the relationships between the

community and health can be a powerful method for promoting health behavioural change within a community (Faridi et al., 2010; Davis-Smith, 2007).

In 2000, the College of Nursing of George Mason University, Virginia, developed a community health program for the community of Smith Island with the goal of identifying individuals with risk factors for diabetes, and providing them counseling with lifestyle modifications and diabetes education (Davidson, 2004). Smith Island is home to 350 watermen and their families. The program screened 273 residents of the community for diabetes, and enabled the community members to learn about health trends within the community, and to have an increased awareness on diabetes and the importance of routine screening. This allowed the community to become united in identifying health problems and taking steps to improve their health behaviours.

The Media and the Message (MM) was a two-year project led by Dietitians of Canada involving community representatives, stakeholders, funders and project team members with the goal of raising awareness on risk factors for the prevention and care of diabetes and to increase public access to up-to-date and healthy behaviour messages (Health Canada, 2002; Dietitians of Canada, 2001). There was a project advisory group that involved representatives from organizations such as Canadian Diabetes Association, Canadian Home Economics Association, Pharmacist, Physiologists and the Media Network who provided feedback during the design of the program as well as its evaluation. The project was successful in that it increased the capacity of health professionals to work with the media, and vice versa, which eventually lead to an increase awareness on diabetes prevention and care provided to the public through media (Lalonde et al., 2007).

Community-based interventions have shown to be effective at mobilizing and engaging communities as well as increasing awareness on diabetes prevention. In most of these programs, the inclusion of community health workers represented the extent of community involvement. The environmental changes along with the social support that was seen among community-based interventions positively impacted the outcomes of these interventions. In fact, the most successful interventions were the

ones that were community-based and associated with participatory approaches (Satterfield et al., 2003).

2.7 SCHOOL-BASED COMMUNITY PROGRAMS

Even though most of the diabetes prevention programs available for children are school-based, involving the community has been shown to significantly increase the level of environmental support for behavioural changes in children, who can be considered a high-risk group. In a rural area of Arkansas, a school-based community intervention program on nutrition knowledge and food choices was implemented in elementary schools. The program was supported by the community leaders, parents, school personnel, and public health representatives (Hosig et al., 1998). The aim was to make the environment more supportive of positive nutrition behaviours by increasing health related knowledge of students, and students' awareness on healthy behaviours. Investigators have reported that due to the support offered from school administrators, and motivated teachers, the nutrition curriculum was successfully incorporated into the school curriculum. As a result of the intervention, students gained significant knowledge on nutrition and food choice behaviours. In this project, the authors concluded that community members and school personnel were interested and motivated to improve the health of the community, and were willing to be involved in projects and interventions similar to this nutritional program (Dollahite et al., 1998).

An Australian team of researchers developed a 3-year obesity prevention adolescent project named It's Your Move. Due to the fact that it was a community-based project, schools, teachers, parents and students were engaged throughout the process from the design to the implementation of healthy eating and physical activity interventions. Investigators reported that the student and teacher's involvement in the formative stages of the project was essential in obtaining access to the schools, building capacities, and developing collaborating partnerships to support interventions. Nevertheless, one of the barriers was getting the information on healthy eating and physical activity to parents (Mathews et al., 2010).

As the rate of obesity in children of United Kingdom has also been increasing, researchers investigated the barriers to healthy lifestyle interventions in secondary schools through a participatory action research. The Schools Acting in Leicester Against Diabetes (SALAD) was implemented in inner city secondary schools serving an ethnically diverse population composed mainly of South Asians. The project adopted a participatory approach meaning that the study population and the schools were involved throughout the research process, from the application of findings to identifying interventions and consideration of results (Stone et al., 2007). The goal was that through a participatory approach there would be an increase in the likelihood of achieving an impact in the community, and to increase the knowledge of the study population. The active involvement of the schools in developing and implementing tailored interventions was useful but also challenging in terms of collaboration. Furthermore, even though school community was actively involved throughout the project, parents did not participate in selecting or implementing interventions thus limiting the outcomes (Khunti et al., 2008).

2.8 COMMUNITY-BASED PROGRAMS IN INDIGENOUS COMMUNITIES

Participatory research approaches have been commonly used in Indigenous communities to develop culturally appropriate and relevant diabetes prevention programs. For example, in 1996, the James Bay Cree, an Indigenous community in Quebec implemented a pilot diabetes education program by community health representatives (CHRs). Researchers were interested in exploring the views of Indigenous Canadians on diabetes and diabetes prevention programs. Thus, a Participatory Action Research project was conducted to identify strengths and barriers associated with the effectiveness and the efficiency of implementation of diabetes prevention and treatment programs within the Cree communities. In order to engage community health representatives into the difference stages of the project, workshops were held to mutually exchange ideas, knowledge and skills between McGill researchers, and CHRs. Some of the barriers identified were the difference in food habits, food and cultural beliefs between health care professionals and the community. An important finding was that the majority of the Cree believed that

diabetes is a disease of the "white man", and is due to the "decline in bush life". Furthermore, throughout this study, the need to educate elementary school children on nutrition and healthy behaviours was expressed. The success in identifying barriers and recommendations for diabetes prevention in the Cree community was attributed to the fact that community members and health representatives were inducted into the research activities and were given control over the research project (Boston et al., 2010).

Most of the programs developed for Indigenous communities emphasize the cultural appropriateness of the interventions. Since dietary and lifestyle habits have traditional and cultural representations, the cultural relevancy of the programs plays a significant role on the outcomes. Studies have shown that the prevalence of type 2 diabetes is on the rise for Native Hawaiians (NH) and other pacific Islanders. A community based participatory research was used to translate Diabetes Prevention Program Lifestyle Intervention (DPP-LI) into community practice. Five community investigators alongside an academic research team developed and implemented a 12 week pilot study to assess the effectiveness of the culturally adapted DPP-LI named PILI 'Ohana Lifestyle Intervention (POLI). The goal of POLI was to promote weight loss in 5 communities. About 239 Native Hawaiians and Pacific Islanders were enrolled in the study, and the mean weight loss was 1.5 kg after 12 weeks. The results have demonstrated that a fully engaged community based participatory research is successful in translating a diabetes prevention program into a culturally relevant intervention (Mau et al., 2010). Moreover, a study conducted by Brown et al, used a community based participatory approach to translate the original Diabetes Prevention Program (DPP) to be cultural and age appropriate for Northern Plains Indian Youth. Overall, 31 community members aged 10 to 68 participated to identify facilitators and barriers to healthy diet and exercise behaviours in Indian youth. Recommendations included incorporating culturally appropriate activities such as gardening, and dancing into the program, increasing access to healthy foods, and having interactive, hands-on activity for healthy lifestyles in the DPP lessons while using group format and tribal members to deliver the lessons, and encourage healthy behaviours (Brown et al., 2010).

2.9 KAHNAWAKE SCHOOLS DIABETES PREVENTION PROJECT

In 1994, the Kahnawake Schools of Diabetes Prevention Project (KSDPP) was developed through a community based participatory approach. Kahnawake is a Kanien'kehá:ka (Mohawk) community of approximately 8000 people located in an urban environment near Montreal, Canada. Baseline surveys by family physicians identified type 2 diabetes as a common problem. In 1985, 12 percent of adults aged 45 to 64 years old had documented type 2 diabetes; this represents twice the rate of the general population of the same age (Montour & Macaulay, 1985, 1988). Those with type 2 diabetes had also six times the rates of complications than those matched for age and sex but without diabetes (Montour et al., 1989). Therefore, presentations were made to the community to inform them of the research results and to make recommendations to promote healthy eating and physical activity (Macaulay, 1991). This marked the initial phase of mobilizing the community to prevent type 2 diabetes, which led to an invitation from community leaders to family physicians to 'do something' to prevent the high rates of diabetes. The family physicians subsequently invited academic researchers to join the team for the development of KSDPP (Bisset et al., 2004). Through a community based participatory research approach, using the expertise of both community members and academic researchers, KSDPP was founded in 1994 (Potvin et al., 2003). A Community Advisory Board (CAB) of volunteers from the health, educational, political, recreational, social, spiritual, economic sections of Kahnawake, was formulated (Macaulay et al., 1999). Other community organizations such as the local hospital, education system and the health and community services system were also stakeholders of KSDPP. Through CAB, the community was a full partner in the project; it participated in developing the goal and objectives, planning and implementing the interventions and evaluations, outlining the obligations of researchers and community in the code of research ethics, collecting and interpreting data, reviewing lay and scientific publications, and disseminating results to community and to the general public (Macaulay et al., 1999). The projects led by KSDPP not only engaged community members into promoting healthy lifestyle for the community, but it also mobilized the community to obtain funding to conduct future research. The involvement of the

community significantly helped the sustainability of the interventions making KSDPP one of the longest lasting diabetes prevention initiatives in the world.

The KSDPP interventions aim to increase knowledge and change the physical environment and social norms of the schools and community by promoting healthy eating and active lifestyles with the long term goal of preventing obesity and diabetes among the Kanien'kehá:ka population (Macaulay et al., 1999). Interventions are at individual, family and community level and they include a classroom-based health education curriculum for grades 1 to 6, a nutrition and wellness policy banning unhealthy food and promoting healthy food choices, and other activities creating a supportive environment in the community and ecological community changes to enable healthy behaviour (Cargo et al., 2003).

The classroom based health education curriculum was developed from 1994 to 1997, by the Kateri Memorial Hospital Center (KMHC), in conjunction with KSDPP and the Kahnawake Education Center. In Kahnawake, the majority of elementary school children receive their education in community schools run by the Kahnawake Education Center. The majority of teachers in the elementary schools are Kanien'kehá:ka from the community. The curriculum consists of three units: 1) nutrition; 2) fitness and 3) lifestyles and diabetes, divided into 10, forty-five minute lessons for each of grades 1 through 6.

Throughout the 16 years of the implementation of the health education curriculum, students' health curriculum knowledge was evaluated as part of the comprehensive evaluations of the school-based intervention program. Moreover, in the early years of implementation, teachers were interviewed to learn more about their perspective on the curriculum (Cargo et al., 2006). Teachers taught the curriculum to varying degrees, and the number of times that children were taught sections of the curriculum was based on the extent to which teachers applied their role as health education curriculum teachers. Furthermore, teachers reported major barriers at organization and personal levels. In addition, studies have shown that KSDPP had some successes in reducing risk factors for type 2-diabetes in the first three years of the implementation; however, the benefits were not maintained over a period of 8 years.

In fact, in years 1994-1996, there were some positive effects of the program on skinfold thickness, but no significant effects were observed on BMI, physical activity and diet. From 1994 to 1999, physical activity, fitness and television watching showed favorable trends but they were not sustained in 2002. Nevertheless, there was a reduction in high fat, and high sugar food consumption (Paradis et al., 2005; Jimenez et al., 2003; Macaulay et al., 1997). Due to active involvement of community members and the participatory research approach adopted by the project, the curriculum continues to be implemented but no follow up has been conducted to determine if there are any issues with the intervention. Also, the importance of having parents as well as teachers and community members to participate in the evaluation of school-based programs has been established (Mathews et al., 2010; Cardon et al., 2009; Khunti et al., 2008; Hosig et al., 1998; McKenzie et al., 1998).

2.10 SUMMARY

Diabetes prevention programs either school-based and/or community-based have shown promising results in positively affecting health behaviours, increasing physical activity, and improving dietary habits. In community-based programs where the community is actively engaged in the development of interventions, the programs are shown to be more sustainable. Nevertheless, the duration of the majority of diabetes prevention programs reported in the literature were short, limiting the assessment of the long-term outcomes of such interventions.

Despite the increasing number of diabetes prevention programs available for Indigenous people many are either descriptive with no reported evaluations, or the outcomes evaluated are only biometrical measures. There is still a gap in knowledge on understanding the factors that contributed or hindered success of long-term diabetes prevention programs in Indigenous communities. In the early stages of KSDPP implementation, evaluations on biometric measures were obtained from children in grades 1-6, and teachers' perspectives on the school-based curriculum were assessed. However, there is a need for more recent evaluation. In this thesis, the school-based education curriculum, which was developed fifteen years ago by KSDPP, the local hospital and education center, was examined to provide an

understanding of the factors that affected the success of this long-term school-based health education curriculum.

The research questions that were addressed in this study were:

1) How was the Kateri Memorial Hospital Center health education curriculum delivered in years 2010-2011 and 2011-2012; and

2) What are the barriers and strengths of the curriculum from the perspectives of teachers, curriculum authors, parents, and school principals.

3.0 METHODS

3.1 STUDY DESIGN

The study adopted a mixed methods design with a qualitative descriptive component combined with cross-sectional survey. The quantitative section was addressed prior to the qualitative portion. The results of the quantitative portion were used to select participants as well as to assist in developing questions for the qualitative component of the study. Please refer to appendix 2 for study design. The approach taken by this study was a community-based participatory research approach. In 1994, the Kahnawake Schools Diabetes Prevention Project (KSDPP) was developed through a community-based participatory approach. Please see appendix 3 for the participatory approach. The dissemination of results from baseline studies in the 1980's made the community aware of the high prevalence of type 2 diabetes and its complications among Kanien'kehá:ka population. This awareness led to the community engagement and active participation in taking actions to reduce diabetes for future generations. Therefore, the community engaged in the formation of KSDPP with the assistance of academic and community researchers. A Community Advisory Board (CAB) of volunteers from the health, educational, political, recreational, social, spiritual, economic, and academic staff was formed (Macaulay et al., 1999). In this study, the community of Kahnawake was a full partner; it participated in developing the goal and objectives, collecting and interpreting data, and disseminating results to the wider community and to the general public (Macaulay et al., 1999).

The initial proposal for this project came from community members who are members of the KSDPP research team. The community wanted to evaluate the curriculum implementation and delivery rates, the appropriateness of the content, and the barriers and facilitators of the curriculum. The ultimate goals were to improve the curriculum and its delivery for future elementary school students. In this case the community requested the assistance of academic researchers in order to proceed with the project. This study required the expertise of both academic researchers and community members; the researchers assisted in developing tools, collecting data, and analyzing the findings, and the community members contributed by acquiring

funding, providing valuable insights from their previous experiences with KSDPP and the development of the health education curriculum, as well as interpretation and dissemination of the findings.

All researchers conducting participatory research in Kahnawake through KSDPP have to adhere to the KSDPP Code of Research Ethics (www.ksdpp.org). Researchers have to obtain approval from the community advisory board, the KSDPP research team that consists of academic and community members, and the Kahnawake combined schools committee (the school board in Kahnawake). Researchers prior to applying for ethical approval from the appropriate university have to ensure that the project will benefit the community, and build capacity for community members. They have to work in partnership with community members for conducting the research project, collecting data, interpreting and analyzing the findings, and disseminating the results back to the community prior to external dissemination. This code of ethics was adhered to throughout this thesis project.

3.1.1 Stakeholders

The three main stakeholders that were involved with this project included KSDPP, Kateri Memorial Hospital Center (KMHC) and Kahnawake Education Center (KEC). KSDPP was comprised of the Community Advisory Board (CAB), and the KSDPP research team. These groups provided feedback and recommendations during all stages of the project. A certificate of approval from CAB as well as McGill University Review Ethics Board (REB) was obtained.

Upon approval of the project from McGill REB, CAB, the KSDPP research team, KEC, and KMHC, a health education curriculum evaluation research committee was formed. This evaluation research committee was involved directly throughout all stages of the study. The committee consisted of a nutritionist, a nurse, a teacher, a former school principal, a community researcher, and an academic researcher. The academic researcher in this study was the author (MSc candidate). CAB and the research team have approved the involvement of all members in this committee. The nurse and nutritionist were representatives from the Kateri Memorial Hospital Center, and were involved in developing the health education curriculum in the years

1994-1997, hence their contributions in evaluating the curriculum was needed, and necessary. The former high school principal is the community lead investigator of this project; his involvement in the committee was crucial as he has been involved with KSDPP since 1994, and during 1994-2006 he was responsible for the overall KSDPP community mobilization. He also acquired the funding for this study from the Aboriginal Diabetes Initiative of Health Canada. The participation of another community researcher who is both a member of CAB and currently undertaking her PhD at McGill University in the faculty of Education was key. She provided insights on the research processes that took place within the community, and assisted in the development of culturally appropriate tools. In addition, most of the members of this committee, and all members of the combined school committee were parents; hence their perspectives were taken into account while developing this research project. The health education curriculum evaluation committee members were involved in all stages of the research from the development of objectives to the dissemination of the findings.

3.2 SETTING AND PARTICIPANTS

The Kahnawake Mohawk Territory is a traditionally Iroquoian-speaking Mohawk nation located on the south shore of the St. Lawrence River in Quebec, Canada, approximately 20km from Montreal. The total area of Kahnawake is 48.05 square kilometers. About 8,000 people live on the territory with a significant number living off the territory. The main languages spoken in Kahnawake are English and Mohawk.

The population for this study included teachers, parents, curriculum authors and school administrators. Curriculum authors consisted of participants who were involved in developing the health education curriculum throughout the years 1994-1997; they included two nurses and a nutritionist. Teachers who were responsible in implementing the health education curriculum at the two designated elementary schools were invited to participate in the study. There were no exclusions in regards to gender, and age. Nevertheless, since the talking circles and semi-structured

interviews were conducted and analyzed in English, eligibility was limited to people able to speak English.

An administrator from each school was invited to participate in this study. Parents of students exposed to the curriculum were invited to participate in the study. The exclusion criteria for parents included parents who were not directly involved in the student's daily life, or were themselves holding a position at school such as being a teacher.

3.3 QUANTITATIVE METHODS

3.3.1 Data Collection

Questionnaires were distributed to classroom teachers who were responsible to teach the health education curriculum in years 2010-2011, and 2011-2012 at Kahnawake elementary schools: the Kateri and Karonhianonhnha elementary schools with a joint population of 430 children in grades 1-6. Due to the participatory nature of the project, and the active involvement of community members, the former school principal assisted in obtaining permission to administer the questionnaire. The community researcher and the MSc candidate jointly administered the questionnaire and the consent forms to the teachers. The presence of the community researcher was included alongside the academic researcher to significantly enhance the response rate and the engagement of participants. Information was gathered on the frequency of curriculum delivery, number of lessons taught, number of teachers who have delivered the curriculum and the number of students who have received the curriculum throughout the school years of 2010-2011 and 2011-2012. The last two school years were chosen for investigation because the objective of the study was to focus on examining the current implementation methods and not to assess the implementation trend of the health education curriculum. Moreover, a two-year time frame was chosen because it significantly reduced the recall bias that would have been present from evaluating a longer period of time while it provided sufficient information on the implementation methods adopted by teachers. The questionnaire was paper based and the estimated time for completion was 10 minutes.

3.3.2 Questionnaire

The questionnaire consisted of 22 closed-ended questions and 3 open-ended questions. Most of the questions were derived from the literature using studies that evaluated health education curricula (Caballero et al., 2003; Steckler et al., 2003). The first category of questions consisted of four questions including demographic information regarding teacher's gender, and years in profession, professional status and length of participation in the curriculum. The second set of questions was made up of four questions related to the resources and support available to the teachers as well as the level of training provided by the school administrators. The third group of questions was comprised of six questions gaining information on the implementation methodology adopted by teachers such as integration of the curriculum into the regular class activities. The fourth set included 8 questions addressing teacher satisfaction with the program such as its language, content, and time allocated for teaching it. The fifth set of questions asked about the number of curriculum lessons taught and the number of students who have received the curriculum in years 2010-2011, and 2011-2012. In addition, the questionnaire ended with several open response items that allowed participants to make comments regarding program strengths, weaknesses and areas for possible improvement. Prior to administering the questionnaire, the questions were pilot tested with recently retired teachers who were not eligible to be a part of the study, but had sufficient knowledge on the health education curriculum to test the questionnaire. The questions, instructions, and responses were checked for relevancy and appropriateness. Teachers who participated were eligible to be included in a draw for a chance to win a $60 cultural gift. Teachers were specifically informed that the intention of the questionnaire was for the sole purpose of evaluating the curriculum, and the results would not be used to affect the teacher's performance evaluation. The data obtained from the questionnaire complemented the results from the talking circles, and was considered the best method to gain knowledge on the implementation and the delivery of the health education curriculum.

3.3.3 Statistical Analysis: General Descriptive Statistics

For the questionnaire, basic descriptive statistics were applied to describe the study sample, and to obtain the frequency of the implementation of the health education curriculum in school years of 2010-2011, and 2011-2012 in Kateri and Karonhianonhnha elementary schools. The most common barriers and facilitators to implementation of the curriculum as perceived by the teachers were reported. Additionally, relationships between teacher's perceptions on the curriculum based on their level of experiences were tested. Following the request of the KSDPP community advisory board, in this study the two elementary schools were not to be compared, hence the data from the two schools were combined.

The evaluation was focused on four constructs: i) level of support provided to teachers, which covered the environmental factors such as administrative supports and resources available to teachers; ii) adequacy of delivery methodology such as the time allocated for curriculum delivery, and the workload associated with the delivery; iii) the appropriateness of the curriculum content which was characterized by culture, language, and age appropriateness of the curriculum, and iv) the importance of the curriculum which was signified by the perceived usefulness of the content, and the personal satisfaction gained from teaching the curriculum. Moreover, the 'dose delivered' which covered the number of units delivered by the teachers and 'dose received' which was the extent to which the students received the curriculum intervention activities in the 2010-2011, and 2011-2012 school years were reported. To balance the forced choice rating scale, most evaluative items were rated on a Likert scale, i.e. Strongly Agree through Strongly Disagree; a score of 5 to 1 was assigned accordingly. The 18 statements were categorized into the four assigned constructs, and proportion of teachers with a score of above 3 ($p>3$) and below 3 ($p<3$) is reported. General descriptive statistics was used to demonstrate the number of curriculum lessons taught, the number of teachers implementing the curriculum and the number of students receiving the curriculum. There were confounding factors present in this study which include teacher's age, school, and gender. The analysis first focused on relating each set of these variables to the implementation methods. The most predictive variables were identified, and an

interaction model combining these variables was used to identify their independent effects. Due to the small sample size, missing data significantly reduced the representativeness of the sample; therefore in order to reduce the potential bias that would have risen due to missing data imputation were performed.

In order to analyze the association between teacher's perception on the curriculum and the amount of time they taught the curriculum, the teacher's length of participation in the health education curriculum, which was signified by the number of years they have been teaching the curriculum, has been reported. The teacher's experiences in year were categorized into ordinal variables (1-5, 6-10, 11-15). The overall 18 statements were categorized into four categories of delivery, content, importance, and support. From the evaluation of these statements, the teachers' perceptions on the curriculum were identified. The statements were rated on a Likert scale, i.e. Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree, and a score of 5 to 1 was assigned accordingly. For statistical purposes and in order to obtain meaningful results in regards to this objective, the score associated with the response of Neutral was eliminated from calculations. Thus, scores 4 and 5 were combined signifying agreement, and scores 1 and 2 were combined suggesting disagreement with the statements. To determine the association between the variables, the teachers were assigned to different categories based on their length of participation in delivering the health education curriculum. Then, the proportions of teachers agreeing or disagreeing with statements in each of the four assigned categories were calculated and reported.

3.4 QUALITATIVE METHODS

3.4.1 Data Collection

In the qualitative portion of this study, the perspectives of teachers, parents, school principals and curriculum authors were obtained to understand current issues with the curriculum and develop recommendation for the improvement of the health education curriculum. The primary methods for exploring the perceptions of the population under study were talking circles and semi-structured interviews.

Proven to be a valuable and culturally appropriate tool in Indigenous health research (Struthers et al., 2003) and recommended by the Kahnawake community advisory board, the talking circle is a method that provides a meaningful, respectful, and orderly social context for comprehensively sharing views (Picou, 2000). This method of group discussion can be used in studies aiming to obtain participants' perceptions on different topics, resolving conflicts, or making new decisions/policies (Fleischhacker et al., 2011; Picou, 2000). In a talking circle, participants sit around a table and discuss the specified topic with each participant having the opportunity to speak in turn sequentially around the circle; participants have the option to speak or remain silent during the discussion (Fleischhacker et al., 2011). The expected length is about two hours. Discussion continues until all participants stay silent for one turn. In this study, unlike traditional circles, a modified version of the talking circle was used where the facilitator did not contribute to the content of the circle but rather observed the discussion to avoid having the facilitator potentially bias the circle discussion (Fleischhacker et al., 2011). The facilitator asked the questions and allowed participants to discuss them with minimum involvement from the facilitators' part. In this study, the talking circle had the advantage over different methods of group discussion (i.e. focus groups) due to the culturally appropriateness of the method, as well as the fact that community members have already been exposed to talking circles, and were aware of the procedures. It provided equal opportunity for the participants to voice their opinions without being interrupted by a dominant speaker while offering a respectful environment for the participants to talk about the facilitators and the barriers of the health education curriculum. Participants also had the opportunity to gain new knowledge and share their perspectives with their peers. Therefore, it was deemed appropriate to use talking circles to assess the perceptions of teachers, parents, and curriculum authors on the health education curriculum. In addition, semi-structured interviews with school administrators were conducted to obtain an in depth understanding of their perspectives on the health education curriculum. Since the investigation was on two elementary schools, there were two principals that were invited to participate in the study. The two school

principals were approached individually to obtain their consent forms, and interviews were conducted at a time and a location convenient for them.

Purposeful sampling was carried out to select teachers, and parents for the talking circles. The objective was to use maximum variation sampling and acquire a wide range of perspectives of the selected group of participants as to enhance the relevancy and accuracy of data obtained (Shoback, 2011). Although purposeful sampling was sought, an element of convenience sampling was also present as subjects were only included based on their accessibility and willingness to participate (Shaw et al., 2010). The strategy of recruitment through personal networks was also practiced, specifically for recruitments of parents.

Upon recruitment, informed consent forms were provided to participants; it included explanations on the research project, participants' rights to withdrawal from the study, and the potential risks and benefits of the project to the subject, and the community. Please see appendix 4 for the consent forms and information letters. The consent forms were also read aloud by the author to obtain participants' verbal agreement. Consent forms were developed with the collaboration of community members and the research committee. Once consent forms were signed, a brief five-minute presentation was given by the author and the community researcher as the facilitators to introduce the health education curriculum research project. To ensure the confidentiality of the discussions, participants were asked to not share with others what was discussed during the talking circles until the results are disseminated in proper format to the community. The talking circles were held at one of the KSDPP offices, and catered lunch was offered to the participants. The talking circle followed the presentation and lasted 60-90 minutes in length and was guided by the facilitators. An interview guide with a set of eleven open-ended questions was followed, though specific probe evolved throughout the talking circle as part of the research process.

3.4.2 Qualitative Measures

The overall purpose of the talking circles and interviews was to better understand the facilitators and barriers that have contributed to the overall effectiveness of the health education curriculum. Please refer to appendix 5 for the interview guides. The

teacher's talking circle was conducted to understand the reasons that teachers were able or unable to deliver the curriculum in whole or in part. It also provided a more in-depth understanding of the answers to questions from the questionnaire. The four main topics that were discussed with the teachers were the challenges and facilitators of the curriculum, general curriculum content, overall effectiveness of the curriculum, and recommendations for strengthening the curriculum. Discussion points for the challenges and the facilitator's topic were time constraints, resources and administrative support available, level of training, and feasibility of integrating the program into the regular classroom activities. The general curriculum content that were examined consisted of the appropriateness of the language used in the curriculum, and the cultural and the scientific relevance of the curriculum content such as the usage of Indigenous traditional foods, and activities to promote active lifestyle. The discussion on the overall effectiveness of the curriculum was focused on teacher's satisfaction with the curriculum goals, and teacher's perceptions on the effect of the health education curriculum on student health behaviour, and food choices during school hours. Lastly, teachers were encouraged to provide any recommendations they had for the improvement of the curriculum.

The discussion topics designed for the curriculum authors' talking circle included an exploration of the purposes and objectives of the health education curriculum, the approaches taken by the curriculum authors to ensure the content scientific accuracy, and the considerations given to the implementation methodology such as providing resources, and guides for teachers to implement the curriculum. Moreover, their overall perspectives on the curriculum, and changes that must be applied were explored.

The talking circle that was conducted with parents focused on assessing their perceptions on the positive and negative factors of the health education curriculum such as the desirability of the curriculum activities, and sufficiency of the time allocated to the curriculum throughout the school year. An overview of the student's change in health behaviour from the knowledge gained from the curriculum was explored. For example, parents were asked whether their children have learned anything from the curriculum, if so what. In this way, they were able to elaborate on

what they would like their children to learn from the curriculum and to know about diabetes prevention, and how they want the curriculum to be implemented. Furthermore, they were asked about the resources needed for parents to support their children's learning on diabetes prevention.

The semi-structure interviews with the elementary school principals were focused on the administration of health education curriculum such as the frequency that the curriculum was being delivered at the specific schools in the 2010-2011, and 2011-2012 academic years, and the presence of reporting mechanism such as logs that teachers were required to complete. Moreover, administrative support for teachers was also discussed throughout the interview; questions addressed on this topic were the importance of this health education curriculum for the principals themselves, and the type of administrative support such as training and resources that were in place for teachers to deliver the curriculum. Finally, their perceived facilitators and barriers on the curriculum were explored, and they were asked to provide suggestion or recommendations for improving the curriculum in the areas such as administrative support and resources.

3.4.3 Qualitative Data Analysis

The talking circles and interviews were all recorded, and transcribed. Notes were also taken by the facilitators throughout the group discussions and interview processes. The transcripts were analyzed using inductive thematic analysis. Thematic analysis is described as a method used for identifying, analyzing, and reporting patterns known as themes within data. It allows an in-depth exploration of ideas and concepts (International Diabetes Federation, 2009). Inductive analysis is a process of coding the data without having any pre-existing coding frame or theories. This analytic method was most appropriate for this study as themes were purely data-driven (International Diabetes Federation, 2009).

Thematic analysis was conducted using multiple phases. Initially the tapes from the interviews and talking circles were transcribed, and transcriptions were read numerous times. Subsequently, codes, which are defined as the most basic elements of the raw data that are meaningful in generating themes, were identified. Coding

was performed manually; the community researcher and the author initially coded the transcripts individually, and secondly codes were refined by their collaborative contributions. Themes were generated, and a thematic map was constructed. Lastly, relevant quotations were selected to support the themes. Due to the small number of interviews and the involvement of a community researcher in coding the raw data, coding was performed manually using key words to identify the codes. Moreover, given the participatory nature of the study, and the setting of the project, the themes were generated taking into account the contextual component as well as the content. Themes were also presented to the study participants, and committee members to review for further interpretation and enhancement of the accuracy of the information.

3.5 ETHICAL CONSIDERATIONS

Community ethical approval was provided by the Kahnawake School of Diabetes Prevention Project (KSDPP) Community Advisory Board, under its mandate from the KSDPP Constitution, and with an endorsement from the Mohawk Council of Kahnawake. This project adhered to the KSDPP Code of Research Ethics, which required all school-based research to be accepted and approved by and the Kahnawake Combined Schools Committee and the Kahnawake Education Center. This study, the consent forms, and questionnaires were also approved by McGill University Research Ethics Board. In order to ensure the confidentiality and anonymity of individuals participating in the project, their names and identifying information were disguised and represented by a code. The tapes and transcripts were also given a code to ensure confidentiality. Tapes will be stored in a locked fireproof chest at KSDPP for a period of 7 years after completion of study, and then the recordings will be deleted. Participation in the study was completely voluntary and participants had the right to withdraw from the study at any time. Publication of results will not identify any individuals, and no names will be used in publications and presentations.

3.6 DISSEMINATION PLAN

Due to participatory nature of the study, the dissemination plan was developed with the assistance of the community members involved in this study. In order to first disseminate the findings to the community of Kahnawake, an article on the local newspaper *The Eastern Door* will be drafted by the MSc candidate, reviewed by community members and published. Presentations will also be made at the two elementary schools, as well as the Kateri Memorial Hospital Center, Kahnawake Schools Diabetes Prevention Project, and Kahnawake Education Center. Furthermore, the findings will be also be published in the form of a journal manuscript and showcased in various conferences in the form of poster presentation or podium presentation; potential conferences include the Family Medicine Forum, and the North American Primary Care Research Group conference.

4.0 RESULTS

4.1 DESCRIPTIVE RESULTS-QUESTIONNAIRE

After applying all relevant exclusion criteria, and performing imputation on missing data, the final study sample size was 23 out of 30 teachers from combined Kateri and Karonhianonhnha elementary schools. As the sample size was small, and the results of the questionnaire were only used to inform the qualitative component of this study, no statistical inference tests were performed. Of the 23 teachers that completed the questionnaire, 17 teachers reported the number of lessons they taught for the year 2010-2011 and 29% taught less than 4 out of the 10 lessons. Two out of 17 teachers taught all 10 lessons. The average number of students receiving the curriculum at the Kateri elementary schools was 12 students per teacher and the average number of students receiving the curriculum at Karonhianonhnha was 85 per teacher. For the year 2011-2012, 16 teachers reported the number of lessons they taught and 37.5% taught less than 4 out of 10 lessons. None of the teachers taught all 10 lessons. In the year 2011-2012, the average number of students receiving the curriculum in Kateri was 9 per teacher and the average number of students receiving the curriculum in Karonhianonhnha was 68 per teacher. In Karonhianonhnha two teachers are responsible to teach the health education curriculum.

Almost half (43%) of the teachers strongly believed that the level of training they received to teach the curriculum was not sufficient. Moreover, 65% of the teachers thought that the teacher's guide and resources available to teach the curriculum were not complete, and 43% believed that the school administrators did not offer support for the health education curriculum. Two-thirds (61%) of the teachers reported having enough knowledge to deliver the health education curriculum, and 83% of the teachers understood the need to teach the curriculum. In addition, 65% of the teachers incorporated the health education curriculum into academic lessons, and 57% thought that the language of the curriculum content was appropriate for teacher's usage. Two-thirds (61%) of the teachers believed that the curriculum did not incorporate Kanien'kehá:ka (Mohawk) traditions and 57% of the teachers reported not having sufficient time to deliver the curriculum during school hours.

Over half (52%) of the teachers reported that the curriculum delivery increased their workload as an educator; however, 22% did not agree with this statement. Finally, 65% of the teachers believed that the curriculum was useful for students. Table 4.1 illustrates teacher's level of agreement with general evaluation items.

The three statements that the majority of teachers disagreed with were statements 3, 12, and 14. These statements are, respectively, 'the teacher guide and resources available to teach the curriculum are complete,' 'the curriculum content incorporates Kanien'kehá:ka (Mohawk) Traditions', and 'I have sufficient time to deliver the curriculum during school hours'. Moreover, the four main statements that the teachers agreed with were statements number 6, 7, 8, and 17. These statements are, respectively, 'I have enough knowledge to deliver the health education program,' 'I understand the need to teach the curriculum,' 'I have incorporated the health education curriculum into academic lessons'; and 'the curriculum is useful for students'.

Table 4.1 – Level of Agreement with General Survey Items

Table 4.1-The percentage of teacher's agreement with general survey items is presented. The total number of teachers who completed the questionnaire was 23. The mean of the scores for each statement is reported; μ<3 signifies disagreement with a statement, μ>3 reports agreement, and 3 is neutral.

Survey Item	Strongly Agree & Agree Combined (%)	Mean (μ)
The level of training I received to teach the curriculum is sufficient	17.4	2.7
The teacher guide and resources available to teach the curriculum are user friendly	26.1	2.8
The teacher guide and resources available to teach the curriculum are complete	22.7	2.5
The school administrators such as the principal offer support for the health education curriculum	30.0	2.8
I feel confident teaching the curriculum	47.8	3.5
I have enough knowledge to deliver the health education program	60.9	3.5
I understand the need to teach the curriculum	82.6	4.1
I have incorporated the health education curriculum into academic lessons	65.2	3.6
I have followed the lessons as guided by the curriculum	47.8	3.1
The language of the curriculum content is appropriate for teacher usage	56.5	3.2
The curriculum content is age-appropriate for students	30.4	2.7
The curriculum content incorporates Kanien'kéhaka Traditions	21.7	2.6
The time (45 minutes/lesson) allocated for the curriculum delivery is sufficient	34.8	2.9
I have sufficient time to deliver the curriculum during school hours	21.7	2.6
Curriculum delivery disrupts regular classroom activities	26.1	3.1
Curriculum delivery increased my workload as an educator	52.1	3.4
The curriculum is useful for students	65.2	3.6
I gain personal satisfaction in delivering the health education curriculum	39.1	3.2

4.2 TEACHERS PERCEPTIONS-QUESTIONNAIRE

In this study, the teachers' positive and negative perceptions on different aspects of the curriculum were also assessed. In order to obtain a clear understanding on all the important features of the health education curriculum and its implementation, the statements were divided into four different constructs, which included 1) the perceived importance of the curriculum 2) the quality of the content 3) the support and resources provided and 4) the adequacy of delivery methodology of the curriculum. To gain meaningful results, scores that were considered neutral (rank of 3) were eliminated from the calculations, and only the scores marked positive (4, and 5) and negative (1 and 2) were used in the analysis. The range of responses with a neutral score was between 12% and 48%. The level of support of the curriculum was assessed through statements 1 and 4 of the questionnaire, the quality of content encompassed statements 10 to 13, the delivery methodology included statements 9, 14 to 16, and the perceived level of importance of the curriculum was examined in statements 5 to 8,17, and 18. Please see appendix 6 for the questionnaire.

After the removal of neutral responses, 84% of teachers had a positive perception for the importance of the curriculum, and 15 teachers out of 23 incorporated the curriculum lessons into the regular academic lessons. For the adequacy of delivery methods, 61% had a negative view on the delivery methodology and its appropriateness; these included having sufficient time and workload level associated with curriculum delivery. As for the quality of curriculum content, 45% had a positive attitude towards it. The main statement that significantly reduced the teacher's positive perception of the content was the fact that it did not incorporate Mohawk traditions; otherwise, the majority of the teachers were positive about the age and the language appropriateness of the content. The level of support provided to teachers, such as training and administrator's support, was perceived negatively for 67% of the teachers.

Additionally, the results demonstrated that teacher's overall satisfaction with the curriculum was mainly due to the perceived importance of the curriculum signifying that teachers most agreement was seen in the usefulness of the curriculum, and the

importance of delivering it. The level of support constituted the majority of teachers' overall negative perception meaning that teachers' dissatisfaction was mainly weighted on the level of support provided to them.

4.3 TEACHERS' EXPERIENCES-QUESTIONNAIRE

The teacher's overall negative perception on the four constructs of the curriculum based on their level of experience (years teaching the curriculum) was analyzed. The number of years teaching the health education curriculum was divided into three categories (1-5, 6-10, 11-15). Three teachers had less than five years of experience, 6 teachers had between 6 to 10 years of experience, and 7 teachers had above 10 years of experience. The percentage of teachers having a negative perception on delivery of curriculum was higher (71%) with 1-5 years of experience compared to 39% with 11-15 years of experience. In addition, the dissatisfaction with the quality of content was 88% for teachers with lower experience and 45% for teachers with the highest number of teaching years. The level of support was perceived negatively for 89% of the teachers with less than 5 years of experience, and 52% for teachers with more than 10 years of participation in the program delivery. For the perceived importance of the curriculum, there was no significant difference between the less experienced teachers and the most experienced ones. Omitting teachers with neutral scores, 100% of the teachers with 1 to 5 years of experience agreed with the importance of the curriculum delivery, while 91% of the teachers with 11 to 15 years of experience agreed with the importance. Table 4.2 demonstrates the proportions of teachers overall disagreement with the four constructs based on their years of experience teaching the curriculum.

Table 4.2 – Teacher's Negative Perception on Each of the Four Constructs Based on Years of Experience

Table 4.2-The percentage of teachers disagreeing and strongly disagreeing with statements given the years of experience is reported for the four constructs of adequacy of delivery, quality of content, level of support and perceived importance of the curriculum. The neutral scores were not assessed in this analysis.

Years of experience	Adequacy of Delivery	Quality of Content	Level of Support	Perceived Importance
1 to 5	71	88	89	0
6 to 10	64	44	50	23
11 to 15	39	45	53	9.0

4.4 THEMATIC TEXTUAL ANALYSIS

Following the analysis of the questionnaires, talking circles were conducted with four teachers from Kateri and Karonhianonhnha elementary schools, three authors of the health education curriculum, and five parents of students from both elementary schools. Semi-structured interviews with the 2 school principals were also conducted. The main themes and sub-themes identified in these talking circles and interviews are reported in this section.

PART 1: VIEWS ON THE HEALTH EDUCATION CURRICULUM

With respect to the differences in the participant groups in terms of their roles on the health education curriculum, a number of broad themes were elaborated: A) environmental factors; B) implementation strategies; C) cultural appropriateness; and D) content relevance.

Theme 1A: Environmental Factors and the Implementation of the Curriculum

A.1.1 Lack of administrative and training support

The curriculum authors stated that during the creation and implementation of the curriculum in late 1990's, the Kahnawake Education Center mandated, supported, and directed its implementation by providing support for teachers to deliver the curriculum. Nevertheless, the current of support provided by school principals and the education center is negligible:

> "Honestly I haven't been, how would I say…really on that to ensure that [it] gets implemented."

Teachers believe that *they are left on their own*, and need more professional development and administrative support. A participant stated: "We need commitment from the Education Center."

Another principal elaborated on the level of administrative support provided to teachers:

> "Well, I guess every so often I [use] the words KSDPP and that we have a program that we should be following in the school."

As for the level of support in terms of providing training to teachers on how to deliver the curriculum, the authors reported that upon the development of the curriculum, training was provided to teachers by the authors themselves:

> "We always insisted the teacher stays in the room. So that's how the capacity building happened. The teacher observed the curriculum being taught for two years"

Additionally, in school services were originally provided for the teachers by the school nurse and nutritionist, as well as workshops to ensure teachers were comfortable delivering the contents of the curriculum. The curriculum authors who were responsible for training the teachers stated that the training was done only for a certain number of years and was discontinued afterwards.

A.1.2 Insufficient Resources for Teaching the Content

Throughout the development of the curriculum, the curriculum authors ensured sufficient information was placed in the curriculum binders *for teachers only* as a reference guide. At the beginning of the implementation the nurses and nutritionist who developed the curriculum were working at the schools acting as a resource for teachers in case they needed clarification on content and delivery. One toolbox for each school was also made that included appropriate tools for teaching, and conducting the activities of the curriculum, as an author of the curriculum mentioned:

> "The resource box, well that supplemented the curriculum, so I went and gathered all, like some of the books…I had posters."

Nevertheless participants have reported that the toolbox is either missing from the classrooms or is not complete:

> "We were missing a lot of stuff when we moved into the new wing. I don't know how some classroom materials disappeared, some library stuff [including toolbox]."

As a result of the missing tools, teachers had to order their own supplies: "So teachers have updated [the toolbox] by buying their own materials."

Participants have suggested that the toolbox be updated on a regular basis, for example, every five years or at the beginning of each school year to ensure the tools are complete and the teachers have access to them. A participant explained:

> "The school could, for example, at the beginning of the year, update the resource box, then do it every year…you know acknowledging that things might get lost."

In order to ensure that the tools would not be lost, participants suggested putting in place a tracking mechanism, *a gatekeeper*, who would be also responsible for updating the toolbox. A participant has elaborated on the problems of the toolbox by stating:

> "I would say that we had the one kit for the school…like those resources…which wasn't sufficient to start off with…way back…when people went to get something out they couldn't find."

In one of the schools, two teachers are assigned to deliver the curriculum to students; thus, the teachers keep the resources they have gathered over the years such as the toolbox, and other related materials in their own classrooms. Even though these specialized teachers have their own resources, the possibility of exchanging those tools with other teachers who are interested in conducting some of the activities of the curriculum is uncertain:

> "Well I don't know if it's [the classroom door] open that much, I know a lot of the stuff is there but I don't know how much [the assigned teacher] opens up her classroom to share with the other teachers."

A. 1.3 The Change Associated with School Environment

The curriculum was developed in the years 1994 to 1997, and since then many changes have occurred within the school environments including the addition of other programs:

> "The language arts program has changed and changed and changed…nothing stays the same for two years."

As one of the principals further elaborated:

> "Because I also know at the same time we've changed our Math program and it's taken…it's the third year in the program and people are just getting used to it. It's a very difficult program."

One of the elementary schools has introduced a French immersion component into their school curriculum: "So…change, change, it's just constant change." Additionally, in one of the schools, there were changes in regards to the location of the library causing the resources to be misplaced. Other related changes are modification in the report card system; in the early years after the start of delivery of the curriculum a component of the report card named Personal Social Education (PSE) was dedicated to the health education program where teachers could evaluate students. Nevertheless, the PSE section has since been removed from the report cards:

> "There used to be a section on the report card that had PSE….it's gone….so from there, there was your health education…your safety would come under there and it was on your report card and its off the report card. So now a lot of people…they're not accountable."

Participants have reported the change in staff and directors such as in the Kahnawake Education Center that *brings in all kinds of new strategies* that could have an effect in the approaches taken to mandate and direct the health education curriculum.

A 1.4 "Other priorities" Affecting Implementation of the Curriculum

With the addition of other programs in the school curriculum such as mathematics and language programs, the priorities have shifted from teaching diabetes prevention to teaching more academic programs such as mathematics:

> "There was a big push at the beginning and then later it was kind of KSDPP…things changed you know, there was downsizing and different priorities, different things happened and it [health education curriculum] was not like so closely followed."

As one of the participants elaborated:

> "There's always new stuff coming on that pushes everything else lower on the totem pole."

Moreover, alongside the addition of various programs into the school curriculum, different policies such as wellness policy were also adapted; these had a significant impact on the school environment:

> "Well, you see the original wellness policy…was changed…where it was very strict and what the kids could eat and not stuff like that and then…but that also kept your focus on this."

In terms of health education, other health related issues such as first aid, safety, evacuation procedures and allergies gained interest over diabetes prevention:

> "[Diabetes prevention] it's lost its importance…I guess…I don't know if it's that much of losing it's importance…but it's just not there."

The shift in priorities in health education decreased considerably the time allotted to diabetes prevention:

> "So they're taking a chunk of time, the evacuation procedures, fire drill procedures…anything to do with that is like half a day."

> "And there is less time because they [students] got to go to Kanien'kéha, they got to go to French, now we're increasing the amount of time in French…there is music program now which is pulling from the classroom teacher's time. There is…you know…all these people coming in…the firemen come in and do this…everybody comes in and does their own thing… so it's pulling away from the classroom teacher's time…"

The increasing number of different programs, and policies that have been adopted by schools lowered the priority of the health education for diabetes prevention and left teachers with less amount of time to be dedicated for student education on diabetes.

Theme 1B: Delivery Methodology for Implementation of the Curriculum

B.1.1 Time as a Restricting Factor for Curriculum Delivery

As previously reported in section A.1.4, the addition of other programs into the school curriculum reduced the time needed to teach the health education curriculum "The lack of time we have in the classroom…"

> "Most people have it [health education curriculum] down as one period in a week, well most people, the younger grades…they have it down, but that block is also safety and maybe art so there's a bunch of different things that they put into that same hour block of the week."

> "The younger grades because they have a little more time because grade 6 only has 16 hours of time in a week to teach in English…that's the Language Arts, the Math, and whatever else…So time is a big factor…because of the three languages in our school [i.e. English, Mohawk, and French]."

In the initial phase of health education curriculum development, the curriculum authors acknowledged the fact that time would be a restricting factor, making the delivery of the contents challenging:

> "There's also always the problem and you're going to find that our or maybe I already found that out is that you're going to struggle or classroom time to teach. You're going to see that the earlier grades, they can give you time but when the academics get pushed more and more, which gets even more phenomenally pushed and then...we push and pull to get time for puberty, sex education [which are] necessary…that [health education curriculum] falls low on the totem pole of this education."

As a result, the authors did not make use of other available programs for diabetes prevention because of their length and complexity. When designing the curriculum, the authors ensured that the contents of each lesson could be delivered in a 45-minute time frame. Nevertheless, most of the participants, including the teachers, have reported that the 45 minutes time allotted for each lesson is not accurate, and does not represent the actual length that it takes to cover all the lesson materials. In fact, participants have reported that the length of lessons is long, and it takes approximately twice as long as the time assigned (45 minutes) to teach one lesson, or in other words, the contents of one lesson can be only taught in two sessions.

> "It could take up two or three periods or maybe up to one hour to cover maybe one lesson."

Participants have elaborated further on this issue:

> "Because a 45 minute math lesson, according to the manual, might take three days, three hours to deliver with the kids, I don't know who tested it to say it at the time would take 45 minutes? If it was put together by nurses, they may have tested it but if you're doing it with adults, it goes a lot faster."
>
> " It looks like it should take 45 minutes or whatever but It really doesn't because you're dealing with kids. Like things look good on paper but when you start dealing with kids, you know that 45 minutes, you know then they take you somewhere else, or even though you bring them back you still lose so it does take longer than anticipated."

Participants reported that because the curriculum is designed for elementary school students, it takes a longer period of time to perform all the activities proposed in the curriculum, and to teach the contents of each lesson.

B.1.2 Differences in Organization Structures

There is a strong difference between organization structures of Kateri and Karonhianonhnha elementary schools. In one of the schools, each homeroom teacher is responsible to teach the health education curriculum in addition to the academic programs while in the other school, two teachers, also referred to as *health teachers*, are assigned to teach health related education:

> "There is actually the two health [teachers] but then there are the teachers that do some in their class periodically. So there is the two that are official [health education teachers]…but then there is the homeroom teacher's themselves that are supposed to also implement the [health education curriculum] into their classroom."

It should be noted that besides teaching the health education curriculum on diabetes prevention the *health teachers* educate students on all aspect of health including bus safety, KSDPP policy, different poisons, and fire safety. Participants reported that the variation in structural organizations between schools could be the reason why the health education curriculum is more regularly taught in one of the schools:

> "And there the program would definitely be delivered at all levels because they have a teacher teaching it [the health education curriculum]…so it is a big difference."

Participants noted that specialized teachers who are only responsible to teach health education would have better organization, and could put more time in educating students on different aspects of health including the health education curriculum on diabetes prevention: "Since I am a health teacher I can find the time to teach."

On the other hand, homeroom teachers that need to teach students the academic programs as well as health concepts are faced with more time constraints. Additionally, the time restriction prevents the teachers from implementing some

of the health education curriculum related activities such as inviting a nutrition guest speaker.

B.1.3 The Lack of Reporting Mechanism in Delivery

Throughout the earlier years of the implementation of the health education curriculum, a reporting mechanism was in place in which a representative from KSDPP would go to each classroom and ensure that teachers are instructing all of the ten lessons. Moreover, as participants have mentioned, there used to be monthly calendars where teachers could report the amount of physical activities conducted with their students as well as the number of health education curriculum lessons taught:

> "When we first started this we had monthly calendars and that had to fill in how much physical activity [performed]…and that was the evaluation, that was when they had to evaluate things so they had to really have everything recorded."

One of participants responsible of the reporting mechanism further explained:

> " …I would make sure if you were in grade one, I made sure you did [lesson] number one, I made sure you did number two, number three, number four and number five…and then I'd go to grade two and grade three, grade four, grade five…just to make sure that everybody was doing it [the curriculum], just keeping my own log kind of thing…to make sure that everybody was doing it because we weren't sure if everyone was doing it."

Even though the reporting mechanism was an approach taken by KSDPP to ensure the implementation of the health education curriculum, most participants perceived it negatively. Participants indicated that this reporting mechanism would *overwhelm* teachers with all the programs, and activities they had to conduct in a specified amount of time.

Moreover, as described in section A.1.3, a section on report cards named Personal Social Education had a health education curriculum component. This also acted as a reporting mechanism because in order for teachers to accurately evaluate student's performance on the health education curriculum, they needed to teach all lessons of the curriculum to students of all levels. However, after the removal

of PSE from report cards, and the absence of a KSDPP representative, all methods of reporting were reduced. As one of the principals has indicated, presently no reporting mechanism is in place:

> "There's no type of reporting mechanism…that's more left up to teacher's discretion as I said because you know all the things that need to get covered if I was to say well, all of these need to be…well they, the teachers start to get stress out because they're starting to get overwhelmed."

B.1.4 Integration of Curriculum Content Into Academics

The health education curriculum lessons were originally designed in a manner in which it could be integrated in some subjects of the academic programs including mathematics, and language arts:

> "They're maybe finding somehow to incorporate health education on their own, maybe but not aimed at, what causes diabetes and stuff like that."

Additionally, the curriculum authors ensured that the curriculum content was flexible to be taught in fragmented fashion, which signifies that each lesson can be divided into several shorter length lessons, or to be integrated in other subjects:

> "Here it says there are ten lessons designed to be delivered in 45 minutes each…these components may be delivered in any order, they are designed to complement each other and then we recommend that aspects of each component be incorporated at every opportunity. So you may choose to deliver the lessons in a fragmented fashion, each part of the lesson has a clear introduction and closure allowing you to divided each lesson into several shorter lessons, if you need to…So I think we just try to be like, very flexible and open…It's like here do it whatever it fits…whatever fits for you."
>
> "There's days where you have your 45 minute class but forget it, you're only doing ten minutes, because something happened, so then wherever you stopped, you could pick up again…it has like little small components in between."

Even though some participants indicated that they could integrate some of the curriculum contents into the academic programs, integration is not appropriate for all content:

> "Some things you can integrate, like say if you're doing measurements, like math you can integrate into this because you're measuring intestines and things like that but you can't always do it sometimes the other way around, some things you can reinforce…that just doesn't work for everything…basically, the integration."

The flexibility of the design of the curriculum, and the fact that some lessons could be integrated was perceived as one of the facilitators of the curriculum.

Theme 1C: Cultural Appropriateness of the Curriculum

C.1.1 The Language of the Curriculum

The official language of the curriculum is English with minimal usage of the Kanien'kéha (Mohawk) language, as one of the curriculum authors has reported:

> "In terms of language, the Kanien'kéha, we don't have Kanien'kéha in there other than names…I'm talking for the nutrition specifically. So we were not mandated or so, it wasn't the thing to do to put the language into it, it was in English and then it was translated into Kanien'kéha…So like today I think that might be different because people are incorporating the language into everyday talk more and more as much as you can, and I mean we might've used a couple of words like onen, and niawen, like not much…very minimal in terms of [Kanien'kéha] language."

Nevertheless, one of the elementary schools delivering the health education curriculum is a Mohawk immersion school instructing Kanien'kéha to students. Therefore, at the beginning, the responsibility of translating some of the contents of the health education curriculum was on the health teachers themselves as no resources for curriculum translation was available:

> "The KSDPP, then provided the guidelines…and it was all scoped and sequenced and all we did was [to] translate some of it."
>
> "I've got some of the lessons that were designed in English, there is a little bit in Kanien'kéha, very little on the nutrition on the kind of food they eat, but it wasn't enough for me because I included nutrition exercise, I included all that but a lot of the information I had look up again and then I had to find in Kanien'kéha vocabulary tape to teach lessons."

An Indigenous French speaking community was given the permission from the Kateri Memorial Hospital Center to translate the health education curriculum into French. The participants believe that the French text in the translated version is too complex for students whose first language is not French:

> " When we found out they had [the French version of the Curriculum] it, we thought ok we could do this in French subject class but they can't really use it because it's just too broad so I said well we'll look at it and maybe you have a unit on Nutrition but it's still not going to be turned into diabetes because there's technical terms…what happens in the body, you know, with the food and it's too much to do in the French class but now there's a French Immersion class and I'm expecting that Grade 1 French immersion teacher to try to do what she can with the program."

With the addition of French immersion in one of the two elementary schools, the possibility of using the French version of the curriculum remains uncertain.

C.1.2 The Mohawk (Kanien'kéha) Cultural Representation

Throughout the process of development of the health education curriculum, the authors could not make significant use of other available resources and programs because of the irrelevancy of those programs with the Mohawk culture of Kahnawake. Thus, in order to make the curriculum culturally appropriate, the curriculum authors relied on the assistance of community members such as local artists, and their own cultural knowledge:

> "One aspect of the cultural relevance was to have the artwork done by a local artist from Kahnawake, and also for sure the foods, I mean I had already been working in the community for almost ten years, when I [wrote] this I was already familiar with a lot of the traditional foods and so on…I just talked to people whether it be the teachers, whether it be people at work, whether it be KSDPP members, you know whoever I could get, so that's how it became relevant and I think just a lot of it was from our own experience in the classrooms."

Local support and teamwork were the approaches taken to ensure the cultural relevancy of the health education curriculum. Nevertheless, implementers of the curriculum believe that the Mohawk culture is not significantly incorporated in the curriculum: "Using Kanien'kéha names does not really mean incorporating the culture."

On the other hand, some of the participants believe that with the increase in cultural diversity among population living in Kahnawake, the cultural appropriateness of the curriculum needs further exploration:

> "When you give people information, they understand how to apply it to themselves, as long as it fits in their world…just like what fits our community, what fits here, what do people understand, always keeping in mind that the community is very diverse, very diverse in terms of religion and tradition."

> "So I think for this to be call truly [cultural] relevant, it shouldn't be done one way or another way, it should be something that is acceptable and that people can identify with…that everybody in the community can identify with because if its too much one way or too much another way it alienates the other people."

Even though at the time of curriculum development, the authors ensured that the curriculum was culturally relevant by using all the resources available to them, with the increase in incorporation of the Mohawk language and culture in every day life as well as the rise in acceptance of other cultures in Kahnawake, the cultural appropriateness of the curriculum is perceived differently among individuals.

Theme 1D: The Content of the Curriculum

D.1.1 Out of Date Contents on Diabetes Prevention

The health education curriculum was developed using guidelines and resources such as *Canadian Diabetes Association Clinical Care Guidelines,* and *Canada Food Guide* that were available during that time. Since then, new recommendations and resources regarding diabetes prevention, and health promotion have been put in place making some of the contents of the curriculum outdated. Most participants regarded the curriculum content as *looking old* with *illustrations not too clear* and *outdated activities.* Participants have elaborated on this issue:

> "It's old material so I had to spend a lot of time myself going on the internet, researching and looking for stuff and then to translate that material…It's all old, like how old is it, you're bringing in pictures, and it's just so old."

The curriculum authors believe that the curriculum content is still accurate, however, some modifications are needed in regards to the contents to make the curriculum more appealing to students:

> "I feel that in order for it to be used it has to be updated, it has to become contemporary, most of the information is still exactly perfect, it just needs to be updated…15 years is a really long time because things don't look like that anymore."

D.1.2 The Repetition of Contents from Grade to Grade

Most participants have reported that the curriculum contents are very repetitive with approximately the same information being covered from grade 1 to grade 6:

> "I have been hearing for years how it's just a repetition, like at grade five and six you are just adding, maybe one different component, but the lessons are primarily the same."

The repetition of the contents significantly reduced the interest of teachers delivering the curriculum, as well as the likelihood of students engaging in learning the contents and participating is the curriculum activities:

> "But you know teachers get tired of doing the same thing year, after year, after year…so even though it's new, but it isn't really new to the kids because I believe, like the grade 1 program you were cutting out those same vegetables as grade 2. So there wasn't much variety and teachers feel that you're doing the same thing over and over, the same way."
>
> "It seems very repetitious, like it seems it's the same thing from grade level to grade level, and that's my thing, it's very repetitious. It's a little bit boring…it seems like it's the same every grade level just changed a little bit."

On the other hand, parents believed that repetition could help their children to better remember the important facts on diabetes, and that repetition is necessary for children's learning process. In this particular matter, the perspective of parents contradicted the opinions of the teachers.

> "Every year they get exposed to it again, they get to hear it again and it becomes repletion and they absorb it more, they remember it. Repetition is one way of forcing it into your head and it is something important, it's worth repeating over again even though it's boring for the teachers."

Upon addressing the issue of repetition of contents with curriculum authors, they reported that at the time of development of the curriculum, repetition was essential for cognitive abilities of students with *special needs*. In order to respect

the different learning styles and to engage all students in the health education, content repetition was essential:

> "I had kids with even physical disabilities in wheelchairs, I had two kids muscular dystrophy, so we have physical activity in the class, part of the lesson, every lesson had that component so I had to make sure that they could be included."

Due to the fact that a separate health education curriculum was not developed for students with special needs, the activities and the lessons instructed were the same for all students.

D.1.3 The Importance of the Curriculum Content

Presently, even though the curriculum is not being delivered as it used to be in early years of the implementation, the content of the health education curriculum is perceived as important. The curriculum is divided into three sections of Diabetes and lifestyles, Fitness, and Healthy Eating, educating children on healthy behaviour and approaches that can be taken to prevent type 2 diabetes. Participants reported that as a result of this curriculum, there is an increase in children's knowledge on healthy behaviour. One specific component of the curriculum such as food labeling is indicated as extremely useful, and important for children. The importance on the content of the curriculum has been highlighted throughout the study:

> "I think, I don't feel that it [curriculum] is being really used right now… and I find that regrettable because I think that would be really nice for children to have this information."

> "Well I would like to see this program upgraded…as a person who has diabetes I see that it's important, I see that it's an important program to do…again it has to have some physical activity component…I can watch what I eat but I'm still not going out and walk."

The importance of the curriculum content and the fact that children need to know this information on diabetes prevention and healthy behaviours are perceived as facilitators of the curriculum.

D.1.4 The Impact on Health Behaviours

The majority of participants reached consensus on the importance of the curriculum content. Therefore, the impact of the health education curriculum on children as perceived by their parents was further explored. The majority of the parents who participated in the talking circle mentioned that health education at school had a positive influence on their children's healthy behaviour. These changes in behaviour were more commonly reported for children attending the school that has specialized *health teachers.*

> "She's [my daughter] more aware of healthy foods, she knows the fast food stuff is really not too good. Sometimes we'll go out and she'll just want to order a salad...she's aware to get some exercise to go outside."
>
> "By him being aware about the foods that he eats, he's more conscious of it. He makes me more conscious of it too, my son comes home with information, papers, recipes, it has all these healthy ingredients."

In the elementary school with the health teachers where more time was provided for health education, changes in children's health behaviour were clearly identified by their parents. Nevertheless, the direct impact of the curriculum content on health behaviours has not been explored at both elementary schools.

PART 2:RENEWAL/REVIVAL OF THE HEALTH EDUCATION CURRICULUM

Participant's perceptions on the approaches that can be taken to improve the health education curriculum were further explored. Participants believed that a renewal or revival of the health education curriculum is needed to increase its implementation rate. The main themes that were identified in this section are A) augmenting the level of support; B) modifying curriculum contents and activities; C) changes in environment; and D) miscellaneous others.

Theme 2A: Augmenting Level of Support

A.2.1 Sense of Ownership of the Curriculum

The health education curriculum was written by nutritionist and nurses of the Kateri Memorial Hospital Center, with support from the two KSDPP intervention agents and was provided to teachers of the two elementary schools for

implementation. The authors of the curriculum obtained *suggestions* from teachers throughout the development and piloting:

> "That was really how I went about doing it plus with my resource people…and I had my resource people that I would ask, and then that kind of answers learning styles…that really kind of fits in there too because I got a lot of tips, a lot of tips from them [teachers] about learning styles and different teaching methods."

Nevertheless, sense of ownership from the schools and teachers is lacking: " The lessons need to be made by teacher."

In general terms, the health education curriculum is perceived as an external program adopted by the schools. Furthermore, participants suggested that promoting professional development for teachers would have a positive impact on the delivery of the health education curriculum:

> "Professional development, training is needed, because there was nothing at the time, or any resources, any additional resources."

If teachers were themselves completely knowledgeable on diabetes, its mechanism of affecting the physiology of a human body, and its outcomes, they would be more engaged in the health education curriculum:

> "One of the things I think is that more of us need more…I guess more…more of ourselves maybe, more professional development in those areas…when you are trying to implement health so you can relate it and say well, you have to understand how this certain thing then affects the body, then I think that would be more helpful in the delivery as opposed to there's something there and you just going to figure it out and understand it."

Providing professional development strategies related to health concepts to teachers was proposed as an approach that can be taken to increase the motivation and encouragement of teachers in delivering the health education curriculum.

A.2.2 The Importance of Parental Education

The majority of participants including teachers, school administrators, parents and curriculum authors, believed that in order to efficiently decrease diabetes risk factors for the next generation, administering a health education curriculum to

students is not sufficient. In other words, participants reported that parental education on type 2 diabetes and its prevention approaches would increase parental awareness on diabetes; thus positively impacting home environment and student's health behaviours:

> "There needs to be more parent education at the maybe starting at nursery and that's my opinion, starting at nursery and kindergarten…the parent info, whether it's providing pamphlets, providing something you might reach more parents…because it's nothing we can do as teachers that hopefully would change the kids we have a lot more kids drinking water, we have a lot more kids, but they're still bringing in not the proper juices."

> "Well it all goes back to the parents…I think there has to be more workshops or you know meeting with parents, to get them 100% on board, because if we try to, if we do it at the school then we become the …we're perceived as the bad guys."

Even though, by administering all ten lessons of the health education curriculum, students will become aware of healthy behaviour and diabetes prevention strategies, they are still dependent on their parents and home environment for food choices and lifestyle habits:

> "Although the students learned what was healthy/not healthy, it didn't necessarily translate or effect their choices. In the end it is the parent that buys the groceries, the views of the household that dictate eating choices/behaviours."

Hence, participants suggested that parents should also become educated on diabetes and healthy behaviours in order to effectively prevent diabetes for the next generation: "to get to the kids, we got to get to the parents".

Parents also strongly believed that their current knowledge on diabetes is very limited and restricted only to their experiences with regards to diabetes. Parents have further elaborated on this issue:

> "I don't really know. It's just like oh, ok it's diabetes, I'm not really sure what it is but it's not severe, it's not contagious, they can't really die from it unless they're really not taking care of themselves. I don't really know about [diabetes]."

Parents suggested that focusing on parental education would significantly impact the health behaviour of the child at home:

> "Once the parents are more informed. It's easier to communicate with their children about it, and they can incorporate it at home also...parents have to be informed too because I don't think they really know. So the information is lost between leaving school and getting home."

A.2.3 Approaches to Increase Parental Awareness

The importance of parental education was mentioned in all groups of participant, we therefore further explored the approaches that could be taken to increase parental awareness on diabetes and its prevention. Participants suggested that effective transfer of information to parents would enhance the likelihood of remembering the important factors on diabetes:

> "There should be more information to parents to keep it simple, easy for them to understand, absorb. Because I think that everyone is super-informed, we all have a general idea but not really enough…maybe they can even get a little list of things they can suggest to children, ways to keep them informed, things that they can do, and about foods."

It was also suggested that the information would be better reinforced using facts and *statistics* as well as visual representations:

> "Parents should know that what is the glucose levels now safe up to, if you ever get tested and you get it on paper so you know what it means."

Providing parents with visual representations such as graphs, pictures, and diagrams along with the facts was also perceived as an effective tool to reinforce the importance of the information on diabetes.

> "We tend to be attracted to things, we tend to like things that are easy to understand, easy to follow, easy to go through. Something point form, something that catches our attention."

Parents mentioned their interest in knowing all the important details on diabetes to provide a better care for their children at home; nevertheless they are also interested in learning more on preventive strategies and alternatives:

> "Not about just the consequences but tips, that's always why I'm looking for advice on healthy alternatives."

A.2.4 Cost

The reduction in funds and financial resources of the elementary schools had an impact on the delivery of health education curriculum. As previously reported, one of the two elementary schools have specialized teachers assigned to teach the health curriculum. It was mentioned by some participants that financial constraints has led to a drop in number of these *health* teachers:

> "Well, there's only two [health teachers] now, there used to be six at one time but due to funding cutbacks and stuff, it's reduced now, there's only two."

Additionally, the decline in financial resources available has negatively impacted the replacement of missing equipment for the health education curriculum toolbox, thus, restricting the number of curriculum activities that can be performed:

> "It's not a very large budget, and you have to be careful on how you spend it."

An increase in funds available for schools was suggested as one of the approaches that can be taken to revive the delivery of health education curriculum.

Theme 2B: Modifications in Curriculum Content and Activities

B.2.1 Adoption of New Technological Approaches

Diabetes was seen as a complex and abstract topic for young elementary school children, thus a health education curriculum on diabetes prevention designed for children should use colorful drawings, images, and simple words: "The [book] got big pictures in it and children love it."

In years 1994 to 1997, the designers and authors of the health education curriculum made use of all the available resources to make the curriculum thorough and easy to understand for children of grades 1 to 6. Nevertheless, participants believe that with advances in technology and the tools that are presently available, the curriculum can be upgraded to a more interactive and colorful version:

> "In order for it to be used, it has to be updated, it has to become more contemporary, 15 years is a really long time, things don't look like that anymore, you know a lot of things are electronic, a lot of things are more dynamic, more interactive, and more colorful."
>
> "Instead of just following something that might be written down, we have to come up with ideas where we can make it exciting like that and use whatever technology is available to us."

In order to increase student's interest in the health education curriculum contents, some teachers have developed their own resources using the Internet:

> "Every material I find on the internet, I have to adapt it, and then I have to look at the kids, what are the kids interested in, how can I make it exciting, what kind of activities can I find to go along with this, I use music a lot, I translate common children's songs into Kanien'kehá:ka and they love it."

Although, the use of technology such as computers can increase students' engagement in activities, participants believe that for some aspects of the curriculum, children still need to be exposed to tactile activities where they could use their sense to feel different objects:

> "You could do stuff on computer, but you'd need the 3 dimensional heart, some of those things have to do with your touching and whatever and I wouldn't take that away to a computer because the whole idea is you want to encourage movement, and I'll tell you when you teach and you're running all over, you want them to get and to learn with the tactile…you want them to use that Play-Doh with your hands."

Overall, the majority of participants have reported that in order to increase student's learning for the health education curriculum, a balance has to be kept between making curriculum activities more interactive by incorporating technological tools, and maintaining the tactile sensation of some of the curriculum exercises.

B.2.2 Usage of Technology for Resources

Originally, the tools that were required for conducting the curriculum activities were kept in a plastic toolbox at each school. Participants believed that some of those resources such as posters, pictures, and games can be kept on a compact disc; this would significantly reduce the likelihood of disappearance of the tools:

> "To me, it would be something, like is all on disc…so if you need this you can go have it printed, if you want it printed in color you can order it from the curriculum center, or here or there."

Participants mentioned that the availability of the health education curriculum, and the tools on a compact disc could possibly increase the accessibility of the materials, allowing the contents and tools to be available to all teachers, and staff.

B.2.3 Reduction in Content Complexity

As mentioned in section B.2.1 diabetes is perceived as an abstract topic, and education on diabetes prevention strategies might require understanding of complex subjects such as human body. Some of the curriculum contents were perceived as complex, and not age appropriate for elementary school children.

> "Some of the material that was done over there, especially talking about inside the body, it wasn't age-appropriate. Not even for grade two, it was too difficult, especially being taught in Kanien'kehá:ka, and forget about trying to teach it to anybody younger."
>
> "It looks like it would be more geared towards a high school biology class."

Due to the perceived complexity of the curriculum contents, participants recommended that the lessons become simpler, and meaningful to elementary school children:

> "I think that if was more just lessons that were more applicable to the kids themselves where they could actually do it and see it that way, then I think for me it would be more meaningful than it is right now…something that they find relevant to their own lives."

In order to increase teachers' motivation to deliver the curriculum, an updated and shorter curriculum with more appropriate, valuable, and meaningful content alongside interesting and interactive activities was suggested.

B.2.4 Incorporating Cultural Relevant Activities

Participants further suggested that in order to increase the cultural relevancy of the curriculum, traditional activities can be incorporated into the contents:

> "There's snow snake, snow-shoeing, introducing traditional athletic stuff."

> "They can learn that gym class and fitness is more than just running around and exercising, it's about educating yourself, knowing about those different things that are available and different ways to keep yourself healthy, not just physically but starting from the inside."

They also mentioned that to better enhance the quality of the contents of the health education curriculum, increasing students' knowledge on traditional foods is highly recommended:

> "At our school, they have the canteen but they just have their basic meals, they need to teach the kids more about traditional foods."

Indigenous traditional basic foods include squash, bean, and corn, which are known to contain healthy nutritional ingredients, thus becoming familiar with them is perceived as to be an essential part of a healthy lifestyle.

Theme 2C: Changes in Environment

C.2.1 Classroom Environment

Presently, most of the activities and teachings related to the health education curriculum are presented in the classrooms either by the homeroom teacher or the health teacher. Some participants have suggested that in order to increase the tactile responses of students and to teach them the interconnection of different life concepts such as health behaviours with diabetes, a different classroom setting is needed. Developing a more interactive and kinesthetic approach for students was recommended:

> "Something where they're not always at their desk with paper and a pencil because we're getting more and more children who aren't good at pencil and paperwork, they need to have hands on stuff they need to be moving."

The proposed classroom setting is outside the classes, in gardens or yards where students can learn by observation:

> "You want to teach the kids about boats? Take them to marina. You can't talk about it in the classroom, take them there, let them use their five senses…see it, touch it, smell it, taste it and then come back into the classroom and say ok, so now what did we learn? And then start talking about that and then develop the question and the thinking so that they understand."

> "We have to extend all class work now and if we could develop all of these things to come into the school yard and its gardens, its trees, its tapping trees, it's just bridging that gap between if we're saying we're supposed to have a relationship with peers, well then what is it? And where is it?"

Teaching the lessons using animated approaches was also suggested as a method to increase the interest of the children in learning about diabetes prevention. It was suggested that teachers invite guest speakers or make use of creative tools such as puppet shows to convey the message.

> "They could have puppets even, that's something to catch their attention. You know that puppet could have diabetes and he could go and talk to them about all the problems that he has and different ways that he has to be safe now."

Additionally, taking into account the Kanien'kehá:ka positive identity of being healthy physically, mentally, spiritually and emotionally was highly recommended.

C.2.2 Kanien'kehá:ka Culture in Teaching

As Kanien'kehá:ka identity is connected with the natural world, it emphasizes being healthy on a holistic level such as physically, emotionally, and spiritually, it was deemed appropriate to educate children more on this identity while teaching the health education curriculum: "If you are Kanien'kehá:ka, you are healthy."

Moreover, participants believed that children should be provided with enough information on the history of diabetes amongst Indigenous peoples for them to better understand the purpose of being educated on diabetes and its prevention strategies:

> "Teach children the history of diabetes amongst Indigenous peoples."

Theme 2D: Miscellaneous Others

D.2.1 A Comprehensive Health Program

Some of the participants reported that instead of having a health education curriculum for diabetes prevention, developing an overall comprehensive health

program for the community would be advantageous. One participant elaborate more on this issue:

> "We need to have a comprehensive health curriculum, so you know what the kids in kindergarten need to know in regards to safety because this [diabetes] is important but don't forget other things, children die of injuries, that's far more important…What's relevant to Kahnawake today? What are our kids getting sick from and dying from? What there potential is? Diabetes for sure is one for sure obesity, those kind of things…what are your priorities, and you better teach those things first, and then work you way down."

A comprehensive health program would be comprised of all aspects of health from safety to diabetes prevention. Participants mentioned that this program would incorporate all the important health education contents that students should be receiving including diabetes prevention.

5.0 DISCUSSION

In this study, we examined the Kateri Memorial Hospital Center health education curriculum using a community-based participatory approach. The results demonstrated that the curriculum is still being partially implemented and perceived as a positive intervention; however, it requires some modification and changes to enhance ongoing implementation. Our finding that teachers are still teaching the curriculum to some extent almost sixteen years after the initial implementation agrees with previous studies that have shown that the sustainability rates of community-based programs developed by community members are higher than other types of primary prevention programs (Feather et al., 1993). This study addressed the gap in knowledge for understanding the factors that contributed to or hindered the success of a long-term diabetes prevention health education curriculum in an Indigenous community. In this study, the KMHC health education curriculum was revisited and an in-depth understanding on the main barriers and facilitators affecting the implementation and the delivery of the curriculum were obtained. By exploring the perspectives of various groups of people directly influenced by the curriculum, major recommendations were identified that could be applied as necessary to renew or revive the curriculum.

5.1 THE DEVELOPMENT OF THE CURRICULUM

5.1.1 Curriculum Authors' Views on the Developmental Stages

Previous studies have shown that lifestyle interventions encouraging physical activity and healthy dietary pattern are highly effective in reducing the risks of developing type 2 diabetes (Gerstein, 1997; Hu et al., 2004; Montonen et al., 2003; WHO, 2003). The high prevalence of diabetes in Kahnawake, and the proven effectiveness of primary prevention interventions mobilized the community and encouraged KMHC, KSDPP, and KEC to develop a health education curriculum. The talking circle conducted with curriculum authors provided information on the developmental processes of the health education curriculum. Even though at the time of the development of the curriculum, other

programs were available in other communities, due to the complexity, length, and lack of cultural representations of those programs, the curriculum authors used their own resources to develop the curriculum. They gathered information using mainly children's books, medical textbooks, and resources such as the Canada Food Guide and the Canadian Diabetes Association Guidelines. In order to ensure that the curriculum was culturally relevant, authors relied on local artists, community support, their own experiences and cultural knowledge. Moreover, the authors obtained suggestions from the teachers throughout the developmental stages to ensure that the contents were age appropriate and relevant for children. To make the curriculum interactive, they designed activities for which a toolbox was provided to each school containing posters, books, and other equipment. To ensure that this curriculum would be effective in reducing diabetes risk factors in the community of Kahnawake, the authors understood the necessity of making it culturally appropriate. As other studies have suggested culturally appropriate programs have shown to be well received by participants and enhance the positive outcomes (Boston et al., 2010; Brown et al., 2010; Mau et al., 2010; Holcomb et al., 1998; McKenzie et al., 1998).

Prior to developing the health education curriculum, the authors predicted that time would be a restricting factor in delivering it, thus they designed each lesson in a manner that could be delivered in only 45 minutes. Also, they ensured that the curriculum content is flexible to be taught in fragmented fashion meaning that each lesson could be divided into several shorter lessons or be integrated into other subjects. At that time, the schools had fewer programs to implement, thus leaving more time to diabetes prevention. The main language spoken was English. Therefore, the curriculum was written initially in English, and later translated to Kanien'kehá:ka for the Mohawk immersion school.

The curriculum authors anticipated that teaching the curriculum needed training and sufficient knowledge on the content. As a result, the authors themselves taught the curriculum for two years along with the teacher. In school services were also provided as resources for teachers, and workshops were made available to ensure teachers were comfortable delivering the contents. Specific information

for teachers was provided in the curriculum itself as a teaching guide. A reporting mechanism was also put in place to ensure that teachers are delivering the lessons. Other programs have also used reporting mechanisms such as attendance logs to determine the delivery rates of the interventions (Naylor et al., 2010; Caballero et al., 2003; Steckler et al., 2003). The mechanism for the KMHC curriculum included a representative from KSDPP reporting the curriculum delivery rate of each teacher.

Currently, the authors believe that the curriculum contents are still accurate and not outdated; nevertheless due to advances in technology, modifications can be done to make the curriculum more interactive and appealing for students. In regards to the repetition of the contents, authors reported that in order to make sure that students with different learning abilities can remember the relevant facts on diabetes prevention repetition was necessary and remained to be perceived as an essential factor.

5.2 EXPERIENCES TEACHING THE CURRICULUM

Based on the results of the questionnaire, while most of the teachers believed that the curriculum is useful, the teacher's guide and resources needed to teach the curriculum were no longer sufficient. The majority of teachers did understand the need to teach the curriculum; however, they have reported time to be a major limiting factor for delivering the curriculum. As a result, some of the teachers have incorporated parts of the health education curriculum lessons into their regular academic lessons. Finally, many of the teachers believed that the curriculum did not incorporate enough Kanien'kehá:ka traditions. Even though more than half of the teachers have reported teaching 4 or more lessons per year for the past two academic years, very few have taught all the 10 lessons of the curriculum. The importance of the curriculum constituted the major part of teacher's positive view on the curriculum, and teacher's dissatisfaction was mainly due to the lack of support. As teachers play a major role in delivering school-based interventions, it is important to ensure they are provided with enough support. Previous studies have indicated the importance of engaging

teachers and motivating them by providing sufficient resources and tools to implement interventions (Naylor et al., 2010; Dollahite et al., 1998).

Findings demonstrated that teachers who have more experience teaching the curriculum, and have taught it for a longer period of time have a more positive view on the quality of content of the curriculum, its delivery and the level of support provided. The amount of training provided to teachers in the early years of the curriculum implementation, and the availability of resources and tools necessary for teaching the curriculum might be the main factors contributing to these results. Additionally, throughout the developmental stages of the curriculum, authors were using feedback from the teachers to refine the curriculum; teachers who were involved in this process had a more positive view on the quality of contents. This is in agreement with findings that engaging teachers throughout the developmental stages can lead to a higher level of support for the interventions (Mathews et al., 2010).

Moreover, open-ended questions assisted to reveal teachers' opinions on the curriculum. The teachers found the information that was provided in the curriculum on the human body, diabetes, lifestyle and fitness helpful, and they were appreciative of the prepared lessons. Nevertheless, many of the teachers felt that the materials are not age appropriate and student friendly. They believed that the lessons were outdated and repetitive, resources were limited, and the lessons were difficult to be integrated into other subject areas. The main concerns were the length of the lessons, and the lack of sufficient time to deliver the lessons. These findings further confirmed some of the barriers of the KMHC curriculum originally identified by Cargo et al., in 2006.

5.3 VIEWS ON THE HEALTH EDUCATION CURRICULUM

5.3.1 Perceived Barriers of the Curriculum

Following semi-structured interviews with the elementary schools principals, as well as talking circles with curriculum authors, teachers, and parents the barriers and facilitators of the health education curriculum were explored. The reported barriers included the lack of administrative and training support for teachers

delivering the curriculum. One of the leading factors in promoting the success primary prevention programs is the support offered from the school administrators (Yates et al., 2009). Moreover, the involvement of the two elementary schools with other programs such as the new mathematics program, safety programs, and changes associated within each school such as instruction of different languages restricted the support that could be provided for administering the health education curriculum. The engagement of schools with other activities also limited the classroom time available for teachers to deliver the curriculum. Competing priorities within school has been previously identified as a barrier to the implementation of diabetes prevention programs (Stone et al., 2007). For example, in the HEALTHY study, which was a middle school-based primary prevention trial, a major barrier to implementation was the conflict between health promotion activities versus the regular academic curriculum that was preparing students for standardized tests (Hirst et al., 2009). According to the participants' perceptions, the reported length of the lessons, which is 45 minutes, underestimates the actual time that is required to teach each lesson. The lack of teachers' time and the difficulties associated with fitting health related lessons into their teaching schedules is often found to be one of the main barriers for implementing diabetes prevention programs in schools (Dollahite et al., 1998; Naylor et al., 2010; Rosecrans et al., 2008).

The difference in organizational structures of the schools was identified as both a facilitator and a barrier. One of the elementary schools has two assigned teachers that are specialized in teaching the health education curriculum, and safety materials while in the other school the homeroom teachers are applied this role. Having homeroom teachers delivering the curriculum was perceived as a barrier due to the lack of time for the teachers to teach the health education curriculum contents in light of their other responsibilities. As a result, homeroom teachers incorporated some of the lessons into their regular academic curriculum; however, certain components of the curriculum contents could not be easily integrated due to their irrelevancy with other academic subjects. The challenges with some of the other school-based primary prevention programs evaluated in the literature were

also teacher's unwillingness to teach new subject matter and to integrate the intended activities into their school curriculum (Mathews et al., 2010). Furthermore, participants elaborated on the lack of resources available for teaching the curriculum content. The health education curriculum includes activities that would help students' understanding on the different components of the curriculum including the physical activity, diabetes, and nutrition.

In 1994, a toolbox was prepared by the curriculum authors for each of the elementary schools, which included a set of equipment necessary for performing the activities. Nevertheless, participants have reported that the toolbox is no longer available, thus significantly limiting the number of activities that could be conducted. Other studies have also declared limitation of resources as one of the barriers. In the Schools Acting in Leicester Against Diabetes (SALAD) program implemented in some schools of United Kingdom, for example, the major barrier identified was limitation of resources and teaching tools (Khunti et al., 2008).

Participants have shown concerns regarding the language of the curriculum, and the Kanien'kehá:ka (Mohawk) cultural representation of the materials. The official language of the health education curriculum is English, and it was later translated into Mohawk. Nevertheless, teachers in the Kanien'kehá:ka immersion school felt that some of the terminologies were not appropriately translated; hence making the delivery of the curriculum dependent on teacher's translation. As for the cultural representation of the curriculum materials, several participants have reported the insufficiency of incorporation of the Kanien'kehá:ka culture while others did not perceive this issue as a barrier. Some of the main barriers reported were based on the curriculum content and its appropriateness. Most of the participants believe that the content is outdated and repetitive. It was reported that the contents are extremely similar between different grades, thus significantly reducing students' engagement in learning the concepts and performing the activities.

Another major barrier reported in this study was the lack of parents' awareness on diabetes prevention. The participants reported that focusing on only children

while not educating parents could decrease the effectiveness of a diabetes prevention program. In another study examining a diabetes prevention program, one of the barriers reported was also the challenge of conveying the information on healthy eating and physical activity to the parents (Mathews et al., 2010). Educating parents and children together has a reinforcing effect on the positive health outcomes (McKenzie et al., 1998). The lifestyle choices that parents or guardians make influences to varying degrees the health behaviour of children, thus having the information being lost between school and home was known to be a contributor to the reduction of the impact of a diabetes prevention program on children's health behaviour.

5.3.2 Perceived Facilitators of the Curriculum

The main facilitators of the health education curriculum that identified in this study included the importance of the content, the well-established presence of KSDPP in the community, and the prepared lessons as guidelines. The majority of the participants have acknowledged the importance of educating children on diabetes prevention strategies and a healthy lifestyle. They believed that this knowledge could assist children in making better health decisions as adults. The fact that a curriculum was developed for teachers with prepared lessons and appropriate guidelines was also perceived as a facilitator.

In terms of the organizational structure of the schools, in the elementary school with specialized health teachers, more time was allocated for health education, thus increasing the curriculum delivery rate. Please refer to Appendix 9 for a list of the barriers and the facilitators of the health education curriculum.

5.3.2 Recommendations for Revising/Renewing the Curriculum

In this study, recommendations for changes to the curriculum were provided by teachers, parents, school principals, and curriculum authors in regards to the content, environmental, cultural and technological aspects of the curriculum. Participants believed that more administrative support such as training, and professional development workshops for teachers were needed. It was

recommended that KSDPP engage the community through health promotion and diabetes prevention education to revive the awareness of the goals of the health education curriculum. Other studies have also shown that community support is essential for the success of primary prevention programs (Bell 2011; Yates et al., 2009; Feather et al., 1993). In fact, based on the community organizational theory, community involvement in research projects addressing lifestyles changes related to health leads to empowerment of the community, access to, control of and ownership of the community throughout the process of behavioural change (Braithwaite et al., 1989). Participants also believed that since parents have responsibilities towards their children such as providing food and teaching lifestyle habits, parental education on diabetes and its prevention strategies are deemed necessary. Previous studies have also reported on the importance of parental engagement in school health promotion campaigns, and its effect on the positive health outcomes (Hirst et al., 2009; McKenzie et al., 1998). Parents and guardians can be educated by providing them pamphlets and information sheets on important facts on diabetes, and its prevention strategies. Providing parents with guides on healthy food alternatives, and lifestyle habits is identified to enhance parental engagement in diabetes prevention programs. In a randomized controlled trial of a diabetes prevention program, a family program was also developed besides the classroom curriculum, which highly encouraged parents to adopt healthy behaviours (Caballero et al., 2003; Steckler et al., 2003).

Finally, having financial resources to hire more special health teachers, and having teachers' engagement in revising the health education curriculum are highly recommended by the participants. This will allow teachers to take more control over the curriculum designing lessons that are feasible and appropriate to teach as well as to develop a sense of ownership of the diabetes prevention program. Other investigators have also reported that involving teachers in the formative stages of a curriculum is essential to build capacities, develop collaborative partnerships to support interventions and to increase the likelihood of the sustainability of a curriculum (Mathews et al., 2010).

In terms of the school environment, it was recommended to have more outdoor activities for students as part of the curriculum activities. This would help students to better understand the information learned in classrooms on diabetes prevention and to link them with real life activities. Moreover, having special health teachers assigned to teach the health education curriculum was suggested. These teachers would have sufficient time to ensure that all the lesson materials are covered, and the information is clearly disseminated to students and parents. This would increase the effectiveness and efficiency of the diabetes prevention curriculum.

The content of the curriculum needs to be upgraded, becoming less repetitive and shorter by eliminating some of the complex topics on diabetes mechanisms. The use of technological tools for developing more interactive, colorful, and interesting activities, worksheets, and diagrams was highly recommended. Other programs targeted at children such as the Hearth Healthy reported that having interactive presentations and activities contributed to its success (Yates et al., 2009). It was suggested that storage of resources and the curriculum on compact disc would be an effective approach to increase accessibility and availability of necessary teaching materials.

The cultural appropriateness of the curriculum was suggested to be enhanced by incorporating more Kanien'kéha language, activities, and linking the health education curriculum with the Kanien'kehá:ka identity of being healthy physically, mentally, spiritually and emotionally. Previous studies have shown that dietary changes from traditional unprocessed foods to high-calorie processed foods have been one of the contributors to the high rates of diabetes among Indigenous communities (CDA 2008; Assembly of First Nations 2006; Bell-Sheeter 2004). Thus, increasing student's knowledge on traditional foods marks a step towards diabetes prevention in Indigenous communities.

Teaching the history of diabetes among Indigenous communities could make the curriculum content more relevant for Indigenous elementary students. Another recommendation suggested by the study participants was the possibility of developing a comprehensive health education program for Kahnawake, which

would include all aspects of health and safety alongside diabetes prevention. Please refer to appendix 10 for the list of recommendations.

5.4 LIMITATIONS

One of the limitations of this study is that the Kateri Memorial Hospital Center health education curriculum has been designed, and implemented in only two elementary schools in an Indigenous setting; hence the findings may not be generalizable to other elementary schools. Nevertheless, beside the culturally relevant curriculum content, other sections of the curriculum are deemed appropriate to be taught in non-Indigenous settings. Therefore, identifying the barriers and facilitators of a diabetes prevention health education curriculum was essential in obtaining an in depth understanding of the challenges faced with the implementation of a long-term curriculum. The findings can be used to develop long-term curricula on diabetes prevention for elementary schools in other settings.

Another limitation of this study was the small sample size of the questionnaire did not allow any statistical inference or prediction. This restriction in sample size that we were aware of a priori was mitigated by the use of the descriptive results to develop relevant questions and selection of the teachers for the talking circles. Furthermore, it was not possible to assess the perspective of students on the health education curriculum due to the fact that students were exposed to varying degrees to the curriculum contents, and the contents taught to them were mostly integrated into their academic curriculum leaving them with no knowledge on the specific details of the KMHC curriculum. However, the perspective of students should be taken into account throughout the revision of the curriculum. This study was also limited in the selection of parents participating in the parents' talking circle. In fact, only parents who wanted to provide their insights on the health education curriculum participated in this study, thus participation bias might have resulted. Nonetheless, in order to reduce this type of bias, the number of parents representing each school was approximately equal, and the parents were actively involved in their children's life.

5.5 FUTURE DIRECTIONS

After the dissemination of findings to the community, community members along with Kahnawake Schools Diabetes Prevention Project, Kahnawake Education Center, and the Kateri Memorial Hospital Center will decide upon the revision of the existing curriculum or the development of a new one. Recommendations identified in this study will be taken into account for the new version of the curriculum, and teachers would be more engaged in the formative stages. In addition, other future plans involve an evaluation of the impact of the curriculum, and other KSDPP interventions on health outcomes of community members including elementary school children.

6.0 CONCLUSION

This study explored the barriers and facilitators of a diabetes prevention health education curriculum through the perspectives of the curriculum authors, teachers, school principals and parents. The findings have shown that in order for diabetes prevention curriculum to be effectively delivered in elementary schools changes must be prioritized, developed and implemented. These modifications include updating the curriculum content as well as the supporting resources for teachers, re-implementing some type of reporting mechanism from teachers to administration, assigning specific teachers to teach the curriculum, making the curriculum more interactive and enjoyable for students by incorporating new technological systems (i.e. interactive computer programming), and providing more training opportunities for teachers. Additionally, allocating sufficient time for health education in schools, making lessons shorter, integrating the curriculum lessons into other subjects, and motivating teachers to take part in updating the curriculum would increase the implementation rate of a diabetes prevention curriculum.

Other critical action to an effective health education curriculum is to encourage community members to be more involved with Kahnawake School Diabetes Prevention Project and other diabetes prevention organizations. This also entails engaging parents to participate in the development and implementation of such curricula by providing them sufficient information on diabetes and its prevention strategies. Enhancing existing family and community wide interventions to increase parental awareness on diabetes could build capacities and affect their decision-making abilities on healthy behaviours, which would significantly influence the outcomes of diabetes prevention programs.

Overall, even though the barriers reported exceed the number of facilitators, all groups of participants believed in the importance of delivering a health education curriculum to elementary school children, and its impact on improving children's health behaviour and lifestyle habits. Nevertheless, a modification on delivery system as well as a commitment and support from the teachers and the education

center is recommended to revive the KMHC health education curriculum for diabetes prevention.

REFERENCES:

Absetz, P., Valve, R., Oldenburg, B., Heinonen, H., Nissinen, A., Fogelholm, M., ... & Uutela, A. (2007). Type 2 Diabetes Prevention in the "Real World" One-year results of the GOAL Implementation Trial. *Diabetes care*, *30*(10), 2465-2470.

Ackermann, R. T., Finch, E. A., Brizendine, E., Zhou, H., & Marrero, D. G. (2008). Translating the Diabetes prevention Program into the community: the DEPLOY Pilot Study. *American journal of preventive medicine*, *35*(4), 357-363.

Acton, K. J., Burrows, N. R., Moore, K., Querec, L., Geiss, L. S., & Engelgau, M. M. (2002). Trends in diabetes prevalence among American Indian and Alaska native children, adolescents, and young adults. *Journal Information*, *92*(9).

Amed, S., Daneman, D., Mahmud, F. H., & Hamilton, J. (2010). Type 2 diabetes in children and adolescents. *Expert review of cardiovascular therapy*, *8*(3), 393-406.

American Diabetes Association. (2006). Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care, 29, s43.*

American Diabetes Association National Institute of Diabetes and Digestive and Kidney Diseases (2004). *Diabetes Care, 27, s47*.

Amundson, H. A., Butcher, M. K., Gohdes, D., Hall, T. O., Harwell, T. S., Helgerson, S. D., & Vanderwood, K. K. (2009). Translating the Diabetes Prevention Program Into Practice in the General Community Findings From the Montana Cardiovascular Disease and Diabetes Prevention Program. *The Diabetes Educator*, *35*(2), 209-223.

Arslanian, S., & Suprasongsin, C. H. (1996). Insulin sensitivity, lipids, and body composition in childhood: is" syndrome X" present?. *Journal of Clinical Endocrinology & Metabolism*, *81*(3), 1058-1062.

Assembly of First Nations. (2006). A First Nations Diabetes Report Card 3.

Bachar, J. J., Lefler, L. J., Reed, L., McCoy, T., Bailey, R., & Bell, R. (2006). Cherokee Choices: a diabetes prevention program for American Indians. *Preventing chronic disease*, *3*(3).

Bandura, A. (1986). *Self-Efficacy: The Exercise of Control.* W. H. Freeman, New York.

Bell, R. A. (2011). Barriers to diabetes prevention and control among American Indians. *population*, *45*(51.0), 19-5.

Bell-Shetter, A. (2004). *Food sovereignty assessment tool*. First Nations Development Institute.

Bisset, S., Cargo, M., Delormier, T., Macaulay, A. C., & Potvin, L. (2004). Legitimizing diabetes as a community health issue: a case analysis of an Aboriginal community in Canada. Health Promotion International, 19(3), 317-326.

Biuso, T. J., Butterworth, S., & Linden, A. (2007). A conceptual framework for targeting prediabetes with lifestyle, clinical, and behavioural management interventions. *Disease Management*, *10*(1), 6-15.

Boston, P., Jordan, S., MacNamara, E., Kozolanka, K., Bobbish-Rondeau, E., Iserhoff, H., ... & Weapenicappo, J. (1997). Using participatory action research to understand the meanings aboriginal Canadians attribute to the rising incidence of diabetes. *Chronic Diseases in Canada*, *18*(1), 5-12.

Braithwaite, R. L., & Lythcott, N. (1989). Community empowerment as a strategy for health promotion for black and other minority populations. *JAMA: the journal of the American Medical Association*, *261*(2), 282-283.

Brown, B. D., Harris, K. J., Harris, J. L., Parker, M., Ricci, C., & Noonan, C. (2010). Translating the diabetes prevention program for Northern Plains Indian youth through community-based participatory research methods. *The Diabetes Educator*, *36*(6), 924-935.

Bryant, C. T., & Rocha-Goldberg, P. (2011). Community-Based Prevention and Control of Diabetes Among North Carolina Latinos. North Carolina Medical Journal, 72(5), 397.

Buchanan, T. A., Xiang, A. H., Peters, R. K., Kjos, S. L., Marroquin, A., Goico, J., ... & Azen, S. P. (2002). Preservation of pancreatic β-cell function and prevention of type 2 diabetes by pharmacological treatment of insulin resistance in high-risk Hispanic women. *Diabetes*, *51*(9), 2796-2803.

Caballero, B., Clay, T., Davis, S. M., Ethelbah, B., Rock, B. H., Lohman, T., ... & Stevens, J. (2003). Pathways: a school-based, randomized controlled trial for the prevention of obesity in American Indian schoolchildren. *The American journal of clinical nutrition*, *78*(5), 1030-1038.

Canadian Diabetes Association. (2012, October). Retrieved from http://www.diabetes.ca/diabetes- and-you/what/prevalence/.

Cardon, G. M., Haerens, L. L., Verstraete, S., & De Bourdeaudhuij, I. (2009). Perceptions of a school-based self-management program promoting an active lifestyle among elementary schoolchildren, teachers, and parents. *Journal of Teaching in Physical Education*, *28*(2), 141-154.

Cardona-Morrell, M., Rychetnik, L., Morrell, S., Espinel, P., & Bauman, A. (2010). Reduction of diabetes risk in routine clinical practice: are physical activity and nutrition interventions feasible and are the outcomes from reference trials replicable? A systematic review and meta-analysis. *BMC public health*, *10*(1), 653.

Cargo, M., Lévesque, L., Macaulay, A. C., McComber, A., Desrosiers, S., Delormier, T., & Potvin, L. (2003). Community governance of the kahnawake schools diabetes prevention project, kahnawake territory, Mohawk nation, Canada. *Health Promotion International*, *18*(3), 177-187.

Cargo, M., Salsberg, J., Delormier, T., Desrosiers, S., & Macaulay, A. C. (2006). Understanding the social context of school health promotion program implementation. Health Education, 106(2), 85-97.

Carrel, A., Meinen, A., Garry, C., & Storandt, R. (2005). Effects of nutrition education and exercise in obese children: the Ho-Chunk Youth Fitness Program. *WMJ-MADISON-*, *104*(5), 44.

Cartwright, E., Schow, D., Herrera, S., Lora, Y., Mendez, M., Mitchell, D., ... & Trejo, A. (2006). Using participatory research to build an effective type 2 diabetes intervention: The process of advocacy among female Hispanic farmworkers and their families in southeast Idaho. *Women & Health*, *43*(4), 89-109.

Chiasson, J. L., Josse, R. G., Gomis, R., Hanefeld, M., Karasik, A., & Laakso, M. (2002). Acarbose for prevention of type 2 diabetes mellitus: the STOP-NIDDM randomised trial. Lancet, 359(9323), 2072.

Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada. (2008). *Canadian Diabetes Association*. S187.

Colagiuri, R., Fitzgerald, R., Furlong, D., Huot, C., Keeley, M., Krueger, H., Robinson, A., Silverberg, J., Turner, C. (2011). Diabetes: Canada at the Tipping Point Charting a New Path. *Canadian Diabetes Association*.

Cotton, B., Smith, A., Hansen, I., Davis, C., Doyle, A., & Walsh, A. (2006). Physician-directed primary care intervention to reduce risk factors for type 2 diabetes in high-risk youth. The American journal of the medical sciences, 332(3), 108-111.

Dabelea, D., Hanson, R. L., Bennett, P. H., Roumain, J., Knowler, W. C., & Pettitt, D. J. (1998). Increasing prevalence of type II diabetes in American Indian children. *Diabetologia*, *41*(8), 904-910.

Davidson, M. R. (2004). Establishing prevention, education and community awareness through a comprehensive diabetes, hypertension and hypercholesterolaemia screening programme: The Smith Island, Maryland, USA experience. International journal of nursing practice, 10(5), 242-246.

Davidson, M., Boland, E. A., & Grey, M. (1997). Teaching Teens to Cope: Coping Skills Training for Adolescents With Insulin-Dependent Diabetes Mellitus. Journal for Specialists in Pediatric Nursing, 2(2), 65-72.

Davis-Smith, Y. M., Davis-Smith, M., Boltri, J. M., Seale, J. P., Shellenberger, S., Blalock, T., & Tobin, B. (2007). Implementing a diabetes prevention program in a rural African-American church. Journal of the National Medical Association, 99(4), 440.

Dean, H. (1998). NIDDM-Y in First Nation children in Canada. *Clinical pediatrics*, *37*(2), 89-96.

Dean, H. J., Mundy, R. L., & Moffatt, M. (1992). Non-insulin-dependent diabetes mellitus in Indian children in Manitoba. *CMAJ: Canadian Medical Association Journal*, *147*(1), 52.

Dean, H. J., Young, T. K., Flett, B., & Wood-Steiman, P. (1998). Screening for type-2 diabetes in aboriginal children in northern Canada. *The Lancet*, *352*(9139), 1523-1524.

Lifshitz, F., & Hall, J. G. (2002). Reduction in the incidence of type II diabetes with lifestyle intervention or metformin. *J Med*, *346*, 393-403.

Diabetes Report 2005*: The Serious Face of Diabetes in Canada.*

.

Dietitians of Canada. The Media and the Message - Promoting Healthy Eating and Active Living for Diabetes Prevention. (2001). A proposal submitted to Health Canada. Toronto: *Canadian Diabetes Strategy*.

Ditmyer, M. M., Price, J. H., Telljohann, S. K., & Rogalski, F. (2003). Pediatricians' perceptions and practices regarding prevention and treatment of type 2 diabetes mellitus in children and adolescents. Archives of pediatrics & adolescent medicine, 157(9), 913.

Dollahite, J., Hosig, K. W., Adeletti White, K., Rodibaugh, R., & Holmes, T. M. (1998). Impact of a school-based community intervention program on nutrition knowledge and food choices in elementary school children in the rural Arkansas delta. *Journal of Nutrition Education*, *30*(5), 289-301.

Shoback, D.(2011). *Dolores Greenspan's basic & clinical endocrinology* (9th ed.) Chapter 17. New York: McGraw-Hill Medical.

Edwards, K. K., & Patchell, B. (2009). State of the science: A cultural view of Native Americans and diabetes prevention. *Journal of cultural diversity*, *16*(1), 32.

Elliot, D. L., Goldberg, L., Moe, E. L., DeFrancesco, C. A., Durham, M. B., & Hix-Small, H. (2004). Preventing substance use and disordered eating: initial outcomes of the ATHENA (Athletes Targeting Healthy Exercise and Nutrition Alternatives) program. Archives of pediatrics & adolescent medicine, 158(11), 1043.

Faridi, Z., Shuval, K., Njike, V. Y., Katz, J. A., Jennings, G., Williams, M., & Katz, D. L. (2010). Partners reducing effects of diabetes (PREDICT): a diabetes prevention physical activity and dietary intervention through African-American churches. *Health education research*, *25*(2), 306-315.

Feather, J., Irvine, J., Belanger, B., Dumais, W., Gladue, R., Isbister, W., & Leach, P. (1993). Promoting social health in northern Saskatchewan. *Canadian journal of public health. Revue canadienne de santé publique*, *84*(4), 250.

Feskens, E. J. (1992). Nutritional factors and the etiology of non-insulin-dependent diabetes mellitus: an epidemiological overview. *World review of nutrition and dietetics*, *69*, 1.

Fleischhacker, S., Vu, M., Ries, A., & McPhail, A. (2011). Engaging tribal leaders in an American Indian healthy eating project through modified talking circles. *Family & Community Health*, *34*(3), 202-210.

Gerstein, H. C. (1997). Glucose: a continuous risk factor for cardiovascular disease. *Diabetic medicine*, *14*(S3), S25-S31.

Gillis, B., Mobley, C., Stadler, D. D., Hartstein, J., Virus, A., & Volpe, S. L. (2009). Rationale, design and methods of the HEALTHY study nutrition intervention component. *International Journal of Obesity*, *33*, S29-S36.

Goldberg, L., MacKinnon, D. P., Elliot, D. L., Moe, E. L., Clarke, G., & Cheong, J. (2000). The adolescents training and learning to avoid steroids program: preventing drug use and promoting health behaviours. *Archives of pediatrics & adolescent medicine*, *154*(4), 332.

Goodman, E., & Whitaker, R. C. (2002). A prospective study of the role of depression in the development and persistence of adolescent obesity. *Pediatrics*, *110*(3), 497-504.

Gottfredson, D. C., & Wilson, D. B. (2003). Characteristics of effective school-based substance abuse prevention. *Prevention Science*, *4*(1), 27-38.

Grey, M., Berry, D., Davidson, M., Galasso, P., Gustafson, E., & Melkus, G. (2004). Preliminary Testing of a Program to Prevent Type 2 Diabetes Among High‐Risk Youth. Journal of School Health, 74(1), 10-15.

Grey, M., Jaser, S. S., Holl, M. G., Jefferson, V., Dziura, J., & Northrup, V. (2009). A multifaceted school-based intervention to reduce risk for type 2 diabetes in at-risk youth. *Preventive medicine*, *49*(2), 122-128.

Haffner, S. M., Hazuda, H. P., Mitchell, B. D., Patterson, J. K., & Stern, M. P. (1991). Increased incidence of type II diabetes mellitus in Mexican Americans. *Diabetes Care*, *14*(2), 102-108.

Hagey, R. (1989). The native diabetes program: rhetorical process and praxis. *Medical Anthropology*, *12*(1), 7-33.

Harris, S. B., Perkins, B. A., & Whalen-Brough, E. (1996). Non-insulin-dependent diabetes mellitus among First Nations children. New entity among First Nations people of north western Ontario. *Canadian Family Physician*, *42*, 869.

Harris, S. B., Gittelsohn, J., Hanley, A., Barnie, A., Wolever, T. M., Gao, J., ... & Zinman, B. (1997). The prevalence of NIDDM and associated risk factors in native Canadians. *Diabetes Care*, *20*(2), 185-187.

Health Canada (2003, October). *Population Health Approach*. Retrieved fromhttp://www.hc-sc.gc.ca/hppb/phdd/ approach/index.html.

Helmink, J. H., Meis, J. J., de Weerdt, I., Visser, F. N., de Vries, N. K., & Kremers, S. P. (2010). Debate Development and implementation of a lifestyle intervention to promote physical activity and healthy diet in the Dutch general practice setting: the BeweegKuur programme. *International Journal of Behavioral Nutrition and Physical Activity, 7(49).*

Herman, W. H., Hoerger, T. J., Brandle, M., Hicks, K., Sorensen, S., Zhang, P., ... & Ratner, R. E. (2005). The cost-effectiveness of lifestyle modification or metformin in preventing type 2 diabetes in adults with impaired glucose tolerance. *Annals of Internal Medicine*, *142*(5), 323-332.

Hirst, K., Baranowski, T., DeBar, L., Foster, G. D., Kaufman, F., Kennel, P., ... & Yin, Z. (2009). HEALTHY study rationale, design and methods: moderating risk of type 2 diabetes in multi-ethnic middle school students. *International journal of obesity (2005)*, *33*, S4.

Holcomb, J. D., Lira, J., Kingery, P. M., Smith, D. W., Lane, D., & Goodway, J. (1998). Evaluation of Jump Into Action: A Program to Reduce the Risk of Non-Insulin Dependent Diabetes Mellitus in School Children on the Texas-Mexico Border. *Journal of school health*, *68*(7), 282-286.

Hosig, K., Dollahite, J., Rodibaugh, R., & Adeletti White, K. (1998). Development and Evaluation of a Consortium to Support a School-based Community Nutrition Education Program in the Rural Arkansas Delta. *Journal of Nutrition Education*, *30*(5), 281-288.

Hu, G., Lindstrom, J., Valle, T. T., Eriksson, J. G., Jousilahti, P., Silventoinen, K., ... & Tuomilehto, J. (2004). Physical activity, body mass index, and risk of type 2 diabetes in patients with normal or impaired glucose regulation. *Archives of Internal Medicine*, *164*(8), 892.

Hu, G., Qiao, Q., Silventoinen, K., Eriksson, J. G., Jousilahti, P., Lindström, J., ... & Tuomilehto, J. (2003). Occupational, commuting, and leisure-time physical activity in relation to risk for type 2 diabetes in middle-aged Finnish men and women. *Diabetologia*, *46*(3), 322-329.

Huang, T. T. K., & Goran, M. I. (2003). Prevention of type 2 diabetes in young people: a theoretical perspective. *Pediatric diabetes*, *4*(1), 38-56.

International Diabetes Federation. (2009). *IDF Diabetes Atlas.* 4th ed. Brussels, Belgium.

Lindström, J., Absetz, P., Hemiö, K., Peltomäki, P., & Peltonen, M. (2010). Reducing the risk of type 2 diabetes with nutrition and physical activity–efficacy and implementation of lifestyle interventions in Finland. *Public health nutrition*, *13*(6), 993.

Jackson, M. Y. (1993). Height, weight, and body mass index of American Indian schoolchildren, 1990–1991. *Journal of the American Dietetic Association*, *93*(10), 1136-1140.

Jimenez, M. M., Receveur, O., Trifonopoulos, M., Kuhnlein, H., Paradis, G., & Macaulay, A. C. (2003). Comparison of the dietary intakes of two different groups of children (grades 4 to 6) before and after the Kahnawake Schools Diabetes Prevention Project. *Journal of the American Dietetic Association*, *103*(9), 1191-1194.

Kattelmann, K. K., Conti, K., & Ren, C. (2010). The medicine wheel nutrition intervention: a diabetes education study with the Cheyenne River Sioux Tribe. *Journal of the American Dietetic Association*, *110*(5), S44-S51.

Keenan, P. S. (2009). Smoking and weight change after new health diagnoses in older adults. *Archives of internal medicine*, *169*(3), 237.

Keoke, ED, Porterfield, KM. (2003). *American Indian Contributions to the World: Fifteen Thousand Years of Inventions.* Checkmark Books.

Khunti, K., Stone, M. A., Bankart, J., Sinfield, P., Pancholi, A., Walker, S., ... & Davies, M. J. (2008). Primary prevention of type-2 diabetes and heart disease: action research in secondary schools serving an ethnically diverse UK population. *Journal of public health*, *30*(1), 30-37.

Knowler, W. C., Barrett-Connor, E., & Fowler, S. E. (2002). The Diabetes Prevention Program Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med 346,*.393-403.

Kriska, A. M., Edelstein, S. L., Hamman, R. F., Otto, A., Bray, G. A., Mayer-Davis, E. J., ... & Regensteiner, J. G. (2006). Physical activity in individuals at risk for diabetes: Diabetes Prevention Program. *Medicine and science in sports and exercise*, *38*(5), 826.

Laatikainen, T., Dunbar, J. A., Chapman, A., Kilkkinen, A., Vartiainen, E., Heistaro, S., ... & Janus, E. D. (2007). Prevention of type 2 diabetes by lifestyle intervention in an Australian primary health care setting: Greater Green Triangle (GGT) Diabetes Prevention Project. *BMC public health*, *7*(1), 249.

Lalonde, J., Jeambey, Z., & Starkey, L. J. (2007). Media Training for Diabetes Prevention: A Participatory Evaluation. *Canadian Journal of Dietetic Practice and Research*, *68*(3), 132-136.

Lee, E., Anderson, P. S., Bryan, J., Bahr, C., Coniglione, T., & Cleves, M. (1985). Diabetes, parental diabetes, and obesity in Oklahoma Indians. *Diabetes Care*, *8*(2), 107-113.

LeMaster, P. L., & Connell, C. M. (1994). Health education interventions among Native Americans: A review and analysis. *Health Education & Behaviour*, *21*(4), 521-538.

Liao, Y., Bang, D., Cosgrove, S., Dulin, R., Harris, Z., Taylor, A., ... & Giles, W. (2011). Surveillance of health status in minority communities-Racial and Ethnic Approaches to Community Health Across the US (REACH US) Risk Factor Survey, United States, 2009. *MMWR. Surveillance summaries: Morbidity and mortality weekly report. Surveillance summaries/CDC*, *60*(6), 1-44.

Lindström, J., Peltonen, M., Eriksson, J. G., Louheranta, A., Fogelholm, M., Uusitupa, M., & Tuomilehto, J. (2006). High-fibre, low-fat diet predicts long-term weight loss and decreased type 2 diabetes risk: the Finnish Diabetes Prevention Study. *Diabetologia*, *49*(5), 912-920.

Linmans, J. J., Spigt, M. G., Deneer, L., Lucas, A. E., de Bakker, M., Gidding, L. G., ... & Knottnerus, J. A. (2011). Effect of lifestyle intervention for people with diabetes or prediabetes in real-world primary care: propensity score analysis. *BMC family practice*, *12*(1), 95.

Ludwig, D. S., & Ebbeling, C. B. (2001). Type 2 diabetes mellitus in children. *JAMA: the journal of the American Medical Association*, *286*(12), 1427-1430.

Luttikhuis, H.O., Baur, L., Jansen, H., Shrewsbury, V. A., O'Malley, C., Stolk, R. P., & Summerbell, C. D. (2009). Interventions for treating obesity in children. *Cochrane Database Syst Rev*, *1*(1).

Macaulay A. (1991). *University-Community Collaboration in Primary Care Research*. In: MJ Bass, EV Dunn, PG Norton, M Stewart, F Tudiver, editors. Conducting Research in the Practice Setting. Thousand Oaks: Sage Publications.

Macaulay, A. C., Paradis, G., Potvin, L., Cross, E. J., Saad-Haddad, C., McComber, A., ... & Rivard, M. (1997). The Kahnawake Schools Diabetes Prevention Project: intervention, evaluation, and baseline results of a diabetes primary prevention program with a native community in Canada. *Preventive Medicine*, *26*(6), 779-790.

Macaulay, A. C., Commanda, L. E., Freeman, W. L., Gibson, N., McCabe, M. L., Robbins, C. M., & Twohig, P. L. (1999). Participatory research maximises community and lay involvement. *BMJ: British Medical Journal*, *319*(7212), 774-778.

Marcoux, M. F., Sallis, J. F., McKenzie, T. L., Marshall, S., Armstrong, C. A., & Goggin, K. J. (1999). Process evaluation of a physical activity self-management program for children: SPARK. *Psychology and Health*, *14*(4), 659-677.

Marlow, E., Melkus, G. D. E., & Bosma, A. M. (1998). STOP diabetes! An educational model for Native American adolescents in the prevention of diabetes. *The Diabetes Educator*, *24*(4), 441-450.

Mathews, L. B., Moodie, M. M., Simmons, A. M., & Swinburn, B. A. (2010). The process evaluation of It's Your Move!, an Australian adolescent community-based obesity prevention project. *BMC public health*, *10*(1), 448.

Mau, M. K., Kaholokula, J. K. A., West, M. R., Leake, A., Efird, J. T., Rose, C., ... & Gomes, H. (2010). Translating diabetes prevention into native Hawaiian and Pacific Islander communities: the PILI 'Ohana Pilot project. *Progress in community health partnerships: research, education, and action*, *4*(1), 7.

Mauvais-Jarvis, F., & Kahn, C. R. (2000). Understanding the pathogenesis and treatment of insulin resistance and type 2 diabetes mellitus: what can we learn from transgenic and knockout mice?. *Diabetes & metabolism*, *26*(6), 433-448.

McKenzie, S. B., O'Connell, J., Smith, L. A., & Ottinger, W. E. (1998). A primary intervention program (pilot study) for Mexican American children at risk for type 2 diabetes. *The Diabetes Educator*, *24*(2), 180-187.

McMurray, R. G., Bassin, S., Jago, R., Bruecker, S., Moe, E. L., Murray, T., ... & Volpe, S. L. (2009). Rationale, design and methods of the HEALTHY study physical education intervention component. *International Journal of Obesity*, *33*, S37-S43.

Mellanby, A. R., Rees, J. B., & Tripp, J. H. (2000). Peer-led and adult-led school health education: a critical review of available comparative research. *Health education research*, *15*(5), 533-545.

Mock, J., Nguyen, T., Nguyen, K. H., Bui-Tong, N., & McPhee, S. J. (2006). Processes and capacity-building benefits of lay health worker outreach focused on preventing cervical cancer among Vietnamese. *Health Promotion Practice*, *7*(3 suppl), 223S-232S.

Montonen, J., Knekt, P., Järvinen, R., Aromaa, A., & Reunanen, A. (2003). Whole-grain and fiber intake and the incidence of type 2 diabetes. *The American journal of clinical nutrition*, *77*(3), 622-629.

Montour, L. T., Macaulay, A. C., & Adelson, N. (1989). Diabetes mellitus in Mohawks of Kahnawake, PQ: a clinical and epidemiologic description. *CMAJ: Canadian Medical Association Journal*, *141*(6), 549-552.

Montour, L. T., & Macaulay, A. C. (1985). High prevalence rates of diabetes mellitus and hypertension on a North American Indian reservation. *Canadian Medical Association Journal*, *132*(10), 1110-1112.

Montour, L. T., & Macaulay, A. C. (1988). Diabetes mellitus and atherosclerosis: returning research results to the Mohawk community. *CMAJ: Canadian Medical Association Journal*, *139*(3), 201-202.

National Diabetes Information Clearinghouse National Diabetes Statistics—Fact Sheet. (2012, October). Retrieved from http://diabetes-niddk.nih.gov/.

Naylor, P. J., Scott, J., Drummond, J., Bridgewater, L., McKay, H. A., & Panagiotopoulos, C. (2010). Implementing a whole school physical activity and healthy eating model in rural and remote First Nations schools: a process evaluation of Action Schools! BC. *Rural Remote Health*, *10*(2), 1296.

Newman, W. P., Hollevoet, J. J., & Frohlich, K. L. (1993). The diabetes project at Fort Totten, North Dakota, 1984–1988. *Diabetes care*, *16*(1), 361-363.

Pan, X. R., Li, G. W., Hu, Y. H., Wang, J. X., Yang, W. Y., An, Z. X., ... & Howard, B. V. (1997). Effects of diet and exercise in preventing NIDDM in people with impaired glucose tolerance: the Da Qing IGT and Diabetes Study. *Diabetes care*, *20*(4), 537-544.

Paradis, G., Lévesque, L., Macaulay, A. C., Cargo, M., McComber, A., Kirby, R., ... & Potvin, L. (2005). Impact of a diabetes prevention program on body size, physical activity, and diet among Kanien'kehá: ka (Mohawk) children 6 to 11 years old: 8-year results from the Kahnawake Schools Diabetes Prevention Project. *Pediatrics*, *115*(2), 333-339.

Picou, J. S. (2000). The "talking circle" as sociological practice: Cultural transformation of chronic disaster impacts. *Sociological Practice*, *2*(2), 77-97.

Potvin, L., Cargo, M., McComber, A. M., Delormier, T., & Macaulay, A. C. (2003). Implementing participatory intervention and research in communities:

lessons from the Kahnawake Schools Diabetes Prevention Project in Canada. *Social Science and Medicine*, *56*(6), 1295-1306.

Ramachandran, A., Snehalatha, C., Mary, S., Mukesh, B., Bhaskar, A. D., & Vijay, V. (2006). The Indian Diabetes Prevention Programme shows that lifestyle modification and metformin prevent type 2 diabetes in Asian Indian subjects with impaired glucose tolerance (IDPP-1). *Diabetologia*, *49*(2), 289-297.

Ratner, R. E., & Group, F. T. D. P. P. R. (2006). An update on the diabetes prevention program. *Endocrine Practice*, *12*, 20-24.

Dyck, R., Osgood, N., Lin, T. H., Gao, A., & Stang, M. R. (2010). Epidemiology of diabetes mellitus among First Nations and non-First Nations adults. *Canadian Medical Association Journal*, *182*(3), 249-256.

Rosecrans, A. M., Gittelsohn, J., Ho, L. S., Harris, S. B., Naqshbandi, M., & Sharma, S. (2008). Process evaluation of a multi-institutional community-based program for diabetes prevention among First Nations. *Health Education Research*, *23*(2), 272-286.

Rosenbaum, M., Nonas, C., Weil, R., Horlick, M., Fennoy, I., Vargas, I., & Kringas, P. (2007). School-based intervention acutely improves insulin sensitivity and decreases inflammatory markers and body fatness in junior high school students. *Journal of Clinical Endocrinology & Metabolism*, *92*(2), 504-508.

Rosenbloom, A. L., House, D. V., & Winter, W. E. (1998). Non-insulin dependent diabetes mellitus (NIDDM) in minority youth: research priorities and needs. *Clinical pediatrics*, *37*(2), 143-152.

Roubideaux, Y. D., Moore, K., Avery, C., Muneta, B., Knight, M., & Buchwald, D. (2000). Diabetes education materials: recommendations of tribal leaders, Indian health professionals, and American Indian community members. *The Diabetes Educator*, *26*(2), 290-294.

Saksvig, B. I., Gittelsohn, J., Harris, S. B., Hanley, A. J., Valente, T. W., & Zinman, B. (2005). A pilot school-based healthy eating and physical activity intervention improves diet, food knowledge, and self-efficacy for native Canadian children. *The Journal of nutrition*, *135*(10), 2392-2398.

Sallis, J. F., McKenzie, T. L., Alcaraz, J. E., Kolody, B., Faucette, N., & Hovell, M. F. (1997). The effects of a 2-year physical education program (SPARK) on physical activity and fitness in elementary school students. Sports, Play and Active Recreation for Kids. *American Journal of Public Health*, *87*(8), 1328-1334.

Satterfield, D. W., Volansky, M., Caspersen, C. J., Engelgau, M. M., Bowman, B. A., Gregg, E. W., ... & Vinicor, F. (2003). Community-based lifestyle interventions to prevent type 2 diabetes. *Diabetes Care*, *26*(9), 2643-2652.

Shaw, J. E., Sicree, R. A., & Zimmet, P. Z. (2010). Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes research and clinical practice*, *87*(1), 4-14.

Simmons, D., Fleming, C. E., Cutfield, R., Patel, A., Innes, J., & Wellingham, J. (1997). The Diabetes Care Support Service for general practitioners in Auckland. *The New Zealand medical journal*, *110*(1038), 48-50.

Simmons, D., Voyle, J., Swinburn, B., & O'Dea, K. (1997). Community- based Approaches for the Primary Prevention of Non- insulin- dependent Diabetes Mellitus. *Diabetic Medicine*, *14*(7), 519-526.

Steckler, A., Ethelbah, B., Martin, C. J., Stewart, D., Pardilla, M., Gittelsohn, J., ... & Vu, M. (2003). Pathways process evaluation results: a school-based prevention trial to promote healthful diet and physical activity in American Indian third, fourth, and fifth grade students. *Preventive medicine*, *37*(6 Pt 2), S80.

Stegmayer, P., Lovrien, F. C., Smith, M., Keller, T., & Gohdes, D. M. (1988). Nutrition Update Designing a Diabetes Nutrition Education Program for a Native American Community. *The Diabetes Educator*, *14*(1), 64-66.

Stewart, P., Douglas Consulting. (2005). *Building a national diabetes strategy: a strategic framework* (Vol. 2). Public Health Agency of Canada.

Stone, M. A., Bankart, J., Sinfield, P., Talbot, D., Farooqi, A., Davies, M. J., & Khunti, K. (2007). Dietary habits of young people attending secondary schools serving a multiethnic, inner-city community in the UK. *Postgraduate medical journal*, *83*(976), 115-119.

Story, M., Lytle, L. A., Birnbaum, A. S., & Perry, C. L. (2002). Peer- Led, School- Based Nutrition Education for Young Adolescents: Feasibility and Process Evaluation of the TEENS Study. *Journal of School Health*, *72*(3), 121-127.

Struthers, R., Hodge, F. S., Geishirt-Cantrell, B., & De Cora, L. (2003). Participant experiences of talking circles on type 2 diabetes in two northern plains american indian tribes. *Qualitative health research*, *13*(8), 1094-1115.

Sweat, V., Bruzzese, J. M., Albert, S., Pinero, D. J., Fierman, A., & Convit, A. (2012). The Banishing Obesity and Diabetes in Youth (BODY) Project: description and feasibility of a program to halt obesity-associated disease among urban high school students. *Journal of community health*, *37*(2), 365-371.

Szathmáry, E. J. (1994). Non-insulin dependent diabetes mellitus among aboriginal North Americans. *Annual Review of Anthropology*, 457-482.

Teufel, N. I., & Ritenbaugh, C. K. (1998). Development of a primary prevention program: insight gained in the Zuni Diabetes Prevention Program. *Clinical Pediatrics*, *37*(2), 131-141.

The Canadian Diabetes Association. (2012, October). Retrieved from http://www.diabetes.ca.

The Diabetes Prevention Program Research Group. (2000). The Diabetes Prevention Program: baseline characteristics of the randomized cohort. *Diabetes Care*, *23*(11), 1619-1629.

The Diabetes Prevention Research Group. (1999). The Diabetes Prevention Program: design and methods for a clinical trial in the prevention in type 2 diabetes. *Diabetes Care*, 22, 623–634.

Thompson, J. L., Allen, P., Helitzer, D. L., Qualls, C., Whyte, A. N., Wolfe, V. K., & Herman, C. J. (2008). Reducing diabetes risk in American Indian women. *American journal of preventive medicine*, *34*(3), 192-201.

Tuomilehto, J., Lindström, J., Eriksson, J. G., Valle, T. T., Hämäläinen, H., Ilanne-Parikka, P., ... & Uusitupa, M. (2001). Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *New England Journal of Medicine*, *344*(18), 1343-1350.

Villarejo, D., & Baron, S. L. (1999). The occupational health status of hired farm workers. *Occupational medicine (Philadelphia, Pa.)*, *14*(3), 613-635.

WHO, J., & Consultation, F. E. (2003). Diet, nutrition and the prevention of chronic diseases. *WHO technical report series*, *916*.

Yates, G., Cornish, W., Miller, J., & Friesen, C. L. (2009). Investing in heart-healthy children: a primary prevention innovation in Atlantic Canada. *Canadian journal of cardiovascular nursing,19*(1), 20-25.

Young, T. K., Martens, P. J., Taback, S. P., Sellers, E. A., Dean, H. J., Cheang, M., & Flett, B. (2002). Type 2 diabetes mellitus in children: prenatal and early infancy risk factors among native Canadians. *Archives of pediatrics & adolescent medicine*, *156*(7), 651.

APPENDIX 1: LITERATURE SEARCH STRATEGY

To review the relevant literature on type 2 diabetes prevention health education curricula a search strategy was designed to capture and identify all applicable articles relating to health education curricula and programs designed for school aged children, and the process evaluation of these programs. As the term "health education curriculum" can refer to a broad range of programs covering health related education such as obesity, safety, and first aid, we narrowed down the term to diabetes prevention. Furthermore, a search strategy was used to better capture potential synonyms for health education program. Additionally, since we were interested in learning about type 2 diabetes prevention programs developed for Indigenous communities, search strategy including all other synonyms for the word "Indigenous" was used.

The resulting search strategy (see Appendix 1.1) was used to search the following electronic databases: MEDLINE (1950 to October 2012), and PubMed (1950 to 2012). The ISI Web of Knowledge Journal was also consulted to extract relevant articles. Limits included English language papers, and human studies. This search was repeated in November 2010 to include newly published articles. The 2008 ISI Web of Knowledge Journal Citation Report was consulted to identify the top journals in the field of medical informatics, based on their impact factor. The Journal of Pediatrics was also hand-searched to identify any literature that had not been captured in the database search. Additionally, citation tracking or snowballing was used to identify additional references citing or cited by key articles and review papers through SCOPUS, and personal files were also included.

References were managed using Endnote X2 Reference Manager software. Only primary studies examining or evaluating diabetes prevention programs developed for children mainly in Indigenous communities were retained. Any articles examining type 2 diabetes and its complications at a biological and cellular level were excluded.

APPENDIX 1: LITERATURE SEARCH STRATEGY

Appendix 1.1: Search Strategy for Electronic Databases (October 2012)

1. Diabetes Mellitus, Type 2/pc [Prevention & Control]
2. Diabetes Mellitus, Type 2/
3. Primary Prevention/
4. 2 and 3
5. diabetes prevention program*.tw.
6. (diabetes adj2 type 2).tw.
7. prevent*.tw.
8. 6 and 7
9. 1 or 4 or 5 or 8
10. Health Education/
11. Health Promotion/
12. primary prevention/
13. health education.tw.
14. or/10-13
15. 9 and 14
16. limit 15 to "child (6 to 12 years)"
17. 10 or 13
18. 9 and 17
19. limit 18 to "child (6 to 12 years)"
20. educat*.tw.
21. 10 or 13 or 20
22. 9 and 21
23. limit 22 to "child (6 to 12 years)"

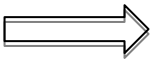
AND

1. Child/ or Health Education/ or Health Promotion/ or Curriculum/
2. Diabetes Mellitus, Type 2/co, dh, pc [Complications, Diet Therapy, Prevention & Control]
3. Questionnaires/ or Program Evaluation/ or Schools/ or Health Education/
4. 1 and 2 and 3
5. Inuits/ or Indians, North American/
6. Community-Based Participatory Research/ or Health Education/ or Primary Prevention/
7. 4 and 5 and 6

APPENDIX 2: STUDY DESIGN

Quantitative
Phase 1:

Method: Questionnaire (open ended & close ended)
Participants: Teachers
Data Collection: Kahnawake elementary schools (2)
Sample Size: 23
Data Analysis: Descriptive Statistics



Qualitative
Phase 2:

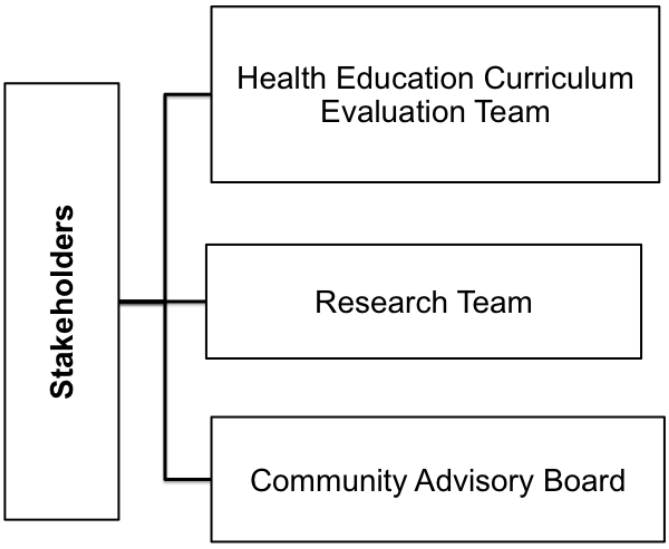
Method: Talking Circle
Participants: Teachers
Data Collection: Kahnawake elementary schools (2) → purposeful sampling
Sample Size: 4
Data Analysis: Thematic Textual Analysis

Qualitative
Phase 3:

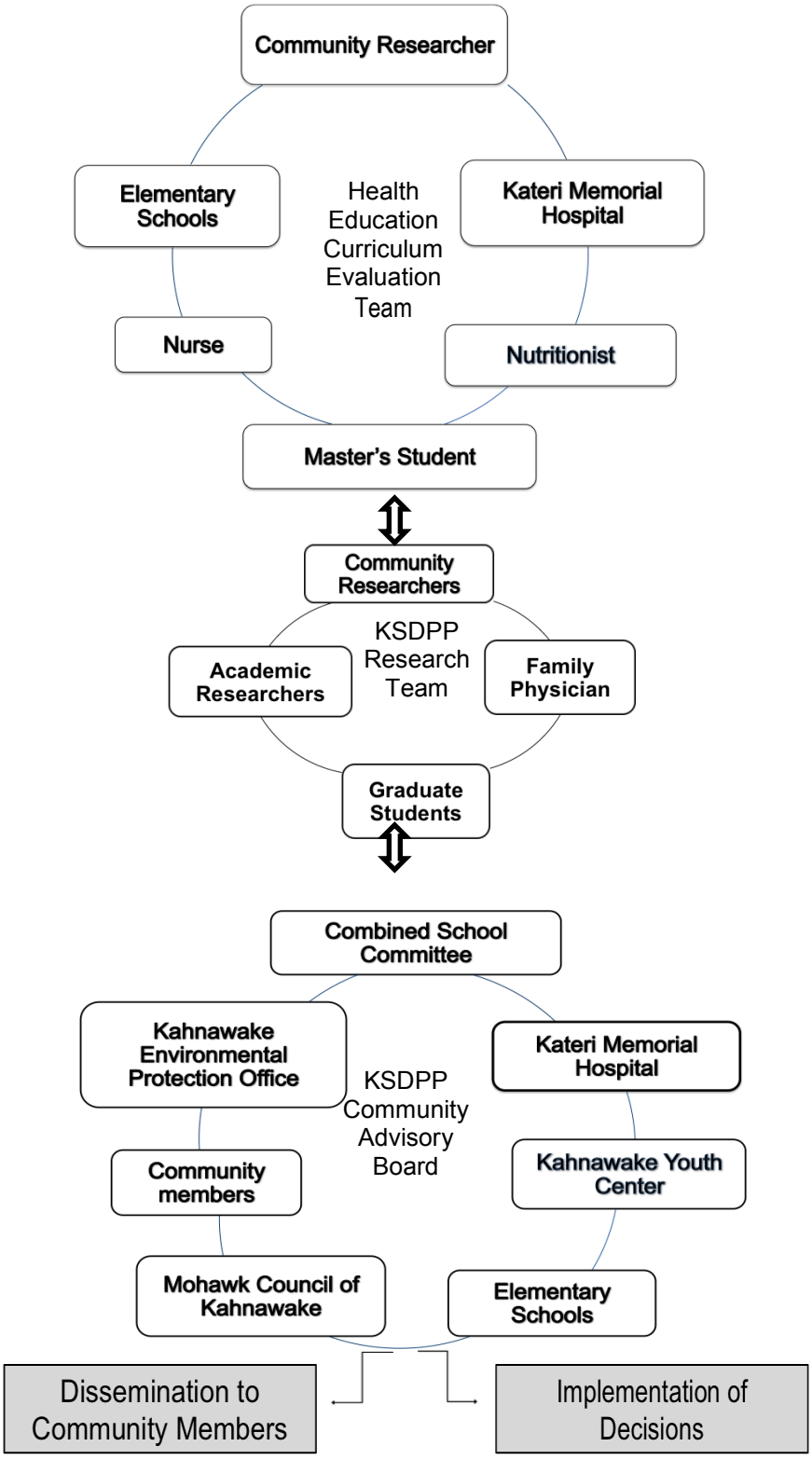
Method: Talking Circle **Participants:** Curriculum Authors **Data Collection:** Kateri Memorial Hospital → purposeful sampling **Sample Size:** 3 **Data Analysis:** Thematic Textual Analysis	**Method:** Semi-structured interview **Participants:** School Administrators **Data Collection:** Kahnawake elementary schools (2)→ All members **Sample Size:** 2 **Data Analysis:** Thematic Textual Analysis	**Method:** Talking Circle **Participants:** Parents **Data Collection:** Kahnawake elementary schools (2)→ random sampling **Sample Size:** 5 **Data Analysis:** Thematic Textual Analysis

APPENDIX 3: PARTICIPATORY APPROACH

The major stakeholders involved throughout this study were the health education curriculum evaluation team, the Kahnawake School of Diabetes Prevention Project (KSDPP) research team members and the KSDPP community advisory board. These stakeholders were involved throughout all stages of the project from the design of the questions and analysis plan to the dissemination of the findings. The involvement of these stakeholders with this project significantly enhanced the quality of the study, contextualizing the results, and making the findings more meaningful for the community of Kahnawake. In appendix 3.1, the decision making process of this study is outlined. The members of all the three main groups of stakeholders are identified. All the decisions regarding the different aspects of this study was first determined within the health education curriculum evaluation team, and then later discussed with KSDPP research team members, and once the decisions were confirmed by these two groups of stakeholders, it would go the KSDPP community advisory board (CAB). The KSDPP CAB members' approval was deemed necessary prior to implementing the decisions.



Appendix 3.1: Decision-Making Process of The Study



APPENDIX 4: CONSENT FORMS

Kahnawake Schools Diabetes Prevention Project (KSDPP)
Evaluation of Kateri Memorial Hospital Centre (KMHC) Health Education Program for Diabetes Prevention

INFORMATION LETTER

Greetings:

You are being asked to participate in a study evaluating the KMHC Health Education Program for Diabetes Prevention developed by two community nurses and a school nutritionist in collaboration with KSDPP and teachers at Kateri and Karonhianonhna School from 1994 to 1997. The study is being conducted by a team of researchers from KSDPP and is funded by the Aboriginal Diabetes Initiative Regional Evaluation & Innovation Fund.

We are evaluating the KMHC Health Education Program for Diabetes Prevention for the years 2010-2011, and 2011-2012. The project's objectives are to:

1. Identify the relevance and accuracy of the curriculum content for students at Kateri and Karionhianonhna School;
2. Identify the cultural appropriateness of the curriculum content and instructional methodology;
3. Identify successes and challenges of the curriculum implementation methods used by teachers to deliver the curriculum;
4. Identify and understand facilitators and barriers involved in delivering the curriculum;
5. Understand the effectiveness of the Health Education Program.

The outcome of this study will help us to develop recommendations for the revision of the Health Education Program and its implementation for the Kahnawake Education Center, KMHC and KSDPP.

We are: 1) having an initial talking circle with key people involved in the development of the Health Education Program; 2) administering a questionnaire to teachers who have taught the program in the last two school years; and 3) conducting a follow-up talking circle with interested teachers who delivered the Health Education Program within the last two years.

We may intend to publish the results of this research, but to protect the identity of participants, no names will be used in the publications and any identifying information will be disguised so that participants cannot be

identified. Your involvement in this study is entirely voluntary and you may withdraw from the study at any time. All of your responses will be kept strictly confidential. Interviews will be recorded, transcribed, and given a code number to ensure confidentiality. The tapes and the transcripts will be kept locked at KSDPP, under the supervision of the KSDPP Office Manager. Digital copies of digitally taped interviews and talking circles will be stored for a period of 5 years after completion of the study, after which time, the recordings will be deleted.

If you would like to participate in the study, please complete and return the attached consent form to the researcher. Thank you for your time and interest.

Respectfully,

KSDPP Project Coordinator

Kahnawake Schools Diabetes Prevention Project (KSDPP)
Evaluation of Kateri Memorial Hospital Centre (KMHC) Health Education Program for Diabetes Prevention

CONSENT FORM

Investigators: *Maedeh Khayyat Kholghi, McGill University*
Alex Otsehtokon McComber, Lead Investigator, KSDPP
Morgan Phillips, Project Coordinator, KSDPP
Dr. Ann Macaulay, Co-Investigator, CM MD FCFP

Purpose: This research is being conducted to gain a better understanding of how the KMHC Health Education for Diabetes Prevention has been implemented for the past two years (2009-2011), and to develop recommendations for the revision of the Health Education Program for the Kahnawake Education Center, KMHC and KSDPP.

Study Procedures: We are: 1) initially having a talking circle with key people involved in the development of the Health Education Program; 2) interviewing current Principals at both Kateri and Karonhianonhna schools; 3) administering a questionnaire to teachers who have taught the program in the last two school years; and 4) conducting a follow-up talking circle with interested teachers who delivered the Health Education Program within the last two years (2009-2010 and 2010-2011). Participation in this research will involve either: a 1-2 hour talking circle; a 60-90 minute interview, which will take place at a location convenient for you and will be conducted by an interviewer on our team; a questionnaire to be filled out by teachers; and a 1-2 hour follow-up talking circle. Participants will be asked questions that will help us to:

1. Identify the relevance and appropriateness of the curriculum content for students at Kateri and Karionhianonhna School;
2. Identify the cultural appropriateness of the curriculum content and instructional methodology;
3. Identify successes and challenges of the curriculum implementation methods used by teachers to deliver the curriculum;
4. Identify and understand facilitators and barriers involved in delivering the curriculum;
5. Understand the effectiveness of the Health Education Program.

Benefit/Risk: The information gathered from this study will provide KSDPP with knowledge that will be useful for Kahnawake's Health Education Program, and other communities that have purchased the Health Education Program over the past eleven years. There is no known risk to participating in this study. You are free to respond to questions asked according to your own comfort. If you find that the interview,

questionnaire or talking circle stirs up any difficult thoughts, you are not obliged to answer or respond to the question.

Confidentiality: Interviews and focus groups will be digitally audiotaped, transcribed and given a code number so that your identity will remain confidential. The tapes and the transcripts will be kept locked at KSDPP, under the supervision of the KSDPP Office Manager. Access to your identifying information will be restricted to Alex Otsehtokon McComber and the team researchers. Digital copies of digitally taped interviews and talking circles will be stored for a period of 5 years after completion of the study, after which time, the recordings will be deleted. To ensure that the information gathered in this study reaches as many people as possible, we intend to publish the results of this research, but to protect the identity of participants, no names will be used in the publications and any identifying information will be disguised so that the speaker cannot be identified.

Voluntary participation/withdrawal: It is important to note that your participation is voluntary and you have the right to withdraw from the study at any time without prejudice of any kind.

Contact for information about the study: The researchers or research assistants will be happy to answer any questions either before or after the interview, questionnaire or talking circle. The Aboriginal Diabetes Initiative Regional Evaluation & Innovation Fund is funding the study.

Contact for concerns about the rights of research participants: If you have any questions or concerns about your treatments or rights as a research participant, please contact Alex Otsehtokon McComber at 450-635-4374, or Deanna Collin, Ethics for Review Administrator, McGill University, 514-398-6193; e-mail: deanna.collin@mcgill.ca.

It is important to read this carefully and ask the investigator any questions you may have about this consent form.

Kahnawake Schools Diabetes Prevention Project (KSDPP)
Evaluation of Kateri Memorial Hospital Centre (KMHC) Health Education Program for Diabetes Prevention

CONSENT FORM TO PARTICIPATE IN RESEARCH

This is to state that I have read the above information and have agreed to participate in the project to evaluate the KMHC Health Education Program for Diabetes Prevention being conducted by the Kahnawake Schools Diabetes Prevention Project in Kahnawake. My questions were answered to my satisfaction. A copy of this signed consent form will be given to me. I understand that I am free to withdraw from the study at any time without giving reasons.

I HEREBY CONSENT AND VOLUNTARILY AGREE TO PARTICIPATE IN THIS STUDY IN THE FOLLOWING MANNER (√):

___ Audiotaped 1-2 hour key informant talking circle;
___ Audiotaped 60-90 minute individual interview;
___ Completion of teacher questionnaire;
___ Audiotaped 1-2 hour follow-up talking circle, which will be audiotaped.

NAME (please print):
_____

ADDRESS:
_____

PHONE:
_____

SIGNATURE:
_____

DATE:
_____

Contact information: The researcher will be happy to answer any questions you might have concerning this study. If at any time you have questions about your rights as a research participant, please contact Alex Otsehtokon McComber at 450-635-4374, or Deanna Collin, Ethics for Review Administrator, McGill University, 514-398-6193; e-mail: deanna.collin@mcgill.ca.

APPENDIX 5: INTERVIEW GUIDE

Kahnawake Schools Diabetes Prevention Project (KSDPP)
Evaluation of Kateri Memorial Hospital Centre (KMHC) Health Education Program for Diabetes Prevention

CURRICULUM AUTHORS TALKING CIRCLE

Information about the talking circle:	
Date:	Location:
Start time:	End time:
Facilitator(s):	
Number of participants:	Interview code:
Transcriber:	Transcription length:

Procedure:

- Arrange seating into a circle format.
- Introduce yourself.
- Explain that this talking circle will take no more than 2 hours
- Explain the talking/sharing circle format (everyone gets chance to talk, the person talking should not be interrupted, a feather or other token may be passed around and held while each person speaks)
- Follow the guideline as close as possible.
- Allow discussion to happen naturally, and to continue if you think the topics discussed are relevant to the study.
- If new questions/topics are discussed, be sure to make note of it (this will assist in the transcription and understanding of the data).
- Try not to let participants get off topic.
- If participants get off topic, refer back to the guideline to move on to the next question.

Please introduce this key informant talking circle session with the following preface:
The purpose of this talking circle is to collect your stories on how the Health Education Program was created, developed and implemented. Our goal is to develop recommendations for the revision of the Health Education Program.

The questions are divided into five sections. In the first section we will ask about how the Health Education Program came to be. The next three sections will ask about specific curriculum content. In the last section, we will ask for specific recommendations for revising the Health Education Program.

This discussion will be recorded, and later we will transcribe the recording. We will then analyze the information from this discussion to help us further develop questions that we will use for teacher questionnaires, and a follow-up talking circle with teachers.

A. BACKGROUND, CREATION AND PURPOSE OF THE HEALTH EDUCATION PROGRAM FOR DIABETES.

Preface: We're interested in hearing your views on the history and background of the creation of the Health Education Program. The first set of questions is about what you can recall about how the program came to be.

A. From your recollection, what was the intention to have the curriculum developed and implemented?

B. What were the goals and objectives?

C. What kind of plan was put in place to build capacity for teachers?

B. CULTURALLY APPROPRIATE CURICULUM CONTENT

Preface: Next, we would like your views on curriculum content and methodology.

D. When you developed the curriculum, how did you ensure that the content was culturally relevant?

    a. Artwork (pictures, designs)
    b. Types of foods
    c. Student activities
    d. Language
    e. Other?

C. GENERAL CURICULUM CONTENT

E. When you developed the curriculum how did you ensure the content was scientifically accurate?

    a. Diabetes & Lifestyles
    b. Nutrition
    c. Fitness
    d. Understanding the human body (what about different grade levels?)
    e. Resources boxes

F. During the development of the curriculum, what resources did you use to help develop the content?

D. INSTRUCTIONAL METHODOLOGY

G. When you developed the curriculum, what considerations were given to age and grade level?

H. What consideration was given to different student learning styles?

I. What consideration was given to resources for teachers?

J. What about the resource boxes?

E. STRENGTHENING THE CURRICULUM

Preface: Finally, we would like to hear your views on the future outlook of the Health Education Program.

K. Do you think the health education program needs to be revised or updated? Why? How?

   a. Cultural appropriateness

   b. General curriculum content

   c. Instructional methodology

L. Is there anything else that you would like to add?

THIS CONCLUDES THIS TALKING CIRCLE. THANK YOU VERY MUCH FOR TAKING THE TIME TO PARTICIPATE. IF YOU HAVE ANYTHING ELSE TO ADD, PLEASE FEEL FREE TO LET US KNOW.

Kahnawake Schools Diabetes Prevention Project (KSDPP)
Evaluation of Kateri Memorial Hospital Centre (KMHC) Health Education Program for Diabetes Prevention

INDIVIDUAL INTERVIEW

Information about the interview:	
Date:	Location
Start time:	End time:
Interviewer:	Interview code:
Transcriber:	Transcription length:

Information about the participant:	
School:	Age:
Gender:	Number of years in profession:
Length of participation in the Health Education Program:	

Procedure:

- Introduce yourself before beginning the interview.
- Make sure the participant is comfortable with the interview, the location of the interview, etc.
- Go through the consent form with the participant and have them sign it.
- If the participant is not comfortable with signing the consent form, you may read the consent form to them and have them give their verbal consent on tape.
- Please follow the interview guideline as closely as possible.
- Allow discussions to happen naturally, and to continue if you think the topics discussed are relevant to the research.
- If you feel the discussion is going off topic, refer back to the interview protocol to move on to the next question.

Please introduce this individual interview with the following preface:
We recently held a talking circle with key people who were involved in the creation and development of the Health Education Program. The purpose of this interview is to understand how the Health Education Program is delivered in each school.

The questions I will be asking you will help us to form the basis of developing recommendations for the revision of the Health Education Program. The first half involves discussing your perspectives on administrative support for the HEP. I will then ask you a few questions

about facilitators and barriers to the program. Finally I will then ask your suggestions and recommendations to improve upon the program overall.

This discussion will be recorded, and later we will transcribe the recording. We will then analyze the information from this discussion to help us further develop questions that we will use for teacher questionnaires, and a follow-up talking circle with teachers.

A. ADMINISTRATION OF HEALTH EDUCATION PROGRAM

1. How many teachers delivered the Health Education Program at your school in 2010-2011?

2. How many teachers delivered the Health Education Program at your school in 2011-2012?

3. What was the frequency of the HEP delivery at your school in 2010-2011? (are you aware of how many lessons out of ten were delivered? Is there some type of reporting mechanism that teachers are required to complete?)

4. What was the frequency of the HEP delivery at your school in 2011-2012?

B. ADMINISTRATIVE SUPPORT FOR TEACHERS

5. At the beginning of each school year, how important is the Health Education Program for school administrators?

6. What type of administrative support(s) is in place for teachers to deliver the HEP? (training, time)

7. What types of resources are available for teachers who implement the HEP?

C. FACILITATORS AND BARRIERS TO THE HEALTH EDUCATION PROGRAM FOR 2010-2011 AND 2011-2012.

8. Can you think of factors that facilitate the delivery of the Health Education Program [and contribute to its effectiveness]?

9. Can you think of factors that hinder the delivery of the Health Education Program [and reduce its effectiveness]?

D. FUTURE OUTLOOK.

10. Can you provide any suggestions or recommendations to improve upon the following areas?

    a. Administrative support?
    b. Resources?

11. Is there anything else that you would to add?

THIS CONCLUDES THIS INTERVIEW. THANK YOU VERY MUCH FOR TAKING THE TIME TO PARTICIPATE. IF YOU HAVE ANYTHING ELSE TO ADD, PLEASE FEEL FREE TO LET US KNOW

Kahnawake Schools Diabetes Prevention Project (KSDPP)
Evaluation of Kateri Memorial Hospital Centre (KMHC) Health Education Program for Diabetes Prevention

FOLLOW-UP TALKING CIRCLE WITH TEACHERS

Information about the interview:	
Date:	Location
Start time:	End time:
Facilitator(s):	
Number of participants:	Interview code:
Transcriber:	Transcription length:

Procedure:

- Arrange seating into a circle format.
- Introduce yourself.
- Explain that this talking circle will take no more than 2 hours
- Explain the talking/sharing circle format (everyone gets chance to talk, the person talking should not be interrupted, a feather or other token may be passed around and held while each person speaks)
- Follow the guideline as close as possible.
- Allow discussion to happen naturally, and to continue if you think the topics discussed are relevant to the study.
- If new questions/topics are discussed, be sure to make note of it (this will assist in the transcription and understanding of the data).
- Try not to let participants get off topic.
- If participants get off topic, refer back to the guideline to move on to the next question.

Please introduce this follow-up talking circle session with the following preface:

We recently discussed the Health Education Curriculum with the creators of the KMHC Health Education Program and current principals of each school, and conducted a teacher survey among teachers who have taught the HEP in the last two school years at both Kateri School and Karonhianonhna. The questions we will be asking you are based on the information we learned during recent discussions and a teacher questionnaire.

The purpose of this talking circle is to better understand facilitators and barriers that have contributed to the overall effectiveness of the Health Education Program. Our goal is to understand the reasons that teachers were able or unable to deliver the curriculum in whole or in part so that we can develop recommendations for the revision of the curriculum.

A.IMPLEMENTATION

Preface: We recently gathered information from people involved in the creation, development and implementation of the Health Education Program, and teachers who have delivered the curriculum during the last two school years (2010-2011 and 2011-2012). Based on the results of the teacher questionnaire, we would like to further discuss your opinions about the curriculum.

1. How many lessons do you remember teaching from the past two years?

2. What is your perception on the time allotted to deliver the curriculum throughout the school year?

3. What are your thoughts on the curriculum content? (e.g. language, clarity, and culture)?

4. Do you think the curriculum content is flexible enough to let you incorporate it into the regular academic curriculum?

B.ENVIRONMENT

1. What kind of support do you get from either the school principals or the school environment to teach the curriculum? (Training)

2. What are your opinions about resource boxes (toolbox)? (Accessibility, up-to-date)

3. Can you think of some of the facilitators that contribute to the success of the curriculum?

4. Can you think of some of the barriers that hinder the success of the curriculum?

C.OVERALL EFFECTIVENESS OF THE HEALTH EDUCATION PROGRAM

1. Do you think the curriculum is important, and needs to be taught in schools? Why or Why not?

2. Can you think of some suggestions to get teachers more motivated/encouraged to teach the curriculum?

D.RECOMMENDATIONS

1. What are your specific suggestions for improving the Health Education Program?

2. Is there anything else that you would like to add?

THIS CONCLUDES THIS FOCUS GROUP TALKING CIRCLE. THANK YOU VERY MUCH FOR TAKING THE TIME TO PARTICIPATE. IF YOU HAVE ANYTHING ELSE TO ADD, PLEASE FEEL FREE TO LET US KNOW

Kahnawake Schools Diabetes Prevention Project (KSDPP)
Evaluation of Kateri Memorial Hospital Centre (KMHC) Health Education Program for Diabetes Prevention

FOLLOW-UP TALKING CIRCLE WITH TEACHERS

Information about the interview:	
Date:	Location
Start time:	End time:
Facilitator(s):	
Number of participants:	Interview code:
Transcriber:	Transcription length:

Procedure:

- Arrange seating into a circle format.
- Introduce yourself.
- Explain that this talking circle will take no more than 2 hours
- Explain the talking/sharing circle format (everyone gets chance to talk, the person talking should not be interrupted, a feather or other token may be passed around and held while each person speaks)
- Follow the guideline as close as possible.
- Allow discussion to happen naturally, and to continue if you think the topics discussed are relevant to the study.
- If new questions/topics are discussed, be sure to make note of it (this will assist in the transcription and understanding of the data).
- Try not to let participants get off topic.
- If participants get off topic, refer back to the guideline to move on to the next question.

Please introduce this follow-up talking circle session with the following preface:

We recently discussed the Health Education Curriculum with the creators of the KMHC Health Education Program and current principals of each school, and conducted a teacher survey among teachers who have taught the HEP in the last two school years at both Kateri School and Karonhianonhna. The questions we will be asking you are based on the information we learned during recent discussions and a teacher questionnaire.

The purpose of this talking circle is to better understand facilitators and barriers that have contributed to the overall effectiveness of the Health Education Program.

A. IMPLEMENTATION

Preface: We recently gathered information from people involved in the creation, development and implementation of the Health Education Program, and teachers who have delivered the curriculum during the last two school years (2010-2011 and 2011-2012). Based on the results of the teacher questionnaire, we would like to further discuss your opinions about the curriculum.

1. How many lessons do you remember teaching from the past two years?

2. What is your perception on the time allotted to deliver the curriculum throughout the school year?

3. What are your thoughts on the curriculum content? (e.g. language, clarity, and culture)?

4. Do you think the curriculum content is flexible enough to let you incorporate it into the regular academic curriculum?

B. ENVIRONMENT

1. What kind of support do you get from either the school principals or the school environment to teach the curriculum? (Training)

2. What are your opinions about resource boxes (toolbox)? (Accessibility, up-to-date)

3. Can you think of some of the facilitators that contribute to the success of the curriculum?

4. Can you think of some of the barriers that hinder the success of the curriculum?

C. OVERALL EFFECTIVENESS OF THE HEALTH EDUCATION PROGRAM

1. Do you think the curriculum is important, and needs to be taught in schools? Why or Why not?

2. Can you think of some suggestions to get teachers more motivated/encouraged to teach the curriculum?

D. RECOMMENDATIONS

1. What are your specific suggestions for improving the Health Education Program?

2. Is there anything else that you would like to add?

THIS CONCLUDES THIS FOCUS GROUP TALKING CIRCLE. THANK YOU VERY MUCH FOR TAKING THE TIME TO PARTICIPATE. IF YOU HAVE ANYTHING ELSE TO ADD, PLEASE FEEL FREE TO LET US KNOW.

APPENDIX 6: TEACHERS' QUESTIONNAIRE

Kahnawake Schools Diabetes Prevention Project (KSDPP)
Evaluation of Kateri Memorial Hospital Centre (KMHC) Health Education Program for Diabetes Prevention

TEACHER QUESTIONNAIRE

For office use:	
Date:	School:
Researcher:	ID number:

Thank you for taking the time to fill out this questionnaire. We recently had discussions with key people in the community who were instrumental in the creation, development and implementation of the KMHC Health Education Program (HEP) for Diabetes Prevention that was developed from 1994 to 1997. As you know, the curriculum contains three units: Nutrition, Fitness, and Lifestyles & Diabetes. Children at each grade level receive ten (10) forty-five (45) minute lessons on these topics.

The purpose of this questionnaire is help evaluate the KMHC Health Education Program for Diabetes Prevention for the years 2009-2010 and 2010-2011 so that we can develop recommendations for the revision of the program. We are asking all teachers who have taught the HEP program in the last two school years to fill out this questionnaire.

Your input is important to the research team at KSDPP. If you have any questions before filling it out, please ask the researcher who is administering the questionnaire. The questionnaire is anonymous and the information collected from these questionnaires will be used to help develop recommendations and will be disseminated back to the schools after the completion of the project.

Section 1: Personal Information
1. Name:
2. School:
3. Age:
4. Gender:
5. Number of years in profession:
6. Length of participation in the Health Education Program (year):

SECTION 2: CLOSE ENDED QUESTIONS ID #:----------

With respect to the Health Education Curriculum, please indicate the extent to which you agree or disagree with the following statements; please check the appropriate box:

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1- The level of training I received to teach the curriculum is sufficient					
2- The teacher guide and resources available to teach the curriculum are user friendly					
3- The teacher guide and resources available to teach the curriculum are complete					
4- The school administrators such as the principal offer support for the health education curriculum					
5- I feel confident teaching the curriculum					
6- I have enough knowledge to deliver the health education program					
7- I understand the need to teach the curriculum					
8- I have incorporated the health education curriculum into academic lessons					
9- I have followed the lessons as guided by the curriculum					
10- The language of the curriculum content is appropriate for teacher usage					

Question	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
11- The curriculum content is age-appropriate for students					
12- The curriculum content incorporates Mohawk Traditions					
13- The time (45 minutes/lesson) allocated for the curriculum delivery is sufficient					
14- I have sufficient time to deliver the curriculum during school hours					
15-Curriculum delivery disrupts regular classroom activities					
16- Curriculum delivery increased my workload as an educator					
17- The curriculum is useful for students					
18- I gain personal satisfaction in delivering the health education program					

Please answer the following questions: ID #:----------

1- How many curriculum lessons of the ten did you teach in the year 2010-2011?

10 ☐ 7-9 ☐ 4-6 ☐ 1-3 ☐ 0 ☐

2- Approximately to how many students in total did you teach the curriculum in the year 2010-2011?

3- How many curriculum lessons of the ten did you teach in the year 2011-2012?

10 ☐ 7-9 ☐ 4-6 ☐ 1-3 ☐ 0 ☐

4- Approximately to how many students in total did you teach the curriculum in the year 2011-2012?

SECTION 3- OPEN ENDED QUESTIONS

1- What did you like most about the health education curriculum?

2- What did you least appreciate about the health education curriculum?

Other comments:

If deemed necessary may we contact you to participate in a talking circle?

☐ *YES* ☐*NO*

APPENDIX 7: QUESTIONNAIRE RESULTS

Appendix 7.1- Percentage of teachers agreeing, disagreeing and having a neutral response for each of the survey items.

Survey Item	**Strongly Agree & Agree Combined (%)**	**Neutral (%)**	**Strongly Disagree & Disagree Combined (%)**
The level of training I received to teach the curriculum is sufficient	17.4	39.1	43.5
The teacher guide and resources available to teach the curriculum are user friendly	26.1	34.8	39.1
The teacher guide and resources available to teach the curriculum are complete	22.7	12.1	65.2
The school administrators such as the principal offer support for the health education curriculum	30.0	26.5	43.5
I feel confident teaching the curriculum	47.8	43.5	8.70
I have enough knowledge to deliver the health education program	60.9	26.1	13.0
I understand the need to teach the curriculum	82.6	13.1	4.34
I have incorporated the health education curriculum into academic lessons	65.2	30.5	4.35
I have followed the lessons as guided by the curriculum	47.8	26.1	26.1
The language of the curriculum content is appropriate for teacher usage	56.5	26.1	17.4
The curriculum content is age-appropriate for students	30.4	21.8	47.8
The curriculum content incorporates Kanien'kéhaka Traditions	21.7	17.4	60.9
The time (45 minutes/lesson) allocated for the curriculum delivery is sufficient	34.8	17.4	47.8
I have sufficient time to deliver the curriculum during school hours	21.7	21.8	56.5
Curriculum delivery disrupts regular classroom activities	26.1	47.8	26.1
Curriculum delivery increased my workload as an educator	52.1	26.2	21.7
The curriculum is useful for students	65.2	13.1	21.7
I gain personal satisfaction in delivering the health education curriculum	39.1	39.1	21.7

APPENDIX 8: LIST OF THEMES AND SUBTHEMES

VIEWS ON THE HEALTH EDUCATION CURRICULUM
Theme 1A: Environmental Factors affecting the Implementation of the curriculum ▪ Lack of administrative and training support ▪ Insufficiency of Resources for Teaching the Content ▪ The Change Associated with School Environment ▪ "Other priorities" Affecting Implementation of the Curriculum
Theme 1B: Delivery Methodology for Implementation of the curriculum ▪ Time as a Restricting Factor for Curriculum Delivery ▪ Differences in Organization Structures ▪ The Lack of Reporting Mechanism in Delivery ▪ Integration of Curriculum Content Into Academics
Theme 1C: Cultural Appropriateness of the Curriculum ▪ The Language of the Curriculum ▪ The Mohawk (Kanien'kéha) Cultural Representation
Theme 1D: The Content of the Curriculum ▪ Out of Date Contents on Diabetes Prevention ▪ The Repetition of Contents from Grade to Grade ▪ The Importance of the Curriculum Content ▪ The Impact on Health Behaviours
RENEWAL/REVIVAL OF THE HEALTH EDUCATION CURRICULUM
Theme 2A: Augmenting Level of Support ▪ Sense of Ownership of the Curriculum ▪ The Importance of Parental Education ▪ Approaches to Increase Parental Awareness ▪ The Cost
Theme 2B: Modifications in Curriculum Contents and Activities ▪ Adoption of New Technological Approaches ▪ Usage of Technology for Resources ▪ Reduction in Content Complexity ▪ Incorporating Cultural Relevant Activities
Theme 2C: Changes in Environment ▪ The Classroom Environment ▪ Kanien'kehá:ka Culture in Teaching
Theme 2D: Others ▪ A Comprehensive Health Program

APPENDIX 9: BARRIERS AND FACILITATORS

Appendix 9.1- The list of barriers & facilitators of the health education curriculum from the perspectives of teachers, curriculum authors, parents and school administrators.

Barriers and Facilitators of the KMHC Health Education Curriculum
Barriers
Environment: • Lack of administrative and training support • Lack of sufficient resources (toolboxes) • Ongoing changes associated with each school • Organizational structures • Financial constraints
Delivery: • Other priorities • Lack of time • Lack of reporting mechanism
Cultural Appropriateness: • Insufficiency of Kanien'kehá:ka cultural representation
Curriculum Content: • Difficulty in integrating contents into academics • Language of curriculum • Outdated material • Repetition of material from grade to grade • Not age appropriate • Lack of Parental Education
Facilitators
Environment: • KSDPP's established presence in community • Organizational structures (health teachers at one school)
Delivery: • Integration of material into academics • Prepared lessons
Curriculum Content: • Acknowledgement of importance of curriculum • Appreciation of prepared lessons as guidelines

APPENDIX 10: LIST OF RECOMMENDATIONS

Appendix 10.1- The list of recommendations reported for the health education curriculum from the perspectives of teachers, parents, curriculum authors, and school administrators

Recommendations for the KMHC Health Education Curriculum
Recommendations
Support: • Administration • Training (professional development, label reading) • Financial (hire more health teachers) • Parental education (label reading) • Community (KEC, KCSC, KSDPP, and other organizations) • Sense of ownership • Revive/establish new reporting mechanisms
Environment: • Outdoor and physical activity • Designate one classroom with designated health teacher(s)
Curriculum content: • Less complex lessons • Shorter lessons • More interactive/fun activities • Incorporate innovative and up-to-date technology (websites, links, games) • Update curriculum content (with accompanying worksheets, diagrams, pictures, posters) • Use contemporary appropriate terms (see “Native”, blood sugar) • Replenish toolbox at the beginning of each school year/revive tracking mechanism
Cultural: • Increased Kanien’kehá:ka cultural teachings • Incorporate holistic teachings (i.e.- in natural setting) • Increase Kanien’kehá:ka language
Other: • Development of comprehensive health program in Kahnawake