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School-based physical activity enhancement programmes to reduce risk factors associated with type 2 diabetes in developing Island settings

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Abstract

Economic development in areas such as Southeast Asia have resulted in a shift from traditional dietary patterns Western-style consumption of foods high in fats and processed carbohydrates. This economic-nutritional shift has resulted in an increase in chronic diseases such as type 2 diabetes. The Pacific Basin is experiencing similar economic growth due to tourism and other development activities resulting in an increase of type 2 diabetes mellitus. This study will seek to determine if the increasing rates of type 2 diabetes can be linked to similar patterns of economic growth, as well as implement a type 2 diabetes screening and lifestyle-based intervention program among at-risk school children aged 10-15 years, and their caregivers.

Keywords: diabetes, type 2 diabetes, lifestyle modification, obesity, overweight, public health, physical activity, school-based programmes, community-based interventions, economic and nutritional shifting, non-communicable diseases, public health, NCD epidemiology, medical anthropology, Fiji, Pacific basin, Health Belief Model

Introduction

Economic development in areas such as Southeast Asia have resulted in a shift from traditional dietary patterns Western-style consumption of foods high in fats and processed carbohydrates.[1] This economic-nutritional shift has resulted in an increase in chronic diseases such as type 2 diabetes. The Pacific Basin is experiencing similar economic growth due to tourism and offshore banking, as well as an increase in type 2 diabetes.

This study will seek to determine if the increasing rates of type 2 diabetes can be linked to similar patterns of economic growth, as well as implement a type 2 diabetes screening and lifestyle-based intervention program among at-risk school children aged 10-15 years, and their caregivers.

In undertaking this study, the following specific research questions will be addressed:

(1) Is a school-based screening and surveillance program feasible for at risk populations on Fiji?

(2) Is the increase in cases of type 2 diabetes addressable using traditional public health intervention and education methods, such as community-based behavioural modification focused on a return to traditional diets and an increase in physical activity?

(3) If demonstrated, has the economic and nutritional shift in Fiji resulted in an increased reliance on prepared foods that are high in saturated fats and processed carbohydrates?

There is ample evidence to support an economic and nutritional shift that is occurring in the developing world.[1] The majority of studies have focused on large areas such as Southeast Asia, where urbanization has created numerous jobs in factories producing goods for purchase developed nations such as North America. As such, it is not known whether similar shifts are occurring in smaller nations such as those found in the Pacific Basin, and whether this occurrence can be linked to increased type 2 diabetes prevalence.

As such, in terms of impact, this study seeks to demonstrate that this shift has occurred in Fiji, and demonstrate the feasibility of a community-based intervention program to increase healthy eating choices and exercise among children aged 10-15 and their caregivers, as a cost-effective prevention, as opposed to the current tertiary approach of the Fijian government which focuses on responding to new and existing cases of type 2 diabetes when they become serious enough to seek medical attention.

Background and significance: understanding of the problem

Economic and nutritional shifts in the developing world have resulted in physical labour-based employment and vegetable/fruit-based diets

being replaced by sedentary lifestyles high in fats and carbohydrates similar to those found in industrialized nations like the United States.[1]

Several studies have been done demonstrating this shift, particularly in Asia and Africa,[1] the Middle East,[2] Bangladesh,[3] and in limited areas of the Pacific Basin, including smaller nations such as the Cook Islands, Fiji and French Polynesia.[4]

The results of this economic-nutritional shift have been an increase in the number of individuals now suffering from chronic diseases, such as diabetes, heart disease, and hypertension.[1,2,5] In Fiji, the continued growth of tourism and offshore financial services has resulted in shifting dietary patterns and evidence of increased incidence rates of type 2 diabetes in health centres and physicians' offices.[1]

Demonstration of the economic and nutritional shifting in other areas of the world has already been, particularly in developing economies such as those found in African and Southeast Asia. Prentice[6] states that the underlying role played by economic development in the econ-nutritional shift, or the role that the economics of rural life have impacted health on various levels. Current research shows that as economic and educational opportunities in rural areas of the developing world become increasingly scarce, young men leave traditional rural settings to seek employment in larger cities.[7,8]

Many studies thus far conducted in areas such as Southeast Asia have shown that the shift in dietary and economic patterns has occurred concomitantly with a decrease in traditional economic activities, primarily subsistence and for-profit farming, and hence a rapid deterioration of traditional economic systems in both rural and urban areas. However, Prentice[6,9] illustrates the role that mass migration from rural to urban areas for employment in playing in the growing epidemic of obesity, and underscore the overall crisis in rural economic and healthcare globally.

As large numbers of individuals are forced to leave traditional villages and associated economic and nutritional patterns behind to move to large areas for employment, obesity rates and other associated chronic diseases continue to rise, rapidly becoming the major source of morbidity and mortality in developing nations.[2] Koopman, et al.[4] found that in two studies between 1993 and 1995, in Gambia that the obesity rates for men living in rural areas was less than 0.2% for men and less than 3% for women; while in urban areas during the same period of time the obesity rates as measured by body mass index (BMI) rose from under 2% to over 4% in the overall population, with significant increases in certain population subgroups, including 32.6% of women over 35 years of age.

Such suggests that as urbanization continues, so will the rates of obesity, and concomitant disease states such as type 2 diabetes and hypertension, associated with rural individuals leaving traditional dietary practices behind in exchange for more stable employment opportunities in urban areas, thus underscoring the need for both prevention programs focused on traditional diets, as well as the need to stabilize rural economies.

Rationale

In terms of the Pacific Basin, while most islands are relatively small having few large population centres, it could be assumed that the problem of a large numbers of individuals leaving rural areas for jobs in larger cities, would be mitigated, thus focusing efforts on preventative measures.

However, Prentice[6] raise an important issue thus far not addressed in measuring how the econ-nutritional shift has impacted chronic disease rates in smaller, isolated nations, or that of the role of remittance funds. Prentice[6] found that as workers in large cities sent home funds to their rural families, that the rates of obesity in rural areas also began to rise as there was less need to focus on agrarian production, and luxury items that were high in fat and processed carbohydrates could be purchased and prepared with less labour. The issue of remittance funds would need to be explored as a mitigating factor in type 2 diabetes in Fiji, as there has been much immigration from areas such as India and Indonesia in recent years, with these individuals filling many of the traditional labour jobs fuelled by the growing tourism industry, such as hotel and resort construction.

Popkin[2] used retrospective statistical data on Body Mass Index (BMI) gathered community-based level throughout the Middle East, including Jordan, Kuwait and Egypt, as mediated by both physical activity and rural versus urban areas, found that there has been a rapid shift in energy consumption and the sources of energy resulting in an increase in the average BMI in both urban and rural areas, particularly for women. Hoque et al.[3] looked at the burden of obesity as a contributing factor to chronic disease among Bangladeshi women. Using quantitative methods, such as data gathered from a national survey which measured BMI of a representative sample of women in both urban and rural areas, the authors concluded that the risk of obesity and chronic disease was nearly equal across all economic and urban/rural strata, thus suggesting that the shift is impacting both those of lower and higher socioeconomic status.[3]

Finally, Prentice[9] and Koopman[4], who studied smaller nations in the Pacific Basin as well as elsewhere in the developing world, found that obesity was increasing both among urban and rural individuals at all socioeconomic levels using national surveillance data related to BMI change over time. Of particular note was that Prentice[9] also specifically looked at quantitative measures of how diets had changed over time by tracking the import of "cheap, highly refined fats, carbohydrates and oils", which among other things he states are contributing factors in the emerging epidemic of obesity in the developing world.

Demonstrating the econ-nutritional shift in Fiji while also developing baseline epidemiological information and surveillance of type 2 diabetes among a cohort of school children, would allow us to being understanding this impact. However, it should be noted that there are significant sociocultural factors which play a role in the econ-nutritional shifting, as well as the control of subsequent chronic diseases.

Because of the significance of cultural factors in the emergence of chronic diseases in developing countries, such as a loss of traditional familial and community structure due to urbanization, and a shift to depending upon pre-prepared food sources as opposed to a reliance on traditional labour-intensive diets from subsistence farming and fishing,[4] qualitative studies could be useful in demonstrating the impact of this shift on individuals and their cultural fabric.

Showing the interplay between the destruction of traditional cultural systems due to urbanization, as mediated by large scale macro-economic factors, would integrate well with the more quantitative data that is currently being produced in developing culturally-appropriate intervention programs that would be more readily accepted due to its familiarity.

Community-based public health research involves the application of

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public health research and intervention modalities at the community level through involvement of key community stakeholders, as well as community members.[10] This involvement is a key component of the community-based participatory research methodology which focuses on raising the capacity of communities to identify and address their own public health problems with assistance from outside resources.[2] While the development of such an approach focuses on creating the capacity for communities to address their own needs in time, it is important to understand that in the early phases of such a program that outside resources will be needed to provide not only program expertise but also financial backing.

In developing a type 2 diabetes intervention for school children aged 10-15 in Fiji community involvement is paramount to program success, as only through wide-scale program acceptance by both the target community, as well as their parents/caregivers, the program is likely to fail. This is also true in terms of political, economic and healthcare resources in the community, as these organizations will provide various levels of support in establishing the program and facilitating its acceptance.

As such, key community stakeholders from which buy-in must be achieved include the target population and their parents/caregivers and extended family, who must understand the need for the program as well as support the necessary lifestyle changed recommended in order to prevent type 2 diabetes and better control the disease among those members of the population who are already diabetic. Additional community stakeholders include teachers and school administrators who will support the program in terms of social capital by encouraging participants to follow program guidelines and helping them understand the need for increased exercise and better eating habits.

Additional stakeholders include leadership at the Ministry of Health who will provide support to the program, as well as community health nurses who will help implement the program, and the medical university which will provide financial resources and personnel in support of the program. Other community stakeholders include influential community leaders, such as religious leaders who are considered highly influential members of the community in Fiji, and business leaders who can provide financial resources. It is important to note that community health nurses, religious leaders, as well as teachers and parents can play a significant role in such a program as they possess an in-depth understanding of the social and other cultural influences which will be targeted in this intervention in changing dietary and physical activity behaviour.

Community-based research must also consider physical factors in the environment which can be used to facilitate behavioural change in the target population. In terms of a program to alter type 2 diabetes in the target population, there is a need to increase physical activity through moderate exercise. Physical factors in the environment can be used to accomplish this, including emphasis on physical activity in school and access to playground equipment, sports fields, and sports equipment to encourage such activities. Other physical factors include community design to increase physical activity through activities of daily living, such as walking to the grocery store instead of driving, as well as community parks and other recreational activities. This will be a difficult task to accomplish on Fiji where the physical environment outside of the tourist areas is characterized by a lack of sidewalks, parks and other community areas which encourage physical activity.

Conceptual framework

This intervention will be based upon the Health Belief Model (HBM) to assist the target population and their caregivers and family in adopting healthy eating and exercise habits, and hence reduce the social, economic and other costs associated with the current high rates of morbidity and mortality associated with type 2 diabetes in Fiji. The HBM is one of the most frequently utilized health-behaviour interventions developed initially to understand why individuals did not utilize health resources.[11]

The HBM theorizes that healthy behaviour is the result of the occurrence of three motivating factors: first, perceived susceptibility states that the target audience possesses sufficient knowledge and understanding that unhealthy eating habits and limited physical activity results in increased risk for type 2 diabetes; second, perceived threat is the belief that one is vulnerable to serious complications and even death resulting from type 2 diabetes; and third, perceived benefit is the belief that adopting healthy eating habits and increased physical activity will reduce the perceived threat, and that one can overcome perceived barriers to adopting these habits, such as developing a home garden to increase the use of fruits and vegetables in cooking, thus resulting in self-efficacy, or the ability to move from passive understanding to action.[11]

Mediating factors include cues to action, which in this case will include targeted messages delivered in an age-appropriate manner in school to show the benefits associated with healthy eating and exercise, as well as helping students develop their own program to increase physical activity in their family.[11]

This is an important factor in developing a program that will be adopted by both children as well as their families and caregivers.

Research methodology introduction

This study seeks to demonstrate the feasibility of a community-based intervention program to increase healthy eating choices and exercise among children aged 10-15 and their caregivers, as a cost-effective prevention, as opposed to the current tertiary approach of the Fijian government which focuses on responding to new and existing cases of type 2 diabetes when they become serious enough to seek medical attention.

Study design

Demonstration of this shift and subsequent impact on rates of type 2 diabetes will be based on an experimental study design. An experimental design has been chosen to allow the greatest control over the research question through manipulation of study factors and random assignment of subjects to control and experimental groups.[12] The use of an experimental design in community-based interventions are common among high-risk populations,[10] such as school-aged children in Fiji, where type 2 diabetes rates are increasing among all population groups. Community-based experimental lifestyle interventions such as this have been shown to have the potential for widespread impact on a population's health.[10] As such, the study will use cluster sampling to identify a research population of 200 10-15-year-old Fijians; subject matching on age, gender, and body mass index will assign 100 to the experiment and 100 to the control groups.

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Both experimental and control groups will participate in dietary consumption/expenditure logs to identify food consumption patterns. The experimental group, in concert with caregivers, will receive a lifestyle intervention to reduce dependence on foods high in fat and carbohydrates and increase levels of physical activity. Pre- and post-testing will be used to determine impact of lifestyle intervention on risk factors for type 2 diabetes in experimental group.

Intervention

The experimental group, in concert with caregivers, will receive a lifestyle intervention to increase levels of physical activity. Pre- and post-testing will be used to determine impact of lifestyle intervention on risk factors for type 2 diabetes in experimental group. The control group will receive no intervention, but will be tracked during the study in order to make comparisons of the efficacy of the intervention in the experimental group in reducing type 2 diabetes risk factors. Risk factors which will attempt to be modified by this study include increasing physical activity to a level of 30 minutes per day five times per week.

Recruitment and program intervention will follow the standard 10 month school calendar of Fiji, with the first month of the school year dedicated to the recruitment of students by the PI and the five AI's and the collection of appropriate data; during the second month the program will be presented to students and caregivers during a special after-school meeting in which they will be presented with various methods for increasing physical activity; students will then receive monthly information from their school that they can take home to share with families to increase participation; follow-up will occur at three, six and nine months at special after-school meetings in which additional quantitative data on increases in physical activity levels and changes in BMI, weight, BP and resting heart rate will be assessed.

Study sample target population

The target population for this study will include 10-15-year-old Fijian school-children chosen from two primary schools. These two primary schools will be chosen from the two main demographic areas on Fiji. These two cities represent the largest population centres on the island, and also draw students from surrounding areas; as such, it is felt that they will represent a cross-section of Fijian school-children in the specified age range.

Sample size

The sample will include a cohort of 200 students aged 10-15 in grades kindergarten to third grade as drawn from the two primary schools. Overall, the population of Fiji is approximately 110,000, with a population of children between 10-15 years of age of approximately 12,000. Based upon a 95% confidence level, such an approach would require a population of 202 in order to representative of the larger population demographic. In terms of measuring change in the experimental versus control population, pre- and post-testing will be used to measure the desired effect.

Sampling strategies

This will be a cohort-design study with all participants, regardless of study arm, being free of diabetes of other co-morbid medical conditions when entering the study, such as impaired fasting blood glucose. As such, random cluster sampling will be used to identify 200 students, with 100 drawn from each primary school. To maintain internal validity subjects will be matched as much as possible matching will occur on age, gender, and body mass index Sampling frame.

The sampling frame will include a complete list of all those students attending the target schools who meet the criteria for potential inclusion in the study. Criteria used to determine the sampling frame include the age breakdown of 10-15, both male and female genders; exclusion of those with diagnosed cases of type 1 or 2 diabetes, or pre-diabetes as represented by an impaired fasting blood glucose, or those who are physically unable to participate in a program to increase physical activity.

Recruitment strategies

Recruitment will be based on working with the Department of Education to identify two suitable primary schools, and then working with the headmasters of each school to receive permission to engage in the intervention. Furthermore, individual students will need to have a signed release from a legal guardian giving them permission to participate in the intervention. In order to facilitate participation, students and their caregivers will be invited to a presentation which will describe what type 2 diabetes is, the consequences of the disease, how it is increasing on the island, and strategies to reduce incidence. This is an important part of the program as it is designed to secure buy-in from potential participants and their caregivers. Presentations will be facilitated by being given in the local language and using language and culture-appropriate methods.

Allocation to treatment arms

Fifty subjects from each school will be assigned to the control group, and 50 subjects from each school will be assigned to the experimental group. Random sampling will be used to identify these students based on pre-determined criteria. These criteria will include a 50% breakdown of females and males, as well as representative age groups. For example, all females within the age range of the school will have an equal chance of inclusion in either the experimental or control groups.

Study variable and key measures

Current studies suggest that increasing physical activity even to these moderate levels can result in a large decrease in the overall risk of developing type 2 diabetes.[1] As such the experimental group will receive educational material on how to engage in physical activity in daily living situations.

It is important to note that even though the intervention is focused on 10-15 year olds, that the program is intended to influence the behaviour of the entire family. Behaviours that the program will encourage include walking as a family to a park, beach or the store instead of driving; playing active games as a family, such as soccer; reducing the amount of time spent playing video games and other sedentary activities; and strategies for getting older children in the family involved. Incentives for participation will include prizes, such as small toys, hats, t-shirts, and so forth for those participants and families who meet program goals at each follow-up at 3, 6, and 9 months.

Physical activity will be reinforced during these follow-ups as well with additional education materials. Caregivers will be asked to help participants keep a weekly physical activity log detailing exercise over that period of time.

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In terms of measuring change in the experimental versus control population, pre- and post-testing will be used to measure the desired effect.

Because type 2 diabetes risk can be greatly reduced through small changed in diet and exercise,[1] the effect of the study may be small, such as increasing physical activity to 30 minutes per day 5 times per week. The program will follow participants longitudinally for a period of 9 months following being introduced into the program.

Participants will be assessed at 3, 6, and 9-month intervals to determine lifestyle changes and adherence to program guidelines. It is anticipated that at 3 months, 10% of participants will be meeting program goals, and 25% and 45% respectively for 6 and 9 months follow-ups. In terms of program adherence participants will be given feedback and additional encouragement in the form of culturally-appropriate educational materials at each follow-up session. Participants will also be given material once per week on developing healthy lifestyle habits that they can take how to share with their families and caregivers. It is anticipated that the net effect in those who develop increased levels of physical activity will be a 5% reduction in overall risk.

Data collection

Data collection methods

Demographics, including age, gender, health status, family living conditions, and so forth will be gathered using standardized questionnaires as filled out by caregivers. Additional data collected from caregivers will be estimates of physical activity among the study population, including what types of activities, how strenuous, how often each day. This data will also be gathered using standardized questionnaires. Data that will be collected directly from participants includes body mass index and weight at study inception as well as each follow-up. Such data would be considered primary in nature since it is collected directly from participants and their caregivers. Data collected at the follow-ups, will include that drawn from physical activity logs, and will be used to determine who physical activity is increasing.

Also, data on weight/BMI will be collected at this time to determine how the physical activity may be affecting such.

Data collection instruments

Currently, there are a wide range of data collection instruments available; however, most of these have been developed for use in countries outside of the Pacific Basin. As such, physical activity recall logs from pre-existing studies will be modified in order to meet the age and culture level of the current population. Additionally, instruments in the form of questionnaires will be designed to collect demographic and morphological data on study participants and will be represented statistically as well as graphically to show not only baseline information but changes as the study progresses. The data collected will be quantitative in nature.

Data management

For this community-based intervention targeting school-aged Fijian children between 10-15 years old in a lifestyle modification program to increase rates of physical activity thus reducing the risk of type 2 diabetes, various types of quantitative data will be collected from study participants as well as their caregivers. Various study personnel will be involved in the collection and analysis of data in the program. Specifically, the study will employ a principle investigator (PI), as well as five associated investigators (AI). These research associates will be the primary staff responsible for the collection of quantitative data. As such, it will be necessary to ensure that research associates are properly trained in order to maintain the validity and reliability of the study instruments, as well as collected data.

The initial study instrument will gather data on study participants from their caregivers on the following: demographics, such as name, address, age/birth date; morphological data on body mass index (BMI), weight, height, resting heart rate, and blood pressure; additional familial data will be gathered on number of people living in the home and their relationship to the study subject, and family history of type 2 diabetes; and finally data on estimated weekly exercise of the subjects as well as their families. This data will be collected at initial interview using Epi Info to both generate as well as collate study data. At the three-month interval additional data will be gathered on morphological characteristics, as well as data on whether or not intervention materials have resulted in increased exercise; this data will be gathered again at the six and nine-month intervals also using Epi Info. The data will be maintained in a secure method using password protection to access the computer files.

Data analysis overview

The purpose of this study is to determine whether a community-based intervention among 10-15-year-old school children in Fiji will result in increased physical activity and hence reduce risk factors for the development of type 2 diabetes.

Type 2 diabetes represents a significant source of morbidity and mortality in Fiji, with incidence rates increasing significantly among school-aged children. Physical activity levels below 30 minutes per day, five times per week, are considered a risk factor for the development of type 2 diabetes.[13]

Hypothesis 1

Null hypothesis number one states that it is hypothesized that a school-based intervention program will not increase physical activity among study participants, and hence reduce the risk of type 2 diabetes. Alternative hypothesis number one states that it is hypothesized that a school-based intervention program will increase physical activity among study participants, and hence reduce the risk of type 2 diabetes. The rationale underlying hypothesis number one is that because risk factors for type 2 diabetes are primarily lifestyle-related, and include diets rich in saturated fats and processed carbohydrates, and low in fruits, vegetables and lean meats, as well as a lack of physical activity.[13]

Current data suggests that increasing physical activity levels to five times per week for at least 30 minutes per day can significantly reduce the overall risk of developing type 2 diabetes.[14,15]

As such, the rationale for this program is to increase physical activity to these levels among the study population as a way of reducing overall risk. Such an approach is multifaceted and will also serve to reduce the risk of other chronic diseases, such as cardiovascular disease.

Univariate analysis testing of this hypothesis will focus on calculating the ratio of participants who increased their physical activity to the standard set by the program, or that of increasing to five times per week for 30 minutes per day.

Additionally, calculation of the average (mean) increase in physical activity, the mean increase in number of days per week that

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participants exercised, and average changes in body weight will be calculated as univariate statistics. Bivariate analysis will focus on chi square test, as we are using nominal data, to test the efficacy of the intervention program against the control group who did not receive the intervention. The multivariate analysis will utilize a two-way ANOVA to compare the means of the intervention and control groups based on multiple nominal variables, such as weight loss, exercise rates, number of days per week exercised, amount of time exercising, and so forth.

Hypothesis 2

Null hypothesis number two states that it is hypothesized that a school-based intervention program will not increase physical activity among family members of study participants, hence not reducing the risk factors for type 2 diabetes. In comparison, alternative hypothesis number 2 states that it is hypothesized that a school-based intervention program will increase physical activity among family members of study participants, and hence reduce the risk factors for type 2 diabetes. The rationale for hypothesis number two is that, as stated above, exercise can reduce the risk of type 2 diabetes development;[13] however, evidence also suggests that such programs can increase the levels of physical activity among family members of those involved in such interventions.[16]

As such, the rationale for the second hypothesis in this intervention is based on increasing physical activity levels among the target population also resulting in an increase among family members, and hence an associated reduction in risk across the entire family group.

Univariate analysis testing of this hypothesis will focus on calculating the ratio of family members of participants who increased their physical activity to the standard set by the program, or that of increasing to five times per week for 30 minutes per day. Additionally, calculation of the average (mean) increase in physical activity, the mean increase in number of days per week that participants exercised, and average changes in body weight will be calculated as univariate statistics. Bivariate analysis will focus on chi-square test, as we are using nominal data, to test the efficacy of family members who participated in the intervention program against the family members of control group participants who did not receive the intervention. The multivariate analysis will utilize a two-way ANOVA to compare the means of the intervention and control group family members based on multiple nominal variables, such as weight loss, exercise rates, number of days per week exercised, amount of time exercising, and so forth.

Human subjects review

Because this community-based investigation will deal directly with minors, specifically Fijian school-aged children between 10-15, the largest ethical concern is that of obtaining informed consent from parent/caregivers for participations; but to a lesser extent we must also consider the issue of assent. Consent can be seen as the process whereby a patient agrees to undergo treatment or to participate in some type of clinical trial after having received information on both the risks as well as benefits associated with participation.[17] In this regard, children are unable to provide consent; rather consent must be given by a legal guardian.

However, it is the policy of such bodies as the American Academy of Paediatrics (AAP) as well as many institutional review boards that minors should provide assent to participation.[7] Assent refers to an active affirmation by a minor, or other individual is incapable of providing consent, that they desire to participate in a research or clinical program.[7] The AAP states that parents and those overseeing studies should not exclude even young children from the process of deciding whether they will participate in a study. Based on this, two primary ethical issues arise: first, ensuring that informed consent is obtained; and second, ensuring that assent is obtained. Informed consent in this regard will entail making sure that legal guardians understand what the program entails, what it requires, as well as potential benefits to participations (i.e. increased physical activity leading to decreased risk of type 2 diabetes), as well as any potential risks (i.e. that an increase in physical activity in the absence of a physical exam by a physician may pose risks for those who are not healthy).

Other issues which must be addressed in obtaining informed consent include the use of multiple languages on Fiji, including English, Dutch, Spanish and Papiamento. As such, it will be important to provide informed consent counselling as well as documentation in the appropriate language. In terms of assent, appropriate language as well as age-appropriate language will be important factors, as well as ensuring that participants understand the needs of the program as much as possible. By ensuring that all participants have had appropriate consent and assent procedures explained and documented to them, the majority of ethical issues in working with minors can be overcome.

Discussion

Strengths and weaknesses

The strengths of this study can be summarized into four basic categories: first, its applicability to furthering the current understanding of how large-scale changes in the economic and nutritional basis are underlying the worldwide increase in chronic diseases; second, its ability to focus on a relatively isolated population of student on the island of Fiji, where it will be possible to use a small study sample of approximately 200 to make inferences about the large population; third, the focus on a community-based intervention among a population of at-risk school children is both cost effective, and has been shown to be effective in other similar programs; and fourth, a small demonstration project such as this can easily be applied to other schools on the island.

The primary weakness of this study come in three forms: first, because data on diet and exercise are based on participants and not directly observable, the potential for recall bias is a potential source of weakness; second, because the island consists of a wide range of nationalities and hence languages and cultures, it may be difficult to make broad inferences about the efficacy of the program among different ethnic groups, as well as the potential language problems present; third, and finally, because the study is looking at a limited age range (10-15), it is difficult to make inferences about its applicability to other at risk groups who are older.

Summary

This is a community-based intervention among school-aged children (10-15) on the island of Fiji. Fiji has experienced much growth in the tourist sector over the past several decades, including gambling as well as traditional tourist pursuits. This has resulted in increased economic opportunities for island residents, along with disposable income, and increased access to luxury goods such as pre-processed

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foods high in fats and carbohydrates. It is theorized that this change is partially responsible for the rapid increase in cases of type 2 diabetes among all age groups, including school-aged children.

This study will look at the feasibility of using a school-based program to increase physical activity as a way of reducing the risk of type 2 diabetes among young children. The program will involve the use of educational materials which are targeted towards students and their families with the goal of increasing physical activity levels to 30 minutes per day, five times per week. Variables of interest will include reduction in weight, BMI and resting heart rate as well as the requisite increase in physical activity to reach these levels, among students and extended family. It is felt that such a program based on the Health Belief Model (HBM) will be a cost-effective means of reducing risk and hence long-term prevalence of type 2 diabetes.

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