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The role of family variables and accessibility to community facilities on the  
evolution of physical activity in children

par

Sandra Anderson

Département de Kinésiologie

Mémoire présenté à la Faculté des Études Supérieures  
En vue de l'obtention du grade de  
Maître ès Sciences (M.Sc.)  
En Sciences de l'Activité Physique

Septembre, 1999

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Faculté des études supérieures

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The role of family variables and accessibility to community  
facilities on the evolution of physical activity in children

présenté par:

Sandra Anderson

a été évalué par un jury composé des personnes suivantes:

Directrice de mémoire: Lise Gauvin  
Président-rapporteur: Suzanne Laberge  
Membre du jury: Louise Potvin

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## Sommaire

Les études démontrent que l'activité physique pratiquée sur une base régulière améliore la capacité cardio-vasculaire, le profil de santé et certains aspects de la santé mentale et du bien-être des individus (Bouchard, Shephard & Stephens, 1994). Cependant, la prévalence de la sédentarité est élevée. Celle-ci est considérée comme un des quatre facteurs de risques des maladies du cœur, la cause principale de mortalité dans la population canadienne (Institut canadien de la recherche pour la condition physique et le mode de vie [ICRCPMV], 1998).

Dans le but de mieux comprendre ce problème de santé publique, certains chercheurs en promotion de la santé et en prévention des maladies ont cherché à élucider les déterminants de la pratique des activités physiques dans la population adulte (Dishman, 1994). Cependant, peu d'études se sont penchées sur les enfants et adolescents en ce qui a trait aux déterminants de la pratique des activités physiques et aux stratégies de promotion de la santé (Dishman, 1994; U.S. Department of Health and Human Services, 1996).

Compte tenu du manque d'information concernant les déterminants de l'activité physique chez les jeunes, le but de cette étude était d'examiner le rôle de certains déterminants communautaires et familiaux sur le taux de pratique de l'activité physique chez les jeunes, et ce, sur une période de deux ans.

Pour ce faire, nous avons analysé des données tirées d'une cohorte unique de familles provenant de trois sites ayant participé au Project Québécois de Démonstration en Santé du Cœur (PQDSC). Ce projet vise la promotion de la santé cardio-vasculaire dans 23 communautés rurales, urbaines et de banlieue à

travers le Québec (Potvin, Paradis, Laurier, Masson, Pelletier & Lessard, 1992). Des données complètes ont été obtenues pour 361 des 1274 familles Québécoises ayant un enfant de 9 ou 10 ans et ayant consentis à participer au PQDSC. De ce nombre, il y avait 184 filles (âge moyen= 9,75 ans) et 177 garçons (âge moyen= 9,77 ans) tous provenant de familles bi-parentales. Afin de mieux comprendre les liens entre les variables communautaires et familiales et le taux de pratique de l'activité physique chez les jeunes, nous avons adopté le cadre conceptuel et analytique proposé par Baron and Kenny (1986). En s'appuyant sur ce cadre nous avons examiné les rôles modérateurs et médiateurs de variables telles le support et l'accessibilité sur les variations des taux de pratique de l'activité physique des enfants à travers le temps.

Nos analyses révèlent des résultats intéressants. Contrairement à ce qui était proposé, le support social n'a pas démontré des propriétés modératrices ou médiatrices bien que le taux de support social était associé transversalement avec le taux de pratique de l'activité physique des filles. De plus, notre étude a révélé des différences entre le support social donné aux garçons par rapport à celui donné aux filles. Nous avons trouvé que, comparativement aux filles, les garçons recevaient plus de support de leurs mères. Ainsi, nous n'avons pas pu conclure que le support social, tel que rapporté par les parents, est associé au changement du niveau d'activité physique du fils à travers le temps. En ce qui a trait à la médiation, le support social ne contribuait pas à expliquer le changement du niveau d'activité physique des garçons et des filles à travers le temps.

Quant à l'accessibilité, il y avait des résultats significatifs. Par contre, aucun de ces résultats n'a démontré des propriétés modératrices ni médiatrices de l'accessibilité. Tel que rapporté par le père, l'accessibilité jouait un rôle significatif sur la variation du niveau d'activité physique chez le fils à travers le temps. Conséquemment, nous avons pu conclure que la perception paternelle quant à la disponibilité des services et des installations communautaires est associée au changement dans le niveau de pratique des activités physiques du fils à travers le temps. En ce qui a trait à la médiation, l'accessibilité ne contribuait pas à expliquer le changement du niveau d'activité physique des garçons et des filles à travers le temps. Ainsi, nous ne pouvons conclure que l'accessibilité joue un rôle de médiation.

Ce mémoire nous a permis d'explorer l'influence des modérateurs et médiateurs de l'activité physique à travers le temps. Le niveau d'activité physique rapporté par les garçons et les filles en 1995 prédisait le niveau d'activité physique rapporté par ces derniers en 1997. Bien qu'aucun effet modérateur ni médiateur ait été observé, nous concluons que la perception des pères face à la disponibilité des services et installations communautaires liés à l'activité physique prédit le change de l'activité physique chez leurs fils.

## Summary

Research has shown that physical activity performed on a regular basis improves cardiovascular fitness, health and some aspects of mental health and emotional well being (Bouchard, Shephard & Stephens, 1994; United States Department of Health and Human Services, 1996). However, the prevalence of physical inactivity is high and is classified as being one of the four major risk factors of Canada's leading killer of men and women: coronary heart disease (Canadian Fitness and Lifestyle Research Institute [CFLRI], 1998).

In an effort to contribute to the advancement of these public health issues, researchers in the area of health promotion and disease prevention have examined determinants of physical activity among the adult population (Dishman, 1994). However, less work has been done on children and youth in regards to understanding physical activity predictors and effective health promotion strategies (Dishman, 1994; U.S. Department of Health and Human Services, 1996).

Due to the dearth of information in the literature concerning physical activity predictors among children and adolescents, the purpose of this study was to examine the role of selected family and community determinants of children's physical activity across time. In order to achieve this end, data analysis on a subsample of a longitudinal cohort was analysed. The families originated from the three sites of the Québec Heart Health Demonstration Project (QHHD). The QHHD is a community-based heart health promotion program conducted in 23 communities across rural, suburban, and inner-city sites in the province of Québec

(Potvin, Paradis, Laurier, Masson, Pelletier & Lessard, 1992). Of the 1274 Québec families with a child of 9 or 10 years of age who agreed to participate, we received complete data on all the variables of interest in a sub-sample of 361 two-parent families, specifically those of 184 girls and 177 boys. The mean age for the girls was 9.75 years and 9.77 years for the boys. The analytical framework proposed by Baron and Kenny (1986) was applied to examine the moderating and mediating roles of family/community variables, such as support and accessibility, on physical activity change across time.

Analyses revealed surprising results. Contrary to what was proposed, social support did not moderate or mediate changes in physical activity across time although social support did predict activity cross-sectionally in girls. In addition, our study revealed differences in amount of support given to girls versus boys. It was found that boys received more support from their moms' than girls. We were unable to conclude that social support reported by the parents is associated with children's physical activity change across time. As for mediation, social support had no explanatory value on the physical activity change across time in either boys or girls.

As for accessibility, there were significant findings, although none demonstrated moderator or mediator properties. Accessibility, as reported by the father, was shown to be a significant predictor of son's change in physical activity across time. Therefore we were able to conclude that knowledge of the community services and facilities as reported by the father, is associated with son's physical activity change across time. As for mediation, accessibility had no



explanatory value on the physical activity change across time in either boys or girls. Thus we cannot conclude that accessibility plays a mediating role.

This thesis allowed us to explore the moderator and mediator paths influencing physical activity across time. Physical activity reported in 1995 predicted physical activity reported in 1997 in both boys and girls. Although no moderation or mediation was observed, we still can conclude that a father's knowledge of community services and facilities may play a role in predicting future physical activity in boys.

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List of Abbreviations

PA 97 = Physical activity reported in 1997

PA 95 = Physical activity reported in 1995

Sup(mom) = Social support as reported by mother

Sup(dad) = Social support as reported by dad

Acc(mom) = Mother's reported knowledge of accessibility to community services

Acc(dad) = Dad's reported knowledge of accessibility to community services

DumLVL = Dummy variable identifying the Laval site

DumMTL = Dummy variable identifying the Montreal site

H.R. Max. = Maximum heart rate



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I dedicate my thesis to two very important guys  
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Thank you for all the love and kisses

## **Chapter 1: Introduction**

Family determinants of children's physical activity: A rationale

Research has shown that physical activity performed on a regular basis improves cardiovascular fitness, health and some aspects of mental health and emotional well being (Bouchard, Shephard & Stephens, 1994). In this regard, a wide range of positive physiological benefits of physical activity has been demonstrated in the literature (e. g. better weight management, decreased risk of cardiovascular disease, improved blood lipid profile; Pate, 1995; U.S. Department of Health and Human Services, 1996). However, the prevalence of physical inactivity is high and is classified as being one of the four major risk factors of Canada's leading killer of men and women: coronary heart disease (Canadian Fitness and Lifestyle Research Institute (CFLRI), 1998). The United States Center for Disease Control and Prevention cites inactivity as the most significant risk factor for coronary heart disease, as well as playing an emerging role as a risk factor for colon cancer, breast cancer, and lung cancer (United States Department of Health and Human Services, 1996).

Taken together, the above statements support the legitimacy of developing strong efforts to promote regular physical activity across a vast segment of the population as an aid to chronic disease prevention and health promotion. Towards this end, in August 1997, the federal-provincial/territorial ministers for fitness, active living, recreation and sport approved and endorsed an action plan entitled *Physical Inactivity: A Framework for Action*. The target set by in this framework is to reduce by 10% the number of Canadians that are presently inactive over a five-year period from 1998 to 2003.

Taking this rationale into the realm of children and youth, two major public health issues arise with respect to physical inactivity in this subgroup. Firstly, the prevalence of obesity has been increasing in children leading to long-term health concerns associated with obesity in adulthood (Whitaker, Wright, Pepe, Seigel & Dietz, 1997). Thus, prevention of obesity in early childhood and in adolescence appears essential and physical activity can contribute to this end. Secondly, physical inactivity in early childhood and in adolescence has been found to be a predictor of adult inactivity (Whitaker, et al., 1997). Hence, promoting activity in our sedentary youth is a priority. It is clear that a different strategy or series of strategies for promoting physical activity in children, ones that combine programs in and outside of schools will have to be developed. Public health research must be geared to changing this detrimental path and to understand the major predictors leading to physical activity at an early age.

In an effort to contribute to the advancement of these public health issues, researchers in the area of health promotion and disease prevention have examined determinants of physical activity among the adult population (Dishman, 1994). However, less work has been done on children and youth in regards to understanding physical activity predictors and effective health promotion strategies (Dishman, 1994; U.S. Department of Health and Human Services, 1996). Nevertheless, a cursory look at the literature shows some promising beginnings. One widely documented statistic is that the prevalence of a physically active lifestyle is higher in male youth compared to female children and adolescents. In addition, work completed by Garcia, Norton Broda, Frenn, Coviak, Pender and

Ronis (1995) has indicated that boys have a tendency to participate more frequently in moderate to vigorous physical activity than do girls. Furthermore, Lewko and Ewing (1980) have stated in their paper on parental influences that parents tend to respond to males and females in a sex stereotypic fashion in the area of games and play. Males are encouraged to participate in more active pursuits outside the home whereas females are reinforced to engage in sedentary activities within the confines of the home. School-based primary prevention programs have been shown in the literature to be effective in reducing children's dietary fat intake and in increasing their self-reported levels of physical activity (Parcel, Simons-Morton, O'Hara, Baranowski, Kolbe & Bee, 1987).

Though the studies have contributed useful information to health promotion and disease prevention, gaps as to explaining why physical inactivity in youth is so prevalent today still exist and thus, warrant further study. Notably, little is known about the influence of the family and community environments on activity involvement. For instance, it is not known whether or not certain family environments will promote positive attitudes and behaviours towards physical activity. Similarly, the extent to which physical activity at an early age result in a better chance of becoming physically active in the future is relatively unexplained. The idea that accessibility to physical activity services may play an intricate role in whether children become and maintain an active lifestyle has not been examined. These issues and others must be answered in order to provide a solid framework for additional research in the advancement of this important public health issue.

Due to the dearth of information in the literature concerning physical activity predictors among children and adolescence, the purpose of this study will be to examine the role of selected family and community determinants of children's physical activity across time. More specifically, some of the literature supports the idea that health behaviour changes occur during late childhood and early adolescence, and that behaviour-specific family environments including family rules, family support, and accessibility are related to certain health behaviours (Soubhi & Potvin, 1996). However, more work has to be done on whether these behaviour-specific family environments lead to increases in physical activity. More specifically, the question of how the family environment plays a role in supporting physical activity will be explored. Secondly, the question of whether accessibility to physical activity services provided by the community (e. g. parks, public pools, and bicycle paths), play a significant role in the life of the child will also be examined.

Rather than simply exploring the existence of direct relationships between family/community variables and physical activity, the current thesis will adopt the analytic framework proposed by Baron and Kenny (1986) to examine the moderating and mediating role of family/community variables on physical activity change across time. That is, in their landmark paper, Baron and Kenny proposed that a moderator is "a qualitative or quantitative variable that affects the direction or strength of the relation between the independent or predictor variable and a dependent or criterion variable." (p.1174). Conversely, a mediator variable is "a variable that accounts for the relation between the predictor and the criterion

variable.” (p.1176). As described later in this document, they also propose statistical strategies for determining how to test the properties of moderating and mediating variables. Uncovering moderator and mediator variables is the cornerstone of theory development. Therefore, in addition to examining the direct effects of family support and accessibility to community resources, we also examined their role in moderating/mediating the change in activity across time.

The data used for this study were collected from a unique cohort of families originating from the three sites of the Québec Heart Health Demonstration Project (QHHD). The QHHD is a community-based heart health promotion program conducted in 23 communities across rural, suburban, and inner-city sites in the province of Québec (Potvin, Paradis, Laurier, Masson, Pelletier & Lessard, 1992). Variables describing family characteristics and behaviour-specific family environments were collected from a cohort of 1274 families in 1995. Parents self-reported health behaviours as did their 9 to 10 year old children. A follow-up assessment was performed on the same families’ two years later (children now 11 to 12 years old). At each time period, questions were addressed about behaviour-specific family environments and accessibility of physical activity services and facilities.

It is proposed that any positive changes in the child’s level of physical activity over a two-year follow-up period will be related to more supportive families and greater accessibility of facilities in community environments once level of physical activity two years earlier is controlled. Furthermore, analyses will allow for an exploration of whether the family environment acts as a moderator and/or as



a mediator of changes in physical activity across a 2-year period. A strong positive family environment is proposed to be associated with greater increases in participation in physical activities. However, more interestingly, it may be that social support affects the direction or strength of the relationship between physical activity reported in 1995 and physical activity reported in 1997. Support may be associated with a consistent pattern of increases in physical activity across time, whereas lack of support may be linked to decreases in physical activity across time, thus indicating moderation. In contrast, it may be that social support accounts for the relation between physical activity reported in 1995 and physical activity reported 1997, where higher activity in 1995 will incite greater support, which in turn may lead to greater activity in 1997, thus indicating mediation.

Secondly, it is proposed that any positive changes in a child's level of physical activity over a two year follow-up period will be positively related to accessibility to services provided by the community (e.g. parks, public pools, bicycle paths) and to the availability of a parent driver. However, accessibility to services provided by the community could also act as a mediator, or a moderator of childhood physical activity. For example, having access to public bicycle paths may affect the direction or strength between physical activity reported in 1995 and physical activity reported in 1997, thus accessibility may be a moderating variable to predict physical activity over-time. In addition, having access to public bicycle paths may account for the relation between physical activity reported in 1995 and physical activity reported in 1997, thus accessibility may be a mediating variable to predict physical activity over-time.

## **Chapter 2: Review of Literature**

## Physical Activity in Children: Determinants and Interventions

### Statement of Problem

A significant amount of research has been performed to explain human behaviour. The topic of promoting physical activity in the population has captured the attention of researchers in psychology, public health, and health promotion. The anticipated outcomes of these efforts would be a solid knowledge base from which physical educators, health professionals and public health practitioners may draw upon to develop health promotion and disease prevention programs. In pursuing this end, several approaches have been adopted. Specifically, some researchers have elected to examine correlates of activity involvement; others have examined the viability of selected theories of human behaviour whereas other still have explored the efficacy of a variety of interventions.

The purpose of this review is to identify direct predictors as well as moderating and /or mediating variables that can possibly predict changes in the involvement of physical activity in children across time. Specific variables of interest include social support from the family environment and accessibility to community services and facilities, as these are key predictor variables in this study. Social support is defined as any behaviour that assists another person in achieving desired goals, and it has been subdivided into informational, material, and emotional support (Dishman, 1994). Accessibility is defined as the joint availability of services offered by the community, such as parks, pools, bicycle paths, and gymnasiums and programs (Gauvin, Potvin, Paradis & Mansi, 1997).

In the context of this review, we will therefore focus on this operationalization of accessibility.

In order to achieve the goals of this review, an investigation into certain conceptual models as well as major physical activity interventions that have been conducted in the schools and communities will be performed. As a prelude to the review, a series of definitions of key concepts will be provided as will an outline of the specific behaviors on amounts of physical activity that are the focus of researchers interests.

### Physical Activity: Definition and Public Health Recommendations

#### Definition of Physical Activity

Physical activity is defined as any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above baseline (United States Department of Health and Human Services, 1996). Physical activity is a complex behaviour with many dimensions differentially associated with various disease and health effects. Physical activity can further be described in terms of type, intensity, frequency, and duration. The type of activity can further be devised into aerobic (with oxygen) and non-aerobic (without oxygen), where aerobic is the most frequently prescribed form of activity (i.e. walking, bicycling, jogging etc...). The intensity (% of maximum heart rate) of an activity is of the following three forms: light (<40% of H.R. Max.), moderate (60%-90% of H.R. Max.), and vigorous (>90% of H.R. Max.). Frequency of an activity refers to the number of times (or bouts) one engages in an activity. Lastly, the duration of an activity simply refers to the amount of time (i.e. minutes) one

spends performing the activity (American College of Sports Medicine (ACSM), 1990,1998).

Recent epidemiological studies on the relationship between habitual physical activity and health benefits have stressed the importance of a dose-response relationship (Pate, 1995). The ACSM and other groups have promoted the use of the exercise prescription model to be used in clinical settings, controlled exercise programs, and for the general public (Blair & Morrow, 1998). In 1990, the ACSM identified the recommended dose of physical activity to be as follows: 2-3 times per week for 20 to 60 minutes at a vigorous intensity. This recommendation was then complemented in 1995 to an accumulated amount of moderate intensity physical activity totalling 30 minutes on a daily basis (Pate, Pratt, Blair, Haskell, Macera, Bouchard, Buhner, Ettinger, Heath, King, Kriska, Leon, Marcus, Morris, Paffenbarger, Patrick, Pollock, Rippe, Sallis & Wilmore, 1995; ACSM, 1998). Similar position statements have been issued in Canada and in Quebec (see Canadian Guide for Health and Physical Activity and *La quantité d'activité physique pour la santé*, [www.activeliving.ca](http://www.activeliving.ca) & [www.kino.quebec.qc.ca](http://www.kino.quebec.qc.ca) respectively).

For children, the amount of needed daily physical activity is quite different. The reality of it is that children must expend 8 Kilo-Kcal per day (KKD) in order to attain positive physical activity outcomes (Canadian Fitness and Lifestyle Research Institute (CFLRI), 1998). This energy expenditure equates to approximately 45 minutes of moderate intensity physical activity on a daily

basis, as well as 30 minutes of vigorous intensity physical activity 3 to 4 times per week.

These specific requirements, while appropriate for health, do not reflect the reality of our population. Both adult and youth are only slightly more active today than 10 years ago (CFLRI, 1998). Despite the strong efforts deployed by many health professionals and health organisations, the rate of adherence to more active lifestyles is very low (Dishman, 1994).

Given these statistics, researchers must now focus mainly on determining what type of individual skills and/or situations can and will predict an individual's adherence to a more physically active life. Psychological theories and models can help researchers identify the important factors involved in determining human behaviour and help understand the behaviour of physical activity (Marcus, King, Clark, Pinto & Bock, 1996). We therefore turn to this issue. According to the CFLRI Physical Activity Benchmarks (1998) approximately 59% and 76% of boys and girls, respectively, aged 5 to 17 have been reported to be inactive according to the guidelines presented above. In the context of this review, an effort will be made to examine how selected psychological variables and interventions are associated with changes in these specific behaviors.

#### Conceptual/Theoretical Frameworks

As indicated previously, several conceptual models have been used to better understand physical activity in children. In this review, we limit our description to those models that pertain to key concepts, namely, the Social Learning Theory, Modelling, and the Personal Investment Theory.

Social Learning Theory. Bandura's social learning theory (1986) assumes that personal factors, environmental events, and behaviour function as interacting and reciprocal determinants of behaviour. Social cognitive theory strongly points to the relevance and importance of a supportive environment to performing and maintaining a pattern of regular physical activity. Bandura (1977) proposed that with expectations of personal efficacy (a belief that one can successfully perform the desired behaviour), a person is more likely to engage in the target behaviour. Efficacy beliefs derive from four principal sources: "performance accomplishments, vicarious experience, verbal persuasion, and physiological states." Verbal persuasion is one form of social support. Given that the self-efficacy theory has been successfully applied in explaining exercise behaviour (Dishman, 1994), that the perceived ability to exercise and participate regularly in a structured program seems to be a critical determinant in children's physical activity levels and that social support in the form of verbal persuasion may positively influence efficacy expectations, it seems reasonable to assume that support might be positively associated with activity levels.

Modelling. Children learn by imitating adults (Strasburger, 1992). According to Bandura's social learning theory, children learn new behaviors by observing others, directly in real life and vicariously through the media (Bandura, 1977). Such "modelling" is a key element in the effects television has on adolescents. Strasburger (1992) suggests that television viewing may be a cause to the increase in weight among adolescents. The number of hours spent watching television has been shown to be a strong predictor of adolescent obesity,

with the prevalence increasing by 2% for each hour viewed (Strasburger, 1992). This may simply be derived from the passiveness of television viewing or more importantly, the decreased amount of time left over to engage in physical activity.

Several other researchers have reported similar findings, which indicate that parental and peer support does influence physical activity in adolescents. Anderssen and Wold (1992) examined the different ways parents and peers may influence leisure-time physical activity in young adolescents. Self-reported data indicate that behaviour and encouragement from significant others do exert an influence on the adolescents' participation in physical activity. This finding also supports Butcher's (1983) data that encouragement from significant others is associated with the level of physical activity participation among girls of age 11-16 years. Also, Brown (1985) points out that social support (i.e. encouragement and involvement) from the mother, father, friends, boyfriends, and teammates is related to maintaining participation in organized competitive sports. In addition, fathers and peers were found to be the most important socialising agents in respect to sport involvement for both girls and boys (Greendorfer & Lewko, 1978). Thus, parental modelling also seems associated with childhood activity.

Personal Investment Theory. Personal-investment theory (Tappe, Duda & Menges-Erhwald, 1990) has recently been applied to the study of exercise behaviour. Personal investment theory suggests that there are three subjective meanings to a given situation. Firstly, personal incentives play a major role in why individuals want to engage in a particular physical activity. The incentives themselves or the specific reasons as to why one would engage in an activity have



been shown to significantly predict the persistence and the participation into the activity in both young adults and adolescents (Duda, 1987; 1988; 1989a; 1989b). Secondly, the thoughts, perceptions, beliefs, and feelings experienced by an individual are referred to as the sense of self (Tappe, Duda & Menges- Ehrnwald, 1990). Studies have investigated the role of self-esteem, self-competence, self-reliance, self-motivation, and social support in the area of physical activity. These aforementioned factors seem to be strong and important predictors of physical activity behaviors among adults and adolescents (Mechanic & Hansell, 1987; Roberts, Kleiber & Duda, 1981; Sonstroem & Kamoer 1980). Thirdly, perceived options are seen as available behavioural alternatives and opportunities viewed by the individual. In the context of physical activity, perceived barriers are in essence perceived options (Maehr & Braskamp, 1986; Andrew, Oldridge, Parker, Cunningham, Rechnitzer, Jones, Buck, Caranagh, Shephard & Sutton, 1981; Heinzelmann & Bagely, 1970).

Research in the area of physical activity adherence strongly indicates that perceived barriers are a major determinant of physical activity adherence (Andrew & Parker, 1979; Slenker, Price, Roberts & Jurs, 1984; Tappe, Duda & Ehrnwald, 1989). With physical activity involvement as the desired situation, the three meanings described above may predispose adults and adolescents to physical activity.

Family Health Behaviour Model. Should we emphasise an understanding of individual conceptions of health and physical activity, or should we focus on the family unit instead? Baranowski and Nader (1985) discuss in their chapter

“Family Health Behaviour”, characteristics of families that are important in all phases of health and illness. They also describe several family theories that may be of value in considering associations between health, illness, and families.

They assume that family characteristics such as structure, assigned roles, mode of interaction, resources, family history, life cycle, and individual members, will influence a variety of important health and illness issues over an entire life span.

The first family theory proposed is called the “Family Systems Theory”. Proponents of this theory consider the family to function as a set of objects together along with their attributes. What is important in this theory is to look at the relationship or interaction between the family members rather than the actual content of the relationship of the members themselves. In addition, the theory also proposes that families operate with a set of beliefs shared by each family member. These “myths” or “paradigms” are involved in each of the family interactions. Thus the family, as a unit, will struggle to maintain their “myths” so that they can function normally. This family system can thus promote a healthy condition, or conversely, an unhealthy one. In sum, this family theory emphasises the dynamics of the whole family together and not their individual attributes.

The “Family Stress Theory” is the second theory described in the chapter. In this theory, it is the interaction between the family’s resources and the objective event that will determine the degree of stress that the family will experience. Resources include “financial (economic well being), education (contributing to cognitive ability that facilitates realistic stress perception and problem solving skills), health (physical well being), and psychological resources

(personality characteristics)” (Baranowski & Nader, 1985). Thus, it is within this stress theory that family resources are seen as important factors in aiding in the adaptation to a crisis situation.

The third theory discussed is the “Role Theories”. Here, emphasis is placed on the individual members of the family. Baranowski and Nader (1985) state that it is the role that the family members play that has the greatest impact on a family member’s health and functioning.

Lastly, the “Transactional Model” is discussed. This model is an extension of the family stress model and the role theories. This model gives attention to both the family as a unit and to the characteristics of each family member.

Although there is a large amount of research on the impact of illness on various family members and on the role of the family on its’ maintenance of health, very little has been done in the area of the family and physical activity adherence and participation. We know that a number of family influences appear to be important determinants of the acquisition of childhood physical activity (Stucky-Ropp & DiLorenzo, 1993). Thus, the theories described above may be helpful to future research in the area of physical activity and the family, however it is not clear as to how and to what extent these theories can be of aid (Baranowski & Nader, 1985).

#### Summary of Conceptual Models

Unfortunately, the literature today offers no theory-based comprehensive review of family influence on children’s physical activity habits. Having said

this, it is noteworthy to mention that Baranowski and Nader (1985) have provided models of family, compliance, and disease control relationships. From these models, attempts to explain and understand the relationship between family characteristics and individual health behaviors must be made.

### Determinants and Correlates of Physical Activity in Youth

#### Individual

Understanding the components involved in the initiation and adherence to a physical activity program is still of major concern for health professionals. Why does an individual start participating in physical activity? How does an individual adhere to the activity? What key factors play a major role in the enjoyment and continued participation of the activity? It is known that more than 50% of the individuals starting an exercise program will either abandon it entirely or irregularly continue to exercise (Dishman, 1994). From a public health standpoint, the problem is no longer getting the population to realise the benefits of physical activity but, rather, of drafting strategies that will help individuals adhere to an exercise program once they have embarked on it.

The need to study determinants of physical activity in children has been recognised (Dishman & Dunn, 1988). Although increasing physical activity levels in children can potentially lead to decreases in cardiovascular disease risk factors and increase fitness levels (U. S. Department of Health and Human Services, 1996), we can only hope that the increased level of physical activity participation will carryover into adult life (Stucky-Ropp & DiLorenzo, 1993). Powell and Dysinger (1987) concluded from their study that the content and

quality of childhood experiences might influence adult physical activity participation. Furthermore, they reported that activities not requiring a team effort might be more readily performed throughout life.

Attitudes, knowledge, and beliefs may be strong determinants as to whether children/adolescents will be physically active. A program or class that can enhance a student's belief about their own ability to engage in physical activity may contribute to their enjoyment in the activity (Ferguson, Yesalis, Pomrehn & Kirkpatrick, 1989; also, see previous discussion).

In addition to believing that they can do an activity, children/adolescents must care enough about themselves to want to participate in physical activity. Thus, another determinant of physical activity is self-esteem. Ferguson et al. (1989) conducted a study in two rural Iowa communities. The project surveyed 603 students, 261 females and 342 males, in grades six to eight. The classroom teachers during physical education class administered a survey composed of 45-questions. They were interested in whether student's attitudes towards exercise, attitudes towards physical education, and beliefs about themselves, such as perceived self-esteem, perceived athletic ability, and perceived ability to maintain commitments, were related to current exercise behaviour and intent to exercise. They found self-esteem showed positive and significant correlations with intent and current exercise behaviour. They stated "just being more physically fit can enhance self-esteem if students participate actively in the program". Conclusions to this study indicate that students who perceive physical activity as being beneficial to their health are more likely to intend to do exercise in the future.

Also, students who have positive attitudes about physical education class, have good self-esteem, and who perceive themselves to be able to maintain commitments, are also more likely to intend to do exercise in the future than those who do not show such positive attitudes (Ferguson, et al., 1989; Godin & Shephard, 1986).

Although the findings described above are positive, Dishman (1994) confirms that personality traits are probably not strong influences on children's physical activity. "Knowledge, beliefs, and attitudes about physical activity are in general weak or inconsistent correlates" (Dishman, 1994). Thus, such psychological variables must be studied in relation to children and physical activity as well as how the family influences them.

Gender has also been seen in the literature as another powerful determinant to physical activity in children. Lewko and Ewing (1980) found in their paper on parental influences, that males are encouraged to participate in more active pursuits outside the home whereas females are reinforced to engage in sedentary activities within the confines of the home. In addition, Garcia, Norton, Broda, Frenn, Coviak, Pender and Ronis (1995) also noted in their paper that boys have a tendency to participate more frequently in moderate to vigorous physical activity than do girls. Thus in general it has been shown that males have greater self-efficacy and confidence than girls and are more likely to participate in vigorous physical activity, strengthening activities, and walking or bicycling than females (Troost, Pate, Dowda, Saunders, Ward & Felton, 1996; U. S Department of Health and Human Services, 1996).

Past behaviors, or past habits of participating in physical activity, seems to be another important determinant of physical activity (Godin & Shepard, 1986; Dishman, 1994). The intention to become physically active is probably stronger for someone who was once active in the past, and thus it may be easier for that individual to resume being active. Individuals who are used to being sedentary might find it more difficult to change their behaviour, and thus the decision to begin an exercise regime may require a lot more effort (Dishman, 1994). We can thus safely assume that if children can initiate being active at a young age, the carryover of physical activity participation into adulthood may be facilitated. In addition, getting children to be active will help them as young adults to either resume or maintain an active lifestyle.

There is evidence that attempts are being made to educate our youth. In 1988, the U.S. Centres for Disease Control established a Division of Adolescent and School Health (DASH). Specifically, the primary goals of DASH were to serve four functions. “First, to identify the most significant health risks among youth; second, to monitor the incidence and prevalence of those risks; third, to implement and sustain broad national programs to prevent those risks; and, fourth, to evaluate and improve the impact of these risk prevention programs” (Kolbe, 1990). From this, we see that DASH is making positive efforts to promote healthy living in adolescents; however, no attempts are being made to educate the parents in this area.

According to Kino-Québec (1998), the rate of physical inactivity seems to be very high in adults aged 25-44 years of age ([www.rrsso7.gouv.qc.ca/](http://www.rrsso7.gouv.qc.ca/)

parlons/amenez.htm, 1998). They strongly affirm that the principle reasons for this are lack of time, obligations to the family, and driving children to their sporting activities.

Kino-Québec offered a preliminary solution to this problem after conducting a population survey. They felt that it was mandatory to try and get adults in this age group to become more active since the survey conducted displayed 88% of adults are positively interested in becoming more physically active. The conclusion set forth by Kino-Québec is that if we can get our parents to think about and organize physical activities, it would have a positive impact on the physical activity participation rate in Québec ([www.rrsso7.gouv.qc.ca/parlons/amenez.htm](http://www.rrsso7.gouv.qc.ca/parlons/amenez.htm), 1998).

We can see that efforts are being made to decrease the physical inactivity rate in adults. Thus we must continue to devise strategies to influence parental behaviors (i.e. physical activity) in the context of youth-directed scholastic programs and community interventions because of the impact that parents' behaviors have on adolescent behaviors.

### Family

Although several definitions may hold for the term “family”, it has been defined by Baranowski and Nader (1985) as two or more people who live in the same home, have some emotional bond, and who are interdependent by performing some social tasks in common. We know that it is extremely important to establish whether families have common activity patterns (Freedson & Evenson, 1991). From this, it is highly unlikely that family members will



influence each other's physical activity behaviors if no such common pattern exists (Dishman, 1994). The role of the family has too often been neglected in predicting physical activity in children. There is a general impression that social and family environments may represent important determinants in children's health status (Boyce, 1985).

Several family factors have been related to physical activity in children. Children have shown to be more active when they believed that parents and peers wanted them to be more physically active (Godin & Shephard, 1984). In addition, direct encouragement to get children to become more physically active via the parents seem to be related to higher levels of physical activity in very young children (Klesges, Coates, Moldenhaver, Holzer, Gustavson & Barnes, 1984). Parents play a very important role in the family and are important targets in the area of health education because they act as role models for their children.

A study conducted by Lewko and Ewing (1980) sampled 370 elementary students from three public schools. They hypothesised that in order to become highly involved in sport, both males and females require support and encouragement, from parents in particular, with the need for such influence being more pronounced in females. In order for girls to be active in sports, their value orientation would have to be high because they would be entering a male-oriented achievement setting, and in a sense violating social expectations. Thus, modifying both early parental interactions and stereotyping of sport may contribute to a greater involvement of females in sport.

There seems to be a strong and consistent association between a parent and child's physical activity level. Thus, there is a great deal of optimism about the potential effectiveness of family-based physical activity interventions. However, family-based interventions involving physical activity have not been consistently successful (Dishman, 1994). Epstein (1996) conducted a family-based study that involved children and obesity. He stated, "The family environment can contribute to childhood obesity". Thus, can we make the assumption that the family environment can also contribute to physical inactivity? A study conducted by Klesges, Eck, Hanson, Haddock and Klesges (1990) found that the family risk for obesity (number of overweight parents) and the physical environment were significant predictors of a child's level of physical activity. Furthermore, they concluded that overweight parents were associated with low physical activity levels in young children. Epstein (1996) believes that there is a strong influence in the parent-child relationship, including "parental modelling, arrangement of the environment to promote an active or sedentary lifestyle, and for the encouragement and reinforcing of physical activity patterns". Thus, it may be imperative for parents to be involved in interventions to increase physical activity participation in children. It is believed that the family environment may be the key to the development of several health behaviors in children (Baranowski & Nader, 1985). Pate and Blair (1978) believe that that the key to instilling positive attitudes towards physical activity in children is to have them living in a home where the parents are physically active themselves. Thus, a better

understanding of the family influences on a child's physical activity level needs to be pursued.

### Schools

In general, the most preferred approach to increasing physical activity in youth revolves around implementing programs in the school system. Parents are seen as important targets in the area of health education because they are viewed as important role models for their children. Thus, one may want to roughly define a positive family environment as one with parents who practice what they preach in terms of health behaviors (e. g. physical activity). Crockett (1987) proposes that by disseminating health information to parents via school-based programs, it may be beneficial to the children in four ways. First, children need the support of their parents if they are to implement the behaviour changes they have learned in school. Second, parents can benefit from the information about healthy living themselves. Third, adults may be especially willing to learn about promoting healthy living when they have young children at home. Last, efforts to promote healthful behaviour changes among children may be more effective in interventions that are aimed at attitudes and habits of the family rather than those of individual persons. These four statements, provided by Crockett (1987), do suggest a possible outlet to disseminate information regarding a healthy living behaviour change to both children and parents.

By reaching parents via school-based health information sessions or seminars, we may be able to improve their health status, as well as their children's. Parents can greatly benefit from the health information provided, and

thus reach out to their children through their knowledge and changed behaviors (Crockett, 1987). In this regard, the family unit has been demonstrated to be the most significant influence in sport participation (Higginson, 1985).

However, it should be noted that our school systems are not providing the necessary information to children about healthy living and in fact, the quality of the physical education classes seem to be decreasing over time (U.S. Department of Health and Human Services, 1996). In fact, the ultimate goal of a physical education class should be to promote physical activity participation across a lifetime (Simons-Morton, Taylor, Snider, Huang & Fulton, 1994). The quality of physical education classes may change in time due to an emphasis on health and physical activity (e.g., [www.edu.gov.mb.ca/metks4/curricul/k-s4curr/phyhlth/update.html](http://www.edu.gov.mb.ca/metks4/curricul/k-s4curr/phyhlth/update.html)). Specifically, the Manitoba government has recently made positive attempts to update the physical education curriculum. For example, areas of study within the current health curriculum as well as the percentages of time allocated for physical education/health classes are given. For grades 5 to 8, family life education will account for 19% of the time, community health for 17%, safety for 11%, dental health for 9%, nutrition for 11%, and physical well-being for 16%, and social-emotional health accounting for 17% of the time ([www.edu.gov.mb.ca/metks4/curricul/k-s4curr/phyhlth/attachc.html](http://www.edu.gov.mb.ca/metks4/curricul/k-s4curr/phyhlth/attachc.html)).

The literature shows that diet and physical activity patterns appear to be learned at early ages (Simons-Morton, Parcel, O'Hara, Blair & Pate, 1988), suggesting the need for school-based intervention. In this regard, a project conducted by Simons-Morton, Parcel and O'Hara (1988) targeted the adoption

and implementation of changes in the organisation and practices for school lunch, physical education, and classroom health education. Two of the four elementary schools in the Texas City Independent School District were assigned to intervention conditions and the other two to control conditions. The project included 2 years of intervention and three data collection periods. For children's active physical education, random observations of the type, intensity, and duration of children's physical activity were made by trained observers. The following goals were set: "(1) To increase to 50 % the proportion of class content devoted to general and cardiovascular fitness and (2) to increase the amount of time children engage in moderate to vigorous physical activity to at least 50 % of the minutes available" (Simons-Morton, Parcel & O'Hara, 1988). Observations (at baseline) indicated that students engaged in fitness activities 17.5 % of the 30-35 minutes of available class time. At post-test, results then indicated that students in the experimental schools were engaging in fitness activities 38.0 % (school 1) and 44.1 % (school 2) of 40 minutes of available time. However, students in the control schools were observed to engage in the same activities for only 19.5 % (school 3) and 22.7 % (school 4) of 40 minutes of available time (Simons-Morton, Parcel & O'Hara, 1988). Thus, we can see that preliminary results from this study suggest that physical activity interventions that are implemented in the school system may be beneficial to promoting physical activity in children.

### Community

Communities can be defined structurally as "geographical entities or ecologically, as a set of interactive social and institutional relationships bound

together by a common sense of identity or “community” (King, 1991). The problem with this definition is that it is still difficult to identify what the community entails. From the definition, a community can thus be based on certain institutions, schools, and even religious groups.

A community environment has the potential ability to have major positive impacts on the behaviors of its residents. Community based programs and facilities are essential tools in attracting people to participate in events provided for the public. Understanding that the role of the community is to serve its people, it is difficult to accept that so few communities are integrated in helping the promotion of physical activity. However, it is difficult to accept findings that have been brought forth via community-based studies. Most studies that have been conducted have sampled solely urban communities, thus questioning their generalizability. As mentioned previously, the general focus for assessing and increasing the level of physical activity has been centred toward the school system, and not through the community. In short, schools serve as accessible, and economical ways to attain a youth population in regards to increasing levels of physical activity. However, communities have a vast array of outlets that often seem to be overlooked. Communities have launched youth programs and clubs such as aerobic dancing, walking, aerobics, bicycling, social dancing and many other activities including structured team sports, that it is almost puzzling as to why there has not been any increases in the rate of physical activity participation. One reason as to why the population still remains sedentary today is the high degree of automation.

The U. S. Department of Health and Human Services (1996) discuss how community-wide prevention programs have evolved from the concept that “ a population, rather than an individual, approach is required to achieve primary prevention of disease through risk factor reduction.” Before accepting this statement, we must question this approach carefully and thoroughly. Despite the relevance of examining community factors, few if any studies have documented the influence of community variables on children’s physical activity.

### Intervention Studies

#### Promotion of Physical Activity

Promoting physical activity and a healthful diet among children seems to be the major area of concern for most health practitioners. According to Simons-Morton, Parcel, Baranowski, Forthofer and O’Hara (1991) childhood diet and physical activity may lead to an increased risk for cardiovascular disease in adulthood. They suggest that school is an ideal setting to promote a healthful diet and physical activity. Their study was an ancillary project to the previous study mentioned. Thus, it was designed to influence the school environment in terms of effect on student diet and physical activity at school. Again, the Texas City Independent School District was selected for the study. Two of the four elementary schools were assigned to intervention and two to control conditions. Third and fourth graders were assessed annually during three spring data collection periods. Analysing the nutrient contents of lunches, conducting 24-hour dietary recalls, and observing the participation rate of students’ physical activity during physical education classes assessed the effects of the program. In

particular, results (at baseline) for physical activity showed that the mean moderate-vigorous physical activity (MVPA) participation for third and fourth graders was less than 3 minutes at each school. However, at post-test, mean minutes increased for school 3 to 11.7 minutes (3<sup>rd</sup> grade) and 15.0 minutes (4<sup>th</sup> grade), and in school 4 to 16.2 minutes (3<sup>rd</sup> grade) and 16.1 minutes (4<sup>th</sup> grade) per class (Simons-Morton, et. al., 1991). The results of this intervention show positive program effects on physical activity. As indicated previously, children's physical activity in the intervention schools was much higher at post-test than at baseline. In summary, this study suggests that schools are potentially important sites for improving children's physical activity participation.

Simons-Morton, O'Hara, Simons-Morton and Parcel (1987) have shown in their study that physical education programs, which have focused on making the class enjoyable, may enhance a child's intent to be physically active. However, there was no mention as to whether or not the information provided by the physical education class was relayed back to the home to the parents. In addition to enjoyment, Ferguson et al. (1989) found that physical education programs that seem to enhance a student's own personal belief towards their ability to perform an exercise could possibly influence their intent to exercise in the future. As stated by Bandura (1977), "Persistence in activities that are subjectively threatening but in fact relatively safe produces, through experiences of mastery, further enhancement of self-efficacy and corresponding reductions in defensive behaviour... The more dependable the experimental sources, the greater are the changes in perceived self-efficacy." Although self-efficacy is an



important variable that must be emphasised in physical education programs, so should the idea that health behaviour habits can be altered positively.

The intended message provided by the education system to the students should have a primary goal of decreasing physical inactivity and promoting an individual's determination to change unhealthy habits. This is especially true for families who have children who do not participate in physical activity on their own. By modifying school lunches, implementing activity-oriented physical education and discussing health education in classrooms, Simons-Morton, Parcel and O'Hara (1988) found that a large number of children could be influenced via the school system, thus understanding the importance of the development of early patterns of physical activity participation. From this, we can see that the school system can and should become the future major focal point in the area of health behaviour change. To ensure that the information provided by the physical education class has been instilled at home, and that the information has had a relevant impact on the students in terms of behaviour change, parents must be kept well informed.

An important factor that must be looked at within the school system's physical education curriculum is whether or not the students are getting the opportunity to participate in moderate to vigorous physical activity each day of the week (Simons-Morton, Parcel, O'Hara, Blair & Pate, 1988). The basic function of a physical education class is to engage the students to participate and enjoy moderate to vigorous physical activity. However, a majority of the physical education programs devote a major portion of the class to technically structured

sporting events. Not enough time is devoted to encouraging students to participate in moderate to vigorous physical activity. Due to the fact that physical education accounts for almost 50% of a student's total daily physical activity (Simons-Morton, et al., 1991), the lack of moderate to vigorous physical activity in the physical education class is of great concern. Studies have indicated that students in physical education classes that use a specially trained teacher spend greater amounts of the class time being inactive (Metzer, 1990; Silverman, 1991). In a study conducted by Parcel, et al. (1987), the average time available in a physical education class that could be devoted to physical activity was shown. Through the assessment of student behaviour with pre and post-assessments, the following measures were collected. Management and organisation of the class occupied 11.4 minutes; instructions took 3.0 minutes; skill practice took 4.7 minutes; games/ sports/ free play took 9.6 minutes; non-aerobic fitness took 4.0 minutes; and aerobic fitness took 2.1 minutes, for a total time of 34.9 minutes for the entire physical education class. What is most surprising from these data is that although 17% of the time was related to physical activities, only 6.1% of this time was potentially aerobic in nature. Children are only participating in aerobic activity for 2.1 minutes. This example is certainly not meeting the guidelines set for habitual physical activity.

Engaging in continuous aerobic activities may be typical for some adults but less likely for children. However, if children are to be more active, they are most probably going to be so by combining sport, free play and transportation. These combinations of activities are adequate in terms of physical activity, but

they must meet the recommended guidelines stated by the American College of Sports Medicine for them to provide any positive health benefits. Schools have more influence on the lives of children and adolescents than any other social institution other than the family. The ultimate goal of physical education classes should be to promote participation in physical activities over the learning and perfecting of specific agility skills and sports. However, it is very difficult to understand the attitudes towards physical activity outside of school. Will physical activity participation rates outside of school improve once students start to learn and use the information provided by the school regarding a healthy lifestyle? By providing opportunities for physical education classes to incorporate more moderate to vigorous physical activity, physical education classes may therefore be a contributor to reducing the prevalence of physical inactivity.

The basic assumption underlying the major goal of physical education instruction seems to be that children with high fitness levels will have good attitudes toward physical education and subsequently develop active, healthy lifestyles. A study conducted by Sherill, Holgrin and Caywood (1989) examined differences in self-concepts and attitude toward physical education in children of grades 4 & 5 who scored high and low in physical fitness. The Children's Attitude Inventory Toward Physical Education and the Children's Self-concept Scale were used to measure attitude and general self-concept respectively. Significant findings showed that girls high in fitness had higher attitude and self-concept scores than boys low in fitness. Highly fit boys had higher self-concepts

than boys low in fitness. However, should fitness be the most important goal of physical education instruction?

In both the United States and Canada, childhood sport programs are receiving increased attention, and in particular the extent to which females are active participants (Lewko & Ewing, 1980; Higginson, 1985; Garcia, Broda, Frenn, Coviak, Pender & Ronis, 1995). Little has been done in the literature on examining the role of specific family members and their influence on both male and female children. The family environment is instrumental in determining children's sport involvement, particularly the parents (Orlick & Botterill, 1975; Watson, 1975; Snyder & Spreitzer, 1976). It has been frequently hypothesised that "significant others", particularly parents, act as role models thereby having a major influence on the socialization of children into sport (Godin, Shephard & Colantonio, 1986). Parents tend to respond to males and females in a sex stereotypic fashion in the area of play and games. Males are encouraged to participate in more active pursuits outside the home, whereas females are reinforced to engage in sedentary activities within the confines of the home (Lever, 1976; Saegert & Hart, 1977). Thus, if we can identify a family member who has an influence that varies according to the level of child involvement, a major facet in the socialization of sport may potentially be identified.

#### Physical Activity Counselling

Physical activity counselling may be an effective method in improving physical activity levels at all ages, "In most health behaviour areas, face-to-face counselling has been considered the sine qua non for achieving behaviour

change” (Dishman, 1994). Counselling allows one to assess and evaluate goals that have been set over time. Personalized attention and care is given to the individual based on their physical health rather than their mental health. Although strong emotions may arise during some of the counselling sessions, specialized health professionals are there to discuss the difficult obstacles and barriers that often arise when attempting to become more physically active. Physician advice to patients has been shown to be associated with increased levels of physical activity participation (Lewis & Lynch, 1993). Although working with medical practitioners initially may be seen as a problem, many health professionals are available to work one on one at the community level. However, it is up to the community to recognise individual counselling as an important tool. The ultimate goal is to combine the activities already being provided by the communities with individualized counselling sessions. If communities all over the country were to implement this individualized strategy to decrease sedentary lifestyles, a significant number of people would improve their quality of life by experiencing the positive health benefits associated with physical activity (King, 1991).

Unfortunately though, results of community-based interventions to increase physical activity have been generally disappointing. Statistical approaches and measurement of physical activity has varied a lot across many of the studies, making comparisons difficult. In addition to offering setting-specific programs, a number of community organisations sponsor annual community-wide exercise events such as races and fun runs or walking events (Dishman, 1994).

Such events are effective at increasing community awareness concerning physical activity (Dishman, 1994), but is it enough?

Schools offer an almost population-wide setting for promoting physical activity to young people because most young people between the ages of 6 and 16 years attend school. School-based interventions such as SPARK (1993) and CATCH (1996) have been shown to be successful in increasing levels of physical activity (Stone, McKenzie, Welk & Booth, 1998). In the following paragraphs, an overview of many small and large-scale interventions will be discussed. The following interventions include physical activity and dietary habits as the principle variables of interest.

#### Small-Scale Interventions

Go For Health. Go For Health is a three-year school health promotion project that was designed to reduce cardiovascular disease risk factors in elementary school children. A cohort of 409 boys and girls (grades 3 and 4) were recruited in four schools located in one district in Texas. This quasi-experimental study was composed of two intervention schools and two controlled schools. The intervention groups focused on the Social Learning Theory, with emphases placed on curriculum, physical education, and school lunches (Stone, et al., 1998). Knowledge, attitude, self-efficacy and self-reported physical activity, as well as observed physical activity in physical education classes, were the proposed variables to be measured. The project had set two major goals: "1. To implement changes in school policies and practices to support increased aerobic physical activity and improved cardiovascular-healthy food preparation 2. To increase

daily aerobic physical activity and cardiovascular-healthy eating practices of third and fourth grade children.” (Parcel, et al.1987; Parcel, Simons-Morton, O’Hara, Baranowski & Wilson, 1989; Simons-Morton, et al. 1991; Stone, et al. 1998). Days for data collection were randomly selected. Measurement of physical activity was based on observations made during physical education classes and at recess. Data showed that the percent of available time per physical education class was devoted to the following areas: “32.8% of the class was devoted to management and organisation; 41% was devoted to games, sports, free play, and skills; 17% was devoted to fitness activities of which only 6.1% were in activities that were potentially aerobic; and 11.4% in other fitness activities.” (Parcel, et al, 1987). From this, we can assume that cardiovascular fitness in children can be improved if we can make fitness a primary focus in the physical education curriculum.

School Health Policies and Programs Study. The School Health Policies and Program Study (SHPPS) was implemented by the Centers for Disease Control and Prevention (CDC) in 1994. The purpose and rationale for the SHPPS was to describe the health status of youth and the role that schools and school health programs play in acknowledging the health related needs of students (Kann, Collins, Pateman, Small, Ross & Kolbe, 1995). Specifically, SHPPS was designed to answer the following questions: “1. What is the current status of five components of the school health program (health education, physical education, health services, food services, and health policies prohibiting tobacco use, alcohol and other drug use, and violence) at the state, district, school, and classroom

levels nation-wide? 2. Who is responsible for delivering each component of the school health program? What collaboration occurs among components? 3. What is the relationship between state and district policies and school programs and services? 4. What facilitates and prevents the delivery of quality school health programs?" (Kann, et al., 1995). As for now, the ultimate success of SHPPS will be determined by the degree to which it stimulates positive changes in school health programs. Results are forthcoming (Kann, et al., 1995).

#### Large-Scale Interventions

The Minnesota Heart Health Program (MHHP). This program began in 1980. The MHHP is a community-based research intervention project aimed at reducing coronary risk across targeted communities (King, 1991). The general goal has been to increase physical activity and to decrease barriers of regular physical activity. The program has influenced exercise patterns in the communities. First, the program focuses on increasing community organisation efforts through the establishment of a task force comprised of community leaders and relevant organisations. Secondly, the program focuses on the mounting of community-wide mass media campaigns to increase awareness and knowledge. Thirdly, the focus of the program is to implement screening methods to provide individual feedback and incentives for change. Fourthly, focus is aimed towards targeting specific audiences, including youth and their parents, health professionals, and work environments. Lastly, the program focuses on using more general campaigns aimed at the community at large (King, 1991). This comprehensive community approach to increasing physical activity has been



successfully implemented in three different communities, therefore supporting the use of such approaches to other communities (Jacobs, Luepker & Mittelmark, 1986).

Although children and adolescents were not the target population in the Minnesota Heart Health Program (MHHP), it was still an important intervention to discuss. By attempting to modify health behaviors in adults, we can only hope that the modified behaviour will eventually be instilled into children and adolescents. However, an ancillary study to the MHHP was done called the Class of 89 Study. This population-wide study involved 2,376 students from seven schools in three intervention communities. The study began in 1983, and all six graders were invited to participate. Seven annual measurements were taken using the same students. Self-reported data on health-related behaviors (i.e. hours of exercise/week, duration, and intensity of exercise) were collected. Results over the seven-year trial showed higher levels of physical activity in females as well as in males, but these results showed small declines in physical activity over time. Thus, suggesting that behavioural education in schools and community-wide strategies can possibly produce improvements in adolescent physical activity, particularly in girls (Kelder, Perry & Klepp, 1993; Stone, et al. 1998).

Family Health Project (FHP). The Family Health Project (1989) was a community-based intervention program involving 206 San Diego families composed of boys and girls of bi-ethnic origins, mainly Hispanics and Caucasian families (Stone et al., 1998). The cohort for this experimental study used randomly assigned families from 12 local schools. Students in grades 5 and 6

were asked to participate. The intervention itself was based on the social learning theory (Bandura, 1977) in attempts to use the school curriculum to promote a positive diet (good nutrition and good eating habits) and increased physical activity in families. Specifically, target measures of increased knowledge and beliefs about health, and increased levels physical activity and fitness were of primary interest. Self-reported measures for knowledge and beliefs about health and physical activity were taken. Results of the study showed a significant increase in children's knowledge of cardiovascular health. However, no significant increase in the fitness or physical activity levels in children was found (Nader, Sallis, Patterson, Abramson, Rupp, Senn, Atkins, Roppe, Morris, Wallace & Vega, 1989).

Child and Adolescent Trial for Cardiovascular Health (CATCH). CATCH is a school-based intervention program with a sample size of 5,106 boys and girls of multi-ethnic backgrounds. The cohort for this experimental study was recruited among 96 schools in California, Los Angeles, Minnesota, and Texas. Of these 96 schools, 56 were assigned to the intervention group and 40 to the controlled group (Stone, et al., 1998). Of interest, the intervention focused on activity by looking at physical activity patterns in physical education classes, assessing self-reported physical activity questionnaires, and conducting fitness tests. Specifically, the intervention was based on the social cognitive theory proposed and the organisational change theory. Additional aspects of the intervention focused on the health curricula, dietary components of lunch, physical education programs, and the family. The goals of CATCH were to 1.

Increase moderate to vigorous physical activity in physical education classes 2. Increase out of school physical activity 3. Improve overall cardiovascular fitness in the students. Results indicated an increase in moderate to vigorous physical activity levels for the students during physical education classes. In addition, an increase in vigorous physical activity was seen outside of school for the intervention schools. However, no fitness changes were observed (Luepker, Perry & McKinlay, 1996; McKenzie, Nader & Strikmiller, 1996; Stone, et al., 1998).

The family was an important aspect of the CATCH intervention. It involved a home curriculum of activity packets that complimented the schools' curriculum (Luepker, et al., 1996). Adult participation was required to complete the packets that were sent home with the students. Over the three school years of the intervention, nineteen activity packets were given. Scorecards were given for recording completed home activities. These cards were used for rewards to encourage family participation. Furthermore, the CATCH intervention had a "family fun night" where students were able to invite their family members. The fun nights consisted of booths with healthy snacks, distribution of nutritious recipes, dancing, and games (Luepker, et al., 1996). Results of CATCH in terms of the family were modest. The CATCH was able to obtain 70% of the participation by parents during the three-year intervention (Luepker, et al., 1996). However, the participation was limited to working on at least one of five to eight activity packets each year with their children, and to attend the family nights (Luepker, et al., 1996). These findings suggest that a family-based program may need to be more extensive and/or intensive in implementation.

Sports, Play and Active Recreation for Kids (SPARK). SPARK (1997) is another school-based intervention program with a sample size of 955 boys and girls (grades 4 and 5) who come from middle and upper socio-economic statuses. The cohort of this quasi-experimental study was recruited in 7 schools in San Diego. Of these 7 schools, 4 were assigned to the intervention group and 3 were assigned to the control group. Of interest, the intervention focused on specialist-led and trained teacher-led physical education classes. As with CATCH, SPARK focused on the social cognitive theory, but also looked at self-monitoring. For this intervention study, SPARK chose to use personnel (physical education specialists) other than the existing school staff to deliver all or part of the intervention. Specifically, the intervention group was taught by physical education specialists and the control group was led by the regular physical education teachers (Stone, et al., 1998). Physical activity in physical education classes, self-reported physical activity questionnaires, and fitness tests were the three sources of measurement. The goal of SPARK was to 1. Increase physical activity in physical education classes 2. Increase out of school moderate to vigorous physical activity 3. Improve fitness scores. Results showed that both specialist-led and trained teacher-led physical education classes provided additional moderate to vigorous physical activity during physical education classes. However, there was no change in out of school physical activity levels or in any self-monitoring (Sallis, McKenzie, Alcaraz, Kolody, Faucette & Hovell, 1997; McKenzie, Sallis, Kolody & Faucette, 1997).

## Summary

In this concise review of intervention programs, designed for both schools and communities to try and increase physical activity levels in children, one major weakness holds true. None of the above interventions take into account any family influences such as family support, rules and accessibility to possibly play an important role in physical activity levels of children and adolescents. As pointed out, the family environment plays an important part in forming habits for children and adolescents to retain. It is imperative that the family environment be presented and taken in a positive manner to get its full benefits across.

### Overall Methodological Strengths and Weaknesses

The major problem concerning the aforementioned correlational and intervention studies has to do with their methods. When family influences are examined, the majority of studies look at children's perception of parent's physical activity as well as other related health habits. Actual measures are not taken from the parents themselves. Measures are taken based on what children say and interpret about their parents.

## Design

Of the studies reviewed, three of the interventions were quasi-experimental studies (nonrandomised). CATCH was the only randomized study that was reviewed. Biases can arise when self-selection is employed to assign interventions to the subjects. With randomization, the subjects are assigned to the intervention at random. Randomization tends to eliminate the influence of nonessential factors not under the direct control of the experimenter and thus may

lead to a bias (Daniel, 1995). Thus, we can only hope that more recent studies include more randomized trials when feasible.

The majority of recent studies also address multiple behaviors with diet being the behaviour most often coupled with physical activity. This is not necessarily a negative component for future research. However, careful thinking must go into the designing of the interventions to ensure proper intent and execution of the study.

### Sample Size

A required sample size depends on a number of issues, including the desired power, alpha level, number of predictors, and expected effect sizes. The simplest rule of thumb proposed by Tabachnick and Fidell (1996), is to use  $N > 50 + 8m$  where “m” is the number of independent variables for testing the multiple correlation and  $N > 104 + m$  for testing individual predictors. In either case, all sample sizes reviewed above seem to respect this rule and have an adequate number of subjects.

### Indirect Measures

Few studies have focused on families in general. Specifically, looking at the family environment as a possible predictor to physical activity participation in children has been overlooked. In addition, accessibility to public and community services may be another important, yet often disregarded variable that could strongly influence the levels of physical activity participation in children.

However, some work has been done in the area of how the family environment influences physical activity in the home with the children present. Other studies

have examined the relationship between the health behaviors of the parents and the health behaviors of their children. Often, there is a positive correlation between the parents' behaviors and the behaviors of the children (Dielman, Leech, Becker, Rosenstock, Horvath & Radius, 1982; Perry, Luepker, Murray, Hearn, Harper, Dudovitz, Maile & Smyth, 1989; Peruse, Leblanc, Leblanc & Bouchard 1988). In 1991, Freedson and Evenson examined the relationship between parents and their children's physical activity levels in 30 families. They found that when both parents were highly active, so were the children. Furthermore, Gottlieb and Chen (1985) found in their multivariate study of teenagers, that parental physical activity was the most powerful predictor of childhood physical activity. Looking at the child body mass index (BMI), teacher-rated Type A behaviour, parent-reported mother and father BMI, parent vigorous activity, and family cardiovascular disease risk, Sallis, Patterson, McKenzie and Nader (1988) were able to conclude, in their study involving 33 low-income pre-school children, that family variables may influence a child's physical activity level even when a child is away from the family. These studies suggest that parental role modelling may play a major role on a child's physical activity level. This role modelling may extend out to settings far away from home during a child's free-play time. When positive support is present in the family, individuals are more likely to participate in regular physical activity (Dishman, Sallis & Orenstein, 1985; Sallis, Hovell, Hofstetter, Faucher, Elder, Blanchard, Caspersen, Powell & Christensen, 1989). Strong family support has demonstrated higher fitness levels among family members (Ferguson, et al. 1989).

As described above, research that has been done on physical activity within the family environment implies the importance of the role that the parents must take for proper health promotion efforts in the community. However, contrary to the positive relationship between parents and children regarding physical activity involvement, some studies have indicated that there has been no significant correlation between parental and childhood physical activity (Sallis, Alcaraz, McKenzie, Hovell & Kolody, 1992). Sallis, et al. (1992) showed in their study, using 297 elementary school children, that there was no significant relationship between the activity levels of the parents and that of their children. In addition, McMurray, Bradley, Harrell, Bernthal, Frauman and Bangdiwala (1993) conducted a study using a subset of healthy children and parents from 18 elementary schools in North Carolina. Data was collected from self-reported activity questionnaires completed by the children. The Exercise Benefits Barriers Scale (Sechrist, Walker & Pender, 1987) provided measures for parental attitude toward exercise. The results suggested that parental exercise habits are not associated with the child's activity habits, indicating that parents actually have little effect on the participation and physical active habits of their children.

#### Summary and Conclusions

From what has been reviewed, there is a definite dearth of information concerning specific antecedents of physical activity in both children and in adolescents. Of greater concern, statistical and methodological approaches adopted by many researchers in health related areas include shortcomings (Smith, Moffat, Gelskey, Hudson & Kaita, 1997). In particular, proper sampling methods



are often neglected. In addition, a great amount of the studies found in the literature concerning physical activity has been demonstrated through observational, rather than experimental studies. Of particular interest, no published studies have examined extensively the impact of moderators and mediators variables on physical activity participation. The moderator and mediator approach described by Baron and Kenny (1986) does justice to this problem. Researchers can use this method in analysing multiple regressions or in structural equation modelling with special emphasis on the interactions occurring within the regression itself. Presently, we do not know whether positive family environments or accessibility to community services can predict physical activity, however we do know that the methodological approach that will be utilised to determine the results for this thesis have come from a solid landmark paper by Baron and Kenny (1986).

We know that physical activity in adolescence is correlated with physical activity in young adulthood (Risto & Xiaolin, 1997). Can we thus assume that physical inactivity in adolescence is correlated with physical inactivity in young adulthood? By targeting adolescents who have a particularly high risk of becoming physically inactive adults, physical activity interventions and community programs can be devised to help reduce the incidence of a sedentary lifestyle in adult years. If we were to develop useful and appropriate interventions that are geared specifically towards increasing the level of physical activity in our children, we may be able to prevent a lifelong habit of adult inactivity and increased health risk behaviors. Should we then develop physical activity

interventions directly through school programs, or should we work with the family and community environment as principle sources of disseminating positive health information to the adolescent? Some of these questions may be addressed through the current set of analyses.

This thesis proposes that any positive changes in a child's level of physical activity over a two-year follow-up period will be related to more supportive families and greater accessibility of facilities in community environments. Anderseen and Wold (1992) support this proposal when they examined the different ways parents and peers may influence leisure-time physical activity in young adolescents. They concluded that behaviour and encouragement from significant others do exert an influence on the adolescents' participation in physical activity. Butcher (1983) also demonstrates that encouragement from significant others is associated with the level of physical activity participation among girls of age 11-16 years. Furthermore, Brown (1985) points out that social support (i.e. encouragement and involvement) from the mother, father, friends, boyfriends and teammates is related to maintaining participation in organized competitive sports. Fathers and peers were found to be the most important socialising agents in respect to sport involvement for both girls and boys (Greendorfer & Lewko, 1978). These findings support the proposed idea that a more supportive family and access to facilities in the community will have a positive impact on a child's level of physical activity.

## **Chapter 3: Methods**

## Methods

### Participants

Cohort. The cohort for this study originated from the Québec Heart Health Demonstration Project (QHHD). The cohort was assembled in the spring of 1995 and was followed-up in 1997. Families (n=1274) were recruited from 23 communities across rural, suburban, and inner city sites in the province of Québec. Measurements on a series of variables describing family characteristics and behaviour-specific family environments were collected in 1995 from parents along with self-reported health behaviours in parents and their 9 to 10 year old children. A second wave of data was collected in 1997 from the same families, with the children now 11 to 12 years old, thus constituting the commencement of a longitudinal panel. We have complete data on all variables of interest in this study in a sub-sample of 361 two-parent families, specifically those of 184 girls and 177 boys. Other participant information appears in Table 1.

Table 1- Family Characteristics

Variables	Families of Girls	Families of Boys
# of participants	184	177
Mean age (1995) of child	9.75	9.77
% in rural site	24.9%	26.0%
% in suburban site	16.9%	16.3%
% in urban site	9.1%	6.6%
% with French as first language	45.0%	44.8%
% with 2 kids or less	30.7%	30.1%
% with more than 2 kids	20.8%	18.3%
% with high school degree	15.1%	14.0%
% with university degree	4.7%	7.8%
% with income <20,000\$	10.3%	7.3%
% with income 20,000\$ to 60,000\$	30.8%	30.5%
% with income >60,000\$	9.3%	11.8%

Sampling Method and Recruitment. To facilitate the data collection and also to co-ordinate with the QHHD team, all families were recruited through community elementary schools. Therefore, the main inclusion criteria for the

present study was that one child in the family was a fourth grader in a community elementary school in 1995. Another inclusion criteria was that at least one adult in the family can answer either a French or English questionnaire. Participants had the freedom to discontinue participation at any time.

Potential Sample Biases. A bias that may potentially affect this study is that the cultures used for our sample were not balanced across recruitment sites. One of the experimental communities is a multi-ethnic area of the inner city of Montreal, in which a little more than 30% of the families are of Portuguese origin and 18% of Spanish origin. While all eligible families were asked to participate many declined because of language barriers. Other sites had more limited ethnic diversity.

### Measures

Measurement Instrument for Physical Activity. In the current investigation, the seven-day recall questionnaire for physical activity was used to operationalize physical activity (Sallis, Buono, Roby, Micale & Nelson, 1993). Frequency of childhood physical activity was measured by asking the child: "Think of the activities you did during the past seven days, from last Monday to last Sunday. For each activity that you participated in, mark an X on the days they were actually performed." (See Appendix A: Family and Heart Health Child Physical Activity Question). The response alternatives to the question at hand involved an array of 27 activities ranging from bicycling to karate to skipping rope. Previous research has shown that this type of self-report measure correlates well

with more direct measures of physical activity. In addition, as shown two-week test re-test reliability is quite high ( $r = 0.69-0.80$ ) (Sallis, et al., 1993).

Measurement Instrument for Accessibility. Accessibility is defined as the joint availability of services offered by the community, such as parks, pools, bicycle paths, and gymnasiums and programs (Gauvin, Potvin, Paradis & Mamsi, 1997). Here, accessibility was measured by asking the parents the following question: "To what extent are the following facilities available in your neighbourhood? The choice of facilities for this question were: a playing field, a park, a skating rink, a sports arena, a bicycle path, an indoor pool, an outdoor pool. The response alternatives for this question were: (1) there are none, (2) children can go there walking or bicycling, (3) children need to be driven or take the bus, (4) I don't know (See Appendix A: Specific-Specific Scales and Items for Physical activity, Scale I). Answering '4' was coded as a missing value, whereas responses '2' and '3' were coded as '3' and '2' to create a gradient of accessibility. Analyses revealed that the Cronbach alpha for this variable was .70.

Measurement Instrument for Social Support. Social support is defined as any behaviour that assists another person in achieving desired goals, and it has been subdivided into informational, material and emotional support (Dishman, 1994). In the present study, social support was measured by asking each parent the following question: "How frequently did the following occur in your family during the last four months? In our family, we go see family members playing sports; In our family, we ask family members who play sports questions about the sport they practice; In our family, we accompany family members who play sports;

In our family, we encourage family members who play sports to keep it up” (See Annex A: Behaviour-Specific Scales and Items for Physical Activity, Scale II).

The response alternatives for this question were (1) never, (2) Rarely, (3) sometimes, (4) often, and (5) always. Analyses showed that the Cronbach alpha for this variable was .82.

### Analysis Strategy

In a landmark paper published by Baron and Kenny (1986), properties of moderator and mediator variables have been distinguished in such a way as to clarify the different ways in which variables may account for differences in people’s behaviour. A moderator was defined as “a qualitative variable (sex, race, class) or quantitative (level of reward) that affects the direction and/or strength of the relation between the independent or predictor variable and a dependent or criterion variable” (Baron & Kenny, 1986). In order to test whether a variable moderates the link between two other variables, Baron and Kenny propose the use of multiple regression techniques. The moderator model has three paths that predict the outcome variable: the impact of the predictor (*path a*), the impact the moderator (*path b*), and the interaction or product of these two (*path c*). The moderator hypothesis is supported if the interaction term in the multiple regression (*path c*) explains a significant portion of additional variance (See Figure 1, page 53).

In the current study, specific interests are in examining the moderating role of family support on the link between physical activity reported in 1995 and physical activity reported in 1997. Thus, in the regression, physical activity reported in 1995 will be entered as the predictor of physical activity reported in

1997 (*path a*). Next, we entered two dummy variables to control for any confounding influence of site (the first dummy variable identified children from the suburban site whereas the second dummy variable designated children from the urban site; consequently, children from the rural site became the controls). Then, family support was entered as the third predictor of physical activity reported in 1997 (*path b*). Finally, the product of physical activity reported in 1995 and support as the predictor of physical activity reported in 1997 (*path c*) was entered. If the interaction term accounted for a significant proportion of the variance, it was to be concluded that family support moderates physical activity across time (Holmbeck, 1997). When indeed such a moderator effect exists, the interaction can be plotted as suggested by Neter, Kutner, Nachtsheim and Wasserman (1996). Specifically, when the plotted regression coefficients  $\beta_1$  and  $\beta_2$  are positive, the interaction effect between the two variables will be of a reinforcement type when  $\beta_3$  is positive. Here the slope of the response function against one of the predictor variables increases for higher levels of the other predictor variable. However, when  $\beta_1$  and  $\beta_2$  are positive, the interaction effect between the two variables will be of an interference type when  $\beta_3$  is negative. Here the slope of the response function against one of the predictor variables decreases for higher levels of the other predictor variable.

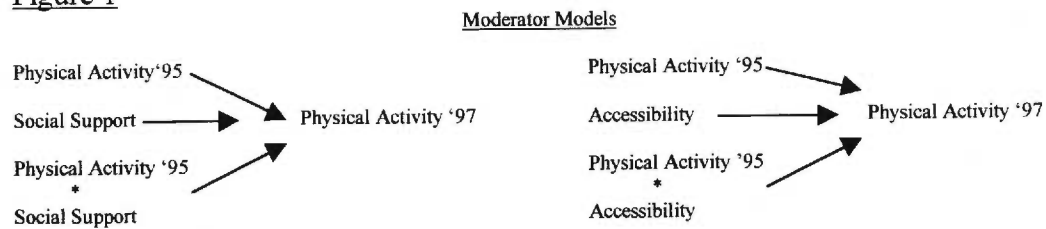
The multiple regression procedure described above will then be repeated one more time. Here, physical activity reported in 1995 was the first predictor followed by the dummy variables for site and accessibility to community facilities and services as the second and third predictors. Again, if the interaction term is



significant in this multiple regression, it implied that the relation between the two variables changes as a function of the moderator variable, thus identifying that accessibility acts as a moderator to physical activity over time. In addition, this study examined the questionnaires answered by females (mother and daughter) and males (father and son) separately due to the vast amount of literature supporting gender differences in the realm of physical activity. Specifically, the U. S. Department of Health and Human Services (1996) explains that approximately 14% of adolescents report no recent physical activity and that this indicator of physical inactivity is higher among girls than boys. In addition, the Canadian Fitness and Lifestyle Research Institute (1998) found that according to parent reports, two-thirds of youth do not meet the guideline for healthy growth and development ( $> 8$  KKD) and this may be an underestimate. Plus, about equal numbers of children (ages 5-12) and adolescents (ages 13-17) are inactive. Overall, more teenage girls than teenage boys are inactive. Thus, looking at boys and girls in two separate analyses will be more practical and conceptually meaningful.

Again, it is worthy to note that two separate analyses will be conducted for both genders and that the variables described above were centred on their means. Centring involves computing the difference between each observation and the mean of all observations for the variable (Neter, et al., 1996). Thus, centring variables will help minimise multicollinearity, which can often be introduced into a regression equation with an interaction.

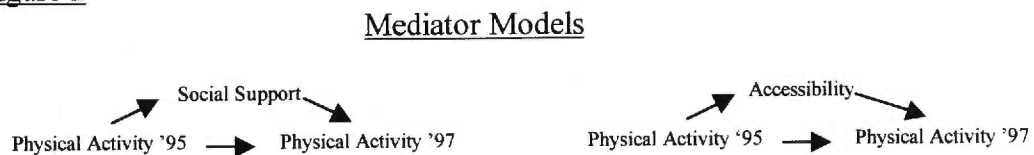
Figure 1



Furthermore, a mediator was defined as “a variable that accounts for the relation between the predictor and the criterion variable” (Baron & Kenny 1986). The mediator model (See Figure 2, p.54) assumes a three-variable system such that there are two causal paths feeding into the outcome variable: the direct impact of one variable (*path c*) and the impact of a potential mediator (*path b*). There is also a path from the predictor to the moderator (*path a*). According to Baron and Kenny (1986), separate coefficients for each equation should be estimated and tested. To establish mediation the following conditions must hold: “First, the independent variable must affect the mediator in the first equation; second, the independent variable must be shown to affect the dependent variable in the second equation; and third, the mediator must affect the dependent variable in the third equation” (Baron & Kenny, 1996). The strongest demonstration of mediation will occur when *path c* is zero. If all of these conditions hold true in the predicted direction, then the effect of the independent variable on the dependent variable must be less in the third equation than in the second equation for mediation to be established. In the current set of analyses, this implies that physical activity reported in 1995 must affect social support in the first equation; second, physical activity reported in 1995 must be shown to affect physical activity reported in 1997 in the second equation; and third, social support must affect physical activity

reported in 1995 in the third equation. If these conditions all hold in the predicted direction, then the effect of physical activity reported in 1995 on physical activity reported in 1997 must be less in the third equation than in the second. Perfect mediation holds if physical activity reported in 1995 has no effect when social support is controlled (Baron & Kenny, 1996). The steps described above will be repeated again for accessibility. Perfect mediation held if physical activity reported in 1995 has no effect when the accessibility variable is held constant. Notably, all analyses were conducted anew while controlling for site (i.e., inclusion of dummy variables as a first step).

Figure 2



The multiple regression analyses were conducted using the SPSS package, version 7.5 for Windows 95. The REGRESSION procedure was used. In the current study, the minimum acceptable tolerance of .01 was imposed. This tolerance level guards against the entry of a variable that is highly correlated with the other predictor variable already in the model.

Sample Size. A required sample size depends on a number of issues, including the desired power, alpha level, number of predictors, and expected effect sizes. The simplest rule of thumb proposed by Tabachnick and Fidell (1996) is to use  $N > 50 + 8m$  where “m” is the number of independent variables for testing the multiple correlation and  $N > 104 + m$  for testing individual predictors. In either

case, our sample size of complete data (i.e., mom, dad, and child) families is 361. The sample is composed of 177 boy families and 184 girl families. These figures significantly exceed the rule of thumb proposed by Tabachnick and Fidell (1996).

#### Specific Purposes of Analysis

The specific objectives (Aiken, & West, 1991) of the proposed analyses are:

- To test whether social support (family environment) moderates the link between physical activity reported in 1995 and physical activity reported in 1997.
- To test whether accessibility moderates the link between physical activity reported in 1995 and physical activity reported 1997.
- To test whether social support (family environment) mediates the link between physical activity reported in 1995 and physical activity reported in 1997.
- To test whether accessibility mediates the link between physical activity reported in 1995 and physical activity reported in 1997.

## **Chapter 4: Results**

## Results

### Descriptive Statistics

Table 2 presents the means for all variables, listed separately for boys and girls. As we can, boys scored higher than girls on physical activity reported in both 1995 and 1997, indicating that boys in this sample are more frequently involved in various vigorous intensity physical activities than girls. Furthermore, boys and girls did differ on the amount of social support received from mom and dad. Boys received more support from their moms.

TABLE 2. Descriptive Statistics

Variables	Mean for Girls	Mean for Boys
# of participants	184	177
Physical activity 1995**	3,58	4,34
Physical activity 1997**	2,29	3,17
Social support (mom)*	17.87	18.67
Social Support (dad)	17.42	17.89
Accessibility (mom)	14.75	14.18
Accessibility (dad)	14.61	14.18

\*p<0.05

\*\*p<0.01

### Correlation Matrix

A pairwise correlation matrix is presented in Appendix B. Correlations for the girls appear above the diagonal line whereas for the boys, they appear below the diagonal. Both boys and girls showed positive correlation between physical activity reported in 1995 and physical activity reported in 1997 ( $r = .477$  and  $r = .342$  respectively), suggesting that a positive physical activity history in boys and girls may lead to a continued participation in physical activity in the future. Social support and accessibility from the father was positively correlated with social support and accessibility from the mother among the boys ( $r = .719$  and  $r = .710$

respectively). This positive correlation was also observed among the girls ( $r = .630$  and  $r = .588$  respectively), suggesting that there may be a strong link between social support and physical activity levels and accessibility and physical activity levels in both boys and girls. However with the girls, only social support from the mother was correlated with physical activity reported in 1995, indicating that a mother's social support towards physical activity in general may contribute to a greater participation rate in girls. In addition, physical activity reported in 1995 and physical activity reported in 1997 among boys was positively correlated with accessibility from the father ( $r = .115$  and  $r = .219$  respectively), whereas with the girls, physical activity reported in 1995 and physical activity reported in 1997 was negatively correlated with accessibility from mom and dad ( $r = -.053$ ;  $r = -.046$ ;  $r = -.053$ ;  $r = -.055$  respectively), suggesting that fathers who have knowledge about the community may play a greater role in whether or not their sons are physically active.

#### Analyses of Moderation Effects

##### Mothers and Daughters with Social Support as Possible Moderator

Hierarchical regression analysis was employed to determine if social support from the mother moderated the relationship between physical activity involvement in 1995 and physical activity involvement in 1997 in girls (Aiken & West, 1991). To clarify the nature of moderation, see Figure 1, p. 53. In the first step of this moderation analysis, the centred value of physical activity reported in 1995 was entered individually into the regression equation with physical activity reported in 1997 as the dependent variable. As predicted in this step, centred

physical activity reported in 1995 emerged as a significant independent predictor of physical activity reported in 1997 among girls, explaining 11.7 % of the variance ( $p = 0.0001$ ). Regression coefficients and associated significance values from this step of the analysis are presented in Table 3.

In the second step of the moderation analysis, physical activity reported in 1997 was regressed on the two dummy variables to control for site (Laval and Montreal). Site showed no significant independent prediction of physical activity reported in 1997 among girls with an incremental variance of 1.2 % ( $p = 0.305$ ).

In the third step of the moderation analysis, physical activity reported in 1997 was regressed on the proposed moderator: social support (mom). Contrary to what was anticipated, social support from the mother showed no significant independent prediction of physical activity reported in 1997 among girls ( $R^2$  change = 0.2%,  $p = 0.505$ ). Regression coefficients and associated significance values for these findings are presented in Table 3.

The final step of the moderation analysis involved entering the product of physical activity reported in 1995 and social support (mom) into the regression equation. Contrary to what was anticipated; there was no evidence of an interaction between physical activity reported in 1995 and social support from the mother in the prediction of physical activity reported in 1997 ( $R^2$  change = 0.2%,  $p = 0.573$ ). Thus, social support from the mother did not moderate the relationship between physical activity involvement in 1995 and physical activity involvement in 1997 for girls once site was controlled. These results are included in Table 3.



**TABLE 3. Moderating Influences of Support (Mom) on Physical Activity Change in Girls.**

Moderator Results						
Variables	B	SE (B)	$\beta$	R <sup>2</sup> square change	R <sup>2</sup> total	R <sup>2</sup> adjusted
Constant	2.143	0.143				
Site						
DumLVL	0.239	0.225	0.079	0.012		
DumMTL	0.359	0.287	0.097			
Centred						
Physical Activity 95	0.269**	0.052	0.370	0.117**		
Centred						
Social Support (mom)	-0.018	0.027	-0.051	0.002		
Interaction PA95*Sup(mom)	0.006	0.011	0.040	0.002	0.132	0.108

\* p &lt; 0.05

\*\* p &lt; 0.01

**Fathers and Daughters with Social Support as Possible Moderator**

Hierarchical regression analysis was repeated here to determine if social support from the father moderated the relationship between physical activity involvement in 1995 and physical activity involvement in 1997 in girls. Following the same steps as described above; we were not able to predict physical activity change from 1995 to 1997 in girls using social support from fathers as the moderator. Regression coefficients and associated significance values from these regressions are presented in Table 4.

**TABLE 4. Moderating Influences of Support (Dad) on Physical Activity Change in Girls.**

Moderator Results						
Variables	B	SE (B)	$\beta$	R <sup>2</sup> square change	R <sup>2</sup> total	R <sup>2</sup> adjusted
Constant	2.141	0.143				
Site						
DumLVL	0.247	0.226	0.082	0.012		
DumMTL	0.395	0.282	0.107			
Centred						
Physical Activity 95	0.266**	0.052	0.366	0.117**		
Centred						
Social Support (dad)	-0.036	0.024	-0.040	0.001		
Interaction PA95*Sup(dad)	0.004	0.010	0.027	0.001	0.130	0.106

\* p &lt; 0.05

\*\* p &lt; 0.01

**Mothers, Fathers and Daughters with Social Support as a Possible Moderator**

Hierarchical regression analysis was repeated to determine if social support through the mother and the father together moderated the relationship between physical activity involvement in 1995 and physical activity involvement in 1997 in girls. Following the appropriate steps involved in the moderation analysis, we were able to conclude that social support does not act as a moderator between physical activity reported in 1995 and physical activity reported in 1997 in girls when both parents are involved. Regression coefficients and associated significance values for these findings are presented in Table 5.

**TABLE 5. Moderating Influences of Support (Mom & Dad) on Physical Activity Change in Girls.**

Moderator Results						
Variables	B	SE (B)	$\beta$	R <sup>2</sup> square change	R <sup>2</sup> total	R <sup>2</sup> adjusted
Constant	2.141	0.145				
Site						
DumL.VL	0.242	0.228	0.080	0.012		
DumMTL	0.364	0.291	0.098			
Centred						
Physical Activity 95	0.268**	0.053	0.370	0.117**		
Centred						
Social Support (mom)	-0.015	0.035	-0.041	0.002		
Centred						
Social Support (dad)	-0.005	0.031	-0.015			
Interaction						
PA95*Sup(mom)	0.006	0.015	0.039	0.002		
Interaction						
PA95*Sup(dad)	0.0003	0.013	0.002		0.132	0.098

\*p<0.05

\*\* p < 0.01

#### Mothers and Daughters with Accessibility as a Possible Moderator

Hierarchical regression analysis was employed to determine if accessibility through the mother moderated the relationship between physical activity involvement in 1995 and physical activity involvement in 1997 in girls. In the first step of this moderation analysis, the centred value of physical activity reported in 1995 was entered individually into the regression equation with physical activity reported in 1997 as the dependent variable. As predicted in this step, centred

physical activity reported in 1995 emerged as a significant independent predictor of physical activity reported in 1997 among girls, explaining 11.7 % of the variance ( $p < 0.001$ ). Regression coefficients and associated significance values from this step of the analysis are presented in Table 6.

In the second step of the moderation analysis, physical activity reported in 1997 was regressed on the two dummy variables to control for site (Laval and Montreal). Site showed no significant independent prediction of physical activity reported in 1997 among girls with an incremental of variance of 1.2 % ( $p = 0.305$ ).

In the third step of the moderation analysis, physical activity reported in 1997 was regressed on the propose moderator: accessibility (mom). Contrary to what was anticipated, accessibility from the mother showed no significant independent prediction of physical activity reported in 1997 among girls ( $R^2$  change = 0.6%,  $p = 0.263$ ). Regression coefficients and associated significance values for this finding are presented in Table 6.

The final step of the moderation analysis involved entering the product of physical activity reported in 1995 and accessibility (mom) into the regression equation. Contrary to what was anticipated, there was no evidence of an interaction between physical activity reported in 1995 and accessibility from the mother in the prediction of physical activity reported in 1997 ( $R^2$  change = 1.4%,  $p = 0.086$ ). Thus, accessibility from the mother does not moderate the relationship between physical activity involvement in 1995 and physical activity involvement in 1997 in girls once site is controlled. These results are included in Table 6.

TABLE 6. Moderating Influences of Accessibility (Mom) on Physical Activity Change in Girls.

Moderator Results						
Variables	B	SE (B)	$\beta$	R <sup>2</sup> square change	R <sup>2</sup> total	R <sup>2</sup> adjusted
Constant	2.063	0.149				
Site						
DumLVL	0.357	0.239	0.118	0.012		
DumMTL	0.581	0.295	0.157			
Centered						
Physical Activity 95	0.270**	0.052	0.372	0.117**		
Centered						
Accessibility (mom)	-0.0488	0.036	-0.101	0.006		
Interaction						
PA95*Acc(mom)	-0.030	0.017	-0.122	0.014	0.149	0.125

\* p &lt; 0.05

\*\* p &lt; 0.01

Fathers and Daughters with Accessibility as a Possible Moderator

Hierarchical regression analysis was employed to determine if accessibility through the father moderated the relationship between physical activity involvement in 1995 and physical activity involvement in 1997 in girls. Following the same steps outlined above, we were able to conclude that accessibility through the father does not act as a moderator between physical activity reported in 1995 and physical activity reported in 1997 in girls. Regression coefficients and associated significance values from the regressions are presented in Table 7.

TABLE 7. Moderating Influences of Accessibility (Dad) on Physical Activity Change in Girls.

Moderator Results						
Variables	B	SE(B)	$\beta$	R <sup>2</sup> square change	R <sup>2</sup> total	R <sup>2</sup> adjusted
Constant	2.094	0.149				
Site						
DumLVL	0.344	0.241	0.114	0.012		
DumMTL	0.492	0.291	0.133			
Centered						
Physical Activity 95	0.263**	0.052	0.362	0.117**		
Centered						
Accessibility (dad)	-0.044	0.037	-0.091	0.007		
Interaction						
PA95*Acc(dad)	0.003	0.018	0.014	0.000	0.136	0.111

\*p&lt;0.05

\*\*p&lt;0.01

Mothers, Fathers and Daughters with Accessibility as a Possible Moderator

Hierarchical regression analysis was employed to determine if accessibility through the mother and the father moderated the relationship between physical activity involvement in 1995 and physical activity involvement in 1997 in girls. Following the steps that have been previously outlined, we can conclude that accessibility (mom & dad) is not a possible moderator between physical activity involvement in 1995 and physical activity involvement in 1997 in girls. Regression coefficients and associated significance values from these regression analyses are presented in Table 8.

**TABLE 8. Moderating Influences of Accessibility (Mom & Dad) on Physical Activity Change in Girls.**

Moderator Results						
Variables	B	SE (B)	$\beta$	R <sup>2</sup> square change	R <sup>2</sup> total	R <sup>2</sup> adjusted
Constant	2.023	0.152				
Site						
DumLVL	0.433	0.246	0.143	0.012		
DumMTL	0.359	0.301	0.181			
Centred						
Physical Activity 95	0.269**	0.052	0.372	0.117**		
Centred						
Accessibility (mom)	-0.0177	0.043	-0.025	0.009		
Centred						
Accessibility (dad)	-0.063	0.045	-0.131			
Interaction						
PA95*Acc(mom)	-0.0413	0.019	-0.167			
Interaction						
PA95*Acc(dad)	0.013	0.019	0.052	0.022	0.159	0.126

\* p < 0.05

\*\* p < 0.01

#### Mothers and Sons with Social Support as a Possible Moderator

Hierarchical regression analysis was employed to determine if social support through the mother moderated the relationship between physical activity involvement in 1995 and physical activity involvement in 1997 in boys. In the first step of this moderation analysis, the centred value of physical activity reported in 1995 was entered individually into the regression equation with physical activity

reported in 1997 as the dependent variable. As predicted in this step, centred physical activity reported in 1995 emerged as a significant independent predictor of physical activity reported in 1997 among boys, explaining 22.8 % of the variance ( $p = 0.000$ ). Regression coefficients and associated significance values from this step of the analysis are presented in Table 9.

In the second step of the moderation analysis, physical activity reported in 1997 was regressed on the two dummy variables to control for site (Laval and Montreal). Site showed no significant independent prediction of physical activity reported in 1997 among boys with an incremental of variance of 0.8 % ( $p = 0.426$ ).

In the third step of the moderation analysis, physical activity reported in 1997 was regressed on the proposed moderator: social support (mom). Contrary to what was anticipated, social support from the mother showed no significant independent prediction of physical activity reported in 1997 among boys ( $R^2$  change  $< 0.01\%$ ,  $p = 0.956$ ). Regression coefficients and associated significance values for this finding is presented in Table 9.

The final step of the moderation analysis involved entering the product of physical activity reported in 1995 and social support (mom) into the regression equation. Contrary to what was anticipated, there was no evidence of an interaction between physical activity reported in 1995 and social support from the mother in the prediction of physical activity reported in 1997 ( $R^2$  change = 0.1%,  $p = 0.679$ ). Thus, social support does not moderate the relationship between

physical activity involvement in 1995 and physical activity involvement in 1997 in boys once site is controlled. These results are included in Table 9.

**TABLE 9. Moderating Influences of Social Support (Mom) on Physical Activity Change in Boys.**

Moderator Results						
Variables	B	SE (B)	$\beta$	R <sup>2</sup> square change	R <sup>2</sup> total	R <sup>2</sup> adjusted
Constant	3.047	0.171				
Site						
DumLVL	0.346	0.279	0.088	0.008		
DumMTL	0.054	0.384	0.010			
Centred						
Physical Activity 95	0.356**	0.051	0.471	0.228**		
Centred						
Social Support (mom)	0.0004	0.034	0.001	0.000		
Interaction PA95*Sup(mom)	-0.005	0.012	-0.028	0.001	0.236	0.214

\* p < 0.05

\*\* p < 0.01

### Fathers and Sons with Social Support as a Possible Moderator

Hierarchical regression analysis was employed to determine if social support through the father moderated the relationship between physical activity involvement in 1995 and physical activity involvement in 1997 in boys. Following the same steps described above, we are able to conclude that social support through the father does not act as a moderator between physical activity reported in 1995 and physical activity reported in 1997 in boys. Regression coefficients and associated significance values from these regressions are presented in Table 10.

**TABLE 10. Moderating Influences of Support (Dad) on Physical Activity Change in Boys.**

Moderator Results						
Variables	B	SE (B)	$\beta$	R <sup>2</sup> square change	R <sup>2</sup> total	R <sup>2</sup> adjusted
Constant	3.048	0.171				
Site						
DumLVL	0.333	0.279	0.085	0.008		
DumMTL	0.050	0.384	0.009			
Centred						
Physical Activity 95	0.355**	0.053	0.470	0.228**		
Centred						
Social Support (dad)	0.016	0.033	0.022	0.000		
Interaction PA95*Sup(dad)	0.0005	0.014	0.002	0.000	0.236	0.213

\* p < 0.05

\*\* p < 0.01

### Mothers, Fathers and Sons with Social Support as a Possible Moderator

Hierarchical regression analysis was employed to determine if social support through the mother and the father moderated the relationship between physical activity involvement in 1995 and physical activity involvement in 1997 in boys. In keeping in line with the previous steps, we are able to conclude that social support driven from both parents does not act as a moderator between physical activity reported in 1995 and physical activity reported in 1997 in boys. Regression coefficients and associated significance values from the regressions are presented in Table 11.

**TABLE 11. Moderating Influences of Support (Mom & Dad) on Physical Activity Change in Boys.**

Moderator Results						
Variables	B	SE (B)	$\beta$	R <sup>2</sup> square change	R <sup>2</sup> total	R <sup>2</sup> adjusted
Constant	3.047	0.172				
Site						
DumLVL	0.332	0.282	0.084	0.008		
DumMTL	0.057	0.386	0.011			
Centred						
Physical Activity 95	0.351**	0.054	0.464	0.228**		
Centred						
Social Support (mom)	-0.014	0.049	-0.028	0.001		
Centred						
Social Support (dad)	0.026	0.047	0.043			
Interaction						
PA95*Sup(mom)	-0.005	0.014	-0.031			
Interaction						
PA95*Sup(dad)	0.004	0.016	0.017	0.001	0.237	0.206

\* p < 0.05

\*\* p < 0.01

### Mothers and Sons with Accessibility as a Possible Moderator

Hierarchical regression analysis was employed to determine if accessibility through the mother moderated the relationship between physical activity involvement in 1995 and physical activity involvement in 1997 in boys. In the first step of this moderation analysis, the centred value of physical activity reported in



1995 was entered individually into the regression equation with physical activity reported in 1997 as the dependent variable. As predicted in this step, centred physical activity reported in 1995 emerged as a significant independent predictor of physical activity reported in 1997 among boys, explaining 22.8 % of the variance ( $p = 0.000$ ), Regression coefficients and associated significance values from this step of the analysis are presented in Table 12.

In the second step of the moderation analysis, physical activity reported in 1997 was regressed on the two dummy variables to control for site (Laval and Montreal). Site showed no significant independent prediction of physical activity reported in 1997 among boys with an incremental of variance of 0.8 % ( $p = 0.426$ ).

In the third step of the moderation analysis, physical activity reported in 1997 was regressed on the proposed moderator: accessibility (mom). Contrary to what was anticipated, accessibility from the mother showed no significant prediction of physical activity reported in 1997 among boys ( $R^2$  change = 0.7%,  $p = 0.223$ ). Regression coefficients and associated significance values for this finding are presented in Table 12.

The final step of the moderation analysis involved entering the product of physical activity reported in 1995 and accessibility (mom) into the regression equation. Contrary to what was anticipated, there was no evidence of an interaction between physical activity reported in 1995 and accessibility from the mother in the prediction of physical activity reported in 1997 ( $R^2$  change = 0.00%,  $p = 0.808$ ). Thus, accessibility through the mother does not moderate the

relationship between physical activity reported in 1995 and physical activity reported in 1997 in boys once site is controlled. These results are in Table 12.

TABLE 12. Moderating Influences of Accessibility (Mom) on Physical Activity Change in Boys.

Moderator Results						
Variables	B	SE (B)	B	R <sup>2</sup> square change	R <sup>2</sup> total	R <sup>2</sup> adjusted
Constant	3.123	0.181				
Site						
DumLVL	0.147	0.318	0.037	0.008		
DumMTL	-0.047	0.388	-0.009			
Centred						
Physical Activity 95	0.357**	0.051	0.472	0.228**		
Centred						
Accessibility (mom)	0.055	0.045	0.096	0.007		
Interaction PA95*Acc(mom)	0.004	0.015	0.016	0.000	0.242	0.220

\* p < 0.05

\*\* p < 0.01

#### Fathers and Sons with Accessibility as a Possible Moderator

Hierarchical regression analysis was employed to determine if accessibility through the father moderated the relationship between physical activity involvement in 1995 and physical activity involvement in 1997 in boys. In the first step of this moderation analysis, the centred value of physical activity reported in 1995 was entered individually into the regression equation with physical activity reported in 1997 as the dependent variable. As predicted in this step, centred physical activity reported in 1995 emerged as a significant independent predictor of physical activity reported in 1997 among boys, explaining 22.8 % of the variance ( $p = 0.000$ ), Regression coefficients and associated significance values from this step of the analysis are presented in Table 13.

In the second step of the moderation analysis, physical activity reported in 1997 was regressed on the two dummy variables to control for site (Laval and Montreal). Site showed no significant independent prediction of physical activity

reported in 1997 among boys with an incremental of variance of 0.8 % ( $p = 0.426$ ).

In the third step of the moderation analysis, physical activity reported in 1997 was regressed on the proposed moderator: accessibility (dad). As anticipated, accessibility from the father to sporting facilities showed a significant independent prediction of physical activity reported in 1997 among boys ( $R^2$  change = 2.1%,  $p = 0.028$ ). Regression coefficients and associated significance values for this finding are presented in Table 13.

The final step of the moderation analysis involved entering the product of physical activity reported in 1995 and accessibility (dad) into the regression equation. Contrary to what was anticipated; there was no evidence of an interaction between physical activity reported in 1995 and accessibility from the father in the prediction of physical activity reported in 1997 ( $R^2$  change = 0.1%,  $p = 0.637$ ). Thus, accessibility through the father does not moderate the relationship between physical activity involvement in 1995 and physical activity involvement in 1997 in boys once site is controlled. These results are included in Table 13.

**TABLE 13. Moderating Influences of Accessibility (Dad) on Physical Activity Change in Boys.**

Moderator Results						
Variables	B	SE (B)	$\beta$	R <sup>2</sup> square change	R <sup>2</sup> total	R <sup>2</sup> adjusted
Constant	3.188	0.180				
Site						
DumLVL	0.029	0.305	0.007	0.008		
DumMTL	-0.193	0.390	-0.036			
Centred						
Physical Activity 95	0.342**	0.051	0.452	0.228**		
Centred						
Accessibility (dad)	0.104*	0.046	0.170	0.021*		
Interaction						
PA95*Acc(dad)	-0.007	0.014	-0.031	0.001	0.257	0.236

\*  $p < 0.05$

\*\*  $p < 0.01$

### Mothers, Fathers and Sons with Accessibility as a Possible Moderator

Hierarchical regression analysis was employed to determine if accessibility through the mother and the father moderated the relationship between physical activity involvement in 1995 and physical activity involvement in 1997 in boys. Following the same steps described above, we are able to conclude that accessibility via both parents does not act as a moderator between physical activity involvement in 1995 and physical activity involvement in 1997 in boys. Regression coefficients and associated significance values from these regression analyses are presented in Table 14.

**TABLE 14. Moderating Influences of Accessibility (Mom & Dad) on Physical Activity Change in Boys.**

<b>Moderator Results</b>						
Variables	B	SE (B)	$\beta$	R <sup>2</sup> square change	R <sup>2</sup> total	R <sup>2</sup> adjusted
Constant	3.192	0.185				
Site						
DumLVL	0.032	0.322	0.008	0.008		
DumMTL	-0.189	0.393	-0.035			
Centred						
Physical Activity95	0.346**	0.052	0.459	0.228**		
Centred						
Accessibility(mom)	-0.003	0.059	-0.006	0.021		
Centred						
Accessibility(dad)	0.106	0.060	0.173			
Interaction						
PA95*Acc(mom)	0.013	0.023	0.058	0.002		
Interaction						
PA95*Acc(dad)	-0.017	0.023	-0.076	0.002	0.259	0.228

\* p < 0.05

\*\* p < 0.01

### Analyses of Mediation Effects

Also of interest was the possible presence of a mediation relationship among the variables. For physical activity reported in 1997, regression equations were used to assess whether social support and/or accessibility to community facilities mediated (i.e., accounted for) the relationship between physical activity reported in 1995 and physical activity reported in 1997. To clarify the nature of

mediation, a diagram is provided (See Figure 2, p. 54). There are two direct paths leading to the dependent variable: the direct effect of the independent variable (*path c*) and the direct path from the mediator (*path b*); there is also a direct path from the independent variable (IV) to the mediator. Baron and Kenny (1986) state that in order to establish mediation, the following conditions (which correspond to four regression equations) must hold: First, the IV must account for significant variance in the dependent variable (DV) (i.e., significance of *path c*). Second, the mediator must account for significant variance in the DV (i.e., significance of *path b*). Third, the IV must account for significant variance in the mediator (i.e., significance of *path a*). Finally, when the DV is regressed on the IV and mediator simultaneously, the IV-DV relationship should no longer emerge as significant; alternatively, this path should show a significant reduction from its value in the first equation (i.e., significant reduction in *path c* when both the IV and mediating variable are included in the equation). In the previous regression, we observed that site had no influence on outcomes; we therefore elected not to include them in the current analyses. However, a separate set of analysis not reported here, suggest that controlling for site did not change the overall pattern of findings.

Among girls, results of mediation analyses are presented in Tables 15 to 18. Because both social support and accessibility to community facilities (from mothers and fathers separately) do not predict physical activity reported in 1997 among the girls ( $R^2 = 0.000$ ,  $p = 0.990$ ;  $R^2 = 0.001$ ,  $p = 0.660$ ;  $R^2 = 0.006$ ,  $p = 0.288$ ;  $R^2 = 0.007$ ,  $p = 0.257$ ) a critical path that is necessary for mediation is not present; thus, mediation is not possible in this case.

TABLE 15. Mediating Influences of Support (Mom) on Physical Activity Change in Girls.

Mediating Results			
Variables	B	SE (B)	$\beta$
Path a	0.249	0.144	0.126
Path b	-0.0004	0.028	-0.001
Path c	0.263**	0.052	0.363

\*  $p < 0.05$ \*\*  $p < 0.01$ 

TABLE 16. Mediating Influences of Support (Dad) on Physical Activity Change in Girls.

Mediating Results			
Variables	B	SE (B)	$\beta$
Path a	0.027	0.159	0.013
Path b	-0.011	0.026	-0.033
Path c	0.263**	0.052	0.363

\*  $p < 0.05$ \*\*  $p < 0.01$ 

TABLE 17. Mediating Influences of Accessibility (Mom) on Physical Activity Change in Girls.

Mediating Results			
Variables	B	SE (B)	$\beta$
Path a	-0.004	0.107	-0.002
Path b	-0.041	0.038	-0.086
Path c	0.263**	0.052	0.363

\*  $p < 0.05$ \*\*  $p < 0.01$ 

TABLE 18. Mediating Influences of Accessibility (Dad) on Physical Activity Change in Girls.

Mediating Results			
Variables	B	SE (B)	$\beta$
Path a	0.0007	0.105	0.000
Path b	-0.044	0.039	-0.092
Path c	0.263**	0.052	0.363

\*  $p < 0.05$ \*\*  $p < 0.01$ 

For males, results of mediation analyses are presented in Tables 19 to 22.

Because social support from mothers and fathers separately do not predict physical activity reported in 1997 among the boys ( $R^2 = 0.000$ ,  $p = 0.776$ ;  $R^2 = 0.005$ ,  $p = 0.349$ ); a critical path that is necessary for mediation is not present; thus, complete mediation is not possible in this case. However, partial mediation is present when referring to accessibility. *Path b* was found to be significant ( $R^2 = 0.044$ ,  $p = 0.005$ ) when fathers and sons were being studied. From this, we cannot state that

accessibility is a mediating variable between physical activity reported in 1995 and physical activity reported in 1997 in boys through the father because *path a* was not significant, but we can conclude that fathers do have an impact on boys' physical activity change across time.

**TABLE 19. Mediating Influences of Support (Mom) on Physical Activity Change in Boys.**

Mediating Results			
Variables	B	SE (B)	$\beta$
Path a	0.082	0.115	0.053
Path b	0.011	0.038	0.022
Path c	0.357**	0.051	0.473

\*  $p < 0.05$

\*\*  $p < 0.01$

**TABLE 20. Mediating Influences of Support (Dad) on Physical Activity Change in Boys.**

Mediating Results			
Variables	B	SE (B)	$\beta$
Path a	0.165	0.118	0.105
Path b	0.035	0.037	0.073
Path c	0.357**	0.051	0.473

\*  $p < 0.05$

\*\*  $p < 0.01$

**TABLE 21. Mediating Influences of Accessibility (Mom) on Physical Activity Change in Boys.**

Mediating Results			
Variables	B	SE (B)	$\beta$
Path a	0.030	0.086	0.023
Path b	0.063	0.051	0.109
Path c	0.357**	0.051	0.473

\*  $p < 0.05$

\*\*  $p < 0.01$

**TABLE 22. Mediating Influences of Accessibility (Dad) on Physical Activity Change in Boys.**

Mediating Results			
Variables	B	SE (B)	$\beta$
Path a	0.156	0.083	0.126
Path b	0.145**	0.051	0.238
Path c	0.357**	0.051	

\*  $p < 0.05$

\*\*  $p < 0.01$

### Summary of Analyses

The results of this study are presented in Table 23. This summary chart is presented to simplify and clarify the analyses that were conducted in this study.

We can see that physical activity reported in 1995 has a direct effect in predicting physical activity reported in 1997 in both boys and girls. Although no moderation or mediation was observed, we can conclude that a father's knowledge of accessible community services and facilities plays a major role in predicting future physical activity in boys.

TABLE 23- Summary of Analyses- Outcome of Physical Activity 97.

Variables	Mom & Boys	Dad & Boys	Both & Boys	Mom & Girls	Dad & Girls	Both & Girls
<b>Direct Effects</b>						
Physical Activity 1995	X	X	X	X	X	X
Social Support						
Accessibility		X				
<b>Moderated Effects</b>						
PA95 * Social Support						
PA95 * Accessibility						
<b>Mediated Effects</b>						
Social Support as Mediator						
Accessibility as Mediator						



## **Chapter 5: Discussion**

## Discussion

The principle purpose of this study was to examine the role of selected family and community determinants on children's physical activity change across time. More specifically, the interest was in how social support from the family and accessibility to community services and facilities moderates and/or mediates future physical activity in children. In order to achieve these desired goals, we adopted the analytic framework proposed by Baron and Kenny (1986) to explore moderating/mediating paths rather than simply exploring the existence of direct relationships between family/community variables and physical activity. The database used for this study was collected from a unique cohort of the Québec Heart Health Demonstration Project (QHHD), which was composed of 23 communities across rural, suburban, and inner-city sites.

### Social Support as a Moderator and/or a Mediator

Analyses revealed surprising results. Contrary to what was proposed, social support did not moderate or mediate changes in physical activity across time although social support did predict activity cross-sectionally in girls. We cannot conclude that social support acts as a moderating variable between physical activity reported in 1995 and physical activity reported in 1997 because of the absence of interaction (*path c*). The interaction between physical activity reported in 1995 and social support was not shown to be significant in this study. However, our study did find differences in amount of support given to girls versus boys. It was found that boys received more support from their moms' than girls. We were unable to conclude that social support reported by the parents is

associated with children's physical activity change across time. As for mediation, social support had no explanatory value on the physical activity change across time in both boys and in girls.

These results were similar to the findings reported by Anderseen and Wold (1992) and Butcher (1983). In Bandura's social cognitive theory, the relevance and importance of a supportive environment to performing and maintaining a pattern of regular physical activity is strongly supported (Bandura, 1986). In addition, social support through encouragement and involvement from significant others (i.e. mother, father, peers, friends, and team-mates) seem to exert a positive influence on adolescents' participation in physical activity (Anderssen & Wold, 1992; Butcher, 1983; and Brown, 1985). Contrary to what was anticipated and strongly supported in the literature, no strong relationships of this type were observed.

Is it the role of the parents to ensure that their children become and stay physically active? Godin and Shephard (1984) state that children tend to be more active when the parents and peers want them to be more physically active. In another study, Klesges, Coates, Moldenhaver, Holzer, Gustavson and Barnes (1984) believe that direct encouragement to get children to become more physically active via the parents seem to be related to higher levels of physical activity in very young children. From this evidence and from what was concluded in our study, we must try and understand why social support from the parents has no impact on children's physical activity participation levels across time.

A possible reason for this finding involving physical activity and social support could have been based on the fact that the criteria used to define social support was unclear or misinterpreted by either one or both of the parents. Specifically, were the items in scale II (see Appendix A: Behaviour-Specific Scales and Items for Physical), misunderstood by the parents or elicited social desirability? Also, did the parents involved in the study view family support differently than what was specifically itemized in the scale? A possible resolution to this problem could be achieved if an alternate scale for defining family support could be derived. Thus, further research into the area of social support and its role with physical activity participation in children is required.

#### Accessibility as a Moderator and/or Mediator

As for accessibility, there were significant findings, although none demonstrated moderator or mediator properties. Accessibility, as reported from the father, was shown to be a significant predictor of son's change in physical activity across time. This means that the fathers' knowledge of the services and facilities provided by the community can be an important aspect in whether a son will maintain or become more physically active over time. Contrary to what was proposed, we cannot conclude that accessibility acts as a moderating variable between physical activity reported in 1995 and physical activity reported in 1997 because of the absence of interaction (*path c*). The interaction between physical activity reported in 1995 and accessibility was not shown to be significant in this study. However, we can conclude from this study that knowledge of the community services and facilities as reported by the father, is associated with

son's physical activity change across time. As for mediation, accessibility had no explanatory value on the physical activity change across time in both boys and in girls.

### Gender Differences

Focusing on the gender differences, the findings from this study do seem to parallel the work done by Lewko and Ewing (1980). In their paper on parental influences, Lewko and Ewing (1980) state that males are encouraged to participate in more active pursuits outside the home whereas females are reinforced to engage in sedentary activities within the confines of the home. In addition, Garcia, Norton, Broda, Frenn, Coviak, Pender and Ronis (1995) also note in their paper that boys have a tendency to participate more frequently in moderate to vigorous physical activity than do girls. The findings in our study do support these differences in physical activity participation.

Furthermore, the variability of boys' reported level of activity in 1997 was more associated with physical activity reported in 1995 than the variability found in girls ( $R^2$  change = 22.8% and  $R^2$  change = 11.7% respectively). Does this mean that males may be predisposed at a younger age to be more physically active than their female counterparts? If this is the case, girls should be supported and encouraged for their participation in physical activity, thus breaking away from these social expectations. By making community facilities and services accessible to all, we may no longer see this gender difference in physical activity. With increased support, encouragement and knowledge of what is accessible in terms of physical activity within the community, we can only hope that this

stereotyping of sport involvement will end and that there will be a greater involvement of females in sport.

#### Methodological Strengths and Weaknesses

Little research has been done on family and community variables such as social support and accessibility. Furthermore, research into the area of childhood physical activity determinants is quite scarce. This particular research not only contributed to the lack of knowledge involving children and physical activity, but it also incorporated a strong and very useful conceptual framework that could easily be applied in future studies. By investigating moderating and mediating variables, we were able to try and explain what aided children in becoming or maintaining a physically active lifestyle. Although the study did not demonstrate moderation or mediation, we were still able to retrieve important and relevant information about accessibility and social support. The role of accessibility reported by the father was shown to be positively associated with a son's physical activity participation level ( $R^2$  change = 2.1%,  $p = 0.028$  and  $R^2$  change = 4.4%,  $p = 0.005$ ). Furthermore, the role of social support given by the mother was shown to be positively associated with a son's physical activity participation level ( $t = 1.991$ ,  $p < .05$ ).

One major problem that is often overlooked when studying family dynamics is that the parents may be perceived as one entity, and not as two independent individuals. Thus, when an author concludes that parents play a very important role in terms of health education, we must sit back and determine exactly which parent actually has the greatest impact on a child's level of physical

activity participation. Do both parents contribute equally on health issues discussed in the home or does one parent serve more as an informer and as a role model. In our particular study, we purposely examined both parents separately so as to eliminate such a bias. Our findings concluded that fathers had a greater impact on their son's physical activity involvement because of their knowledge about the services and facilities offered in their community. In a study conducted by Greendorfer and Lewko (1978), fathers were also seen as the predominant figurehead in the family milieu. They demonstrated that fathers and peers were the most important socialising agents in respect to sport involvement for both boys and girls. In addition, our findings concluded that a mother's support had a great impact on their son's physical activity involvement. Although our study found no significant findings concerning mothers and fathers with their daughters, it is not implied that parents do not support their daughters or that they are not aware with what the community has to offer their daughters in terms of facilities and services. The important point that must be made is that when family variables are being explored, it is imperative that mothers and fathers are examined separately, as in our study, so as to get a clearer understanding of the roles each of them play as a parent.

#### Future Research

There is a need for future research to study and identify the family environment as a possible determinant of physical activity participation. By looking at members in a family collectively and not alone, we can hopefully develop proper physical activity guidelines to target the general family.

Communities have also been overlooked in research pertaining to physical activity. Future physical activity interventions in the community should focus on actual and potential services offered to the public. Going into the community allows researchers to identify and work with many target groups. Children and elders are groups that often look towards the community for programs to enhance their lifestyles. Thus, the community may provide an opportunity for researchers to develop and implement pertinent programs.

The area of child and adolescent physical activity participation needs to be further investigated. We know that schools are an easy and cost effective source for studying and implementing physical activity strategies. However, is the information that is being related to the students accurate and useful? Will the concluded results from such school interventions reflect an accurate representation of which students are physically active or not? According to the U.S. Department of Human and Health Services (1996), the quality of physical education classes in the schools seem to be decreasing over time. Some provincial governments have recognised physical education as a valid and serious endeavour that is underdeveloped. Thus, in order to rectify this dilemma, they have recently made attempts to update and improve the issue by reassessing the current physical education curriculum (e. g., [www.edu.gov.mb.ca/metks4/curricul/k-s4curr/phyhlth/attachc.html](http://www.edu.gov.mb.ca/metks4/curricul/k-s4curr/phyhlth/attachc.html)).

In addition to this, a better and more accurate method for measuring physical activity participation must be developed. Most items listed in physical activity scales (such as the 7-day recall) refer to sporting or structured events (see



Appendix A: Family and Health Child Physical Activity Question). Simple forms of physical activity (i.e. walking, stair climbing, etc.) must be taken into consideration when looking at an individual's physical activity level. However, this type of measure is not done nor is it available to current researchers. By developing such a tool, researchers will be one step closer to understanding physical activity adherence.

Nevertheless, in order to achieve a better understanding of the dynamics involved in physical activity, children, and adolescents, future investigations must be focused around the family and community environments. The power of the family and the services provided by the community could be used to encourage children to participate and enjoy physical activity.

### Conclusion

This thesis allowed for the investigation of the moderator and mediator paths in determining physical activity over time. Physical activity reported in 1995 had a direct effect in predicting physical activity reported in 1997 with both boys and girls. Although no moderation or mediation was observed, we were able to conclude that a father's knowledge of community services and facilities do play a major role in predicting future physical activity participation in boys. A better understanding of how to influence physical activity in children will only be achieved if in fact we are able to identify elusive moderation and mediation paths.

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[www.activeliving.ca](http://www.activeliving.ca)

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[www.kino-quebec.qc.ca](http://www.kino-quebec.qc.ca)

[www.rssso7.gouv.qc.ca/parlons/amenez.htm#top](http://www.rssso7.gouv.qc.ca/parlons/amenez.htm#top)

## **Appendix A**



## Behaviour-Specific Scales and Items for Physical Activity

### Scale I. Access to Sports Facilities (7 items)

To what extent are the following facilities available in your neighbourhood?

- a playing field
- a park
- a skating rink
- a sports arena
- a bicycle path
- an indoor pool
- an outdoor pool

Possible answers:

- there are none
- children can go there walking or bicycling
- children need to be driven or take the bus
- I don't know

### Scale II. Family Support for Physical Activity (4 items)

How frequently did the following occur in your family during the last four months?

- In our family, we go see family members playing sports
- In our family, we ask family members who play sports questions about the sport they practice
- In our family, we accompany family members who play sports
- In our family, we encourage family members who play sports to keep it up

Possible answers:

- Never
- Rarely
- Sometimes
- Often
- Always

Family and Heart Health Child Physical Activity Question

Think of all the activities you did last week, from last Monday to last Sunday. For each of the activities that you did, place an **X** on the day you did that particular activity.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Physical education at school							
<b>For the rest, do not include the activities done at school during physical education class</b>							
Bicycling							
Skipping rope							
Playing elastics							
Roller blading							
Skateboarding							
Badminton							
Dodgeball/ throwing the ball							
Tennis							
Ping-pong							
Baseball/softball							
Football							
Volleyball							
Soccer							
Wrestling/boxing							
Floor/ice hockey							
Ice skating							
Ballet/jazz danse							
Aerobic/free dansing							
Gymnastics							
Physical conditioning							
Jogging							
Walking							
Frisbee							
Swimming/diving							
Playing in the parc/outside (tag...)							
Other							

or

I did none of these activities last week.

## **Appendix B**

Correlational Matrix

	PA97	PA95	Sup (mom)	Sup (dad)	Acc (mom)	Acc (dad)	Sup (mom) * Act95	Sup (dad) * Act95	Acc (mom) * Act95	Acc (dad) * Act95
PA97	1.000	.342**	.004	-.024	-.051	-.055	.035	-.004	-.083	.042
PA95	.477**	1.000	.177**	.031	-.053	-.046	-.015	-.072	.034	.079
Sup (mom)	.051	.077	1.000	.630**	-.064	.042	.057	.056	-.091	.060
Sup (dad)	.100	.130	.719**	1.000	.065	.048	.060	.087	-.079	.091
Acc (mom)	.126	.027	.122	.180*	1.000	.588**	-.078	-.063	-.079	-.263**
Acc (dad)	.219**	.115	.113	.056	.710**	1.000	.050	.072	-.259**	-.098
Sup (mom) * Act95	-.068	-.076	.129	-.023	-.037	-.058	1.000	.650**	-.186	.185
Sup (dad) * Act95	.107	.217**	-.029	-.034	-.037	.036	.423**	1.000	-.134	.109
Acc (mom) * Act95	-.025	-.083	-.040	.032	-.033	.063	.033	.156	1.000	.277*
Acc (dad) * Act95	.001	.036	-.059	.029	.060	.078	-.008	.137	.761**	1.000

\*\* Correlation is significant at the 0.01 level (2-tailed)

\* Correlation is significant at the 0.05 level (2-tailed)

## **Curriculum Vitae**

██████████  
 ██████████  
 Languages: English & French

## Sandra Anderson

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<b>Education</b>	1997-2000	Université de Montréal	Montreal, Quebec
	<b>Masters of Science</b> Kinesiology Specialization in Psychology of Sport and Physical Activity		
	1994-1997	Concordia	Montreal, Quebec
	<b>Bachelors of Science</b> Major in Exercise Science Specialization in Athletic Therapy		
<b>Employment History</b>	1998-Present	Concordia University	Montreal, Quebec
	<b>Part-time Professor</b> <ul style="list-style-type: none"> <li>• <b>Social Psychological Aspects of Exercise and Physical Activity. EXCI 363/4. Responsible for presenting lectured information and evaluating the students understanding of the course material.</b></li> <li>• <b>Lifestyle Behavior and Health. EXCI 331/2. Responsible for presenting lectured information and evaluating the students understanding of the course material.</b></li> <li>• <b>Fundamentals of Health and Physical Activity. EXCI 251/4. Responsible for presenting lectured information and evaluating the students understanding of the course material.</b></li> </ul>		
	1998-Present	Université de Montréal	Montreal, Quebec
	<b>Research Assistant</b> <ul style="list-style-type: none"> <li>• <b>Responsible for implementing interventions over the telephone with physical activity organizations across Quebec, Ontario, and Alberta.</b></li> </ul>		
	1998		
	<b>Teaching Assistant</b> <ul style="list-style-type: none"> <li>• <b>Introduction to Exercise Science. EXCI 201/2. Responsible for the correcting of papers, compiling grades, and receiving e-mail assignments.</b></li> </ul>		
	1994-1998	Concordia University	Montreal, Quebec
	<b>Research Assistant</b> <ul style="list-style-type: none"> <li>• <b>Responsible for implementing interventions (involving counseling with teens), coordinating fitness testing, and collecting data.</b></li> </ul>		

1995-1997

**Athletic Therapist**

- **Head therapist for the Concordia Women's Basketball Team**
- **Physio-aid at Action Sport Physio**
- **Head therapist for the McGill Women's Rugby Team**

**Publications &  
Presentations**

1998-present

**Gauvin, L., Spence, J.C., & Anderson, S. (In Press). Healthy population: Reality or wishful thinking. In J.M. Rippe & D.R. Brown (Eds.), Textbook of Medicine, Exercise, Nutrition, and Health. Blackwell Publishing.**

**Lacombe, N., Gauvin, L., Steiger, H.S., & Anderson, S. (1998). Prevalence and correlates of excessive exercise in women with clinically-diagnosed bulimic syndromes. Medicine & Science in Sports & Exercise, 30, Suppl.**

**Anderson, S., Gauvin, L., Potvin, L., & Paradis, G. (1999). Longitudinal impact of family support and access to community facilities on children's physical activity. Paper submitted for presentation at the Annual Conference of the American College of Sports Medicine, Seattle, WA, June, 1999.**

*References available upon request*