Familial Aggregation of Leisure-Time Physical Activity – a Three Generation Study *

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Studies of parental influence on children's physical activity have had different results. Parental effect on physical activity during adolescence is less studied, and three generation studies have not been carried out. The purpose of our study was to examine intra- and intergenerational associations of leisure time physical activity among family members in three generations. Due to the major changes in society during this time, we also took into consideration the socioeconomic status of the adult subjects. The material consisted of 3254 twins at the age of 16, their parents and grandparents. Twins and their parents received a questionnaire in 1991–1993, which included questions about the health and lifestyle, socioeconomic status and leisure time physical activity. The parents' questionnaire also included questions about their own parents' leisure time physical activity and socioeconomic status. Based on these questions adolescents, parents and grandparents were classified into physical activity classes. The socioeconomic classification of parents and grandparents was based on their occupation. Intragenerational physical activity patterns were significantly associated with each other. Among adolescents the strongest correlation were between monozygotic boys (0.720) and monozygotic girls (0.638). Physical activity patterns were not associated between generations, but there was a significant difference between very active and inactive mothers concerning their daughters' physical activity. Farmers had the lowest proportion of very active subjects only among the parental generation. Because physical activity patterns do not appear to be transmitted from one generation to the next, it is probable that by constant training and education we can obtain the benefits of physical activity.

■ Key words: Leisure-time, physical activity, adolescents, family, socioeconomic status

Introduction

Several studies reveal that both parents' exercise patterns and encouragement have an effect on children's exercise behavior (4, 8, 14, 23, 24, 26, 27). According to other studies parental exercise is not associated with a child's exercise habits (7). Parental effect on adolescents' physical activity patterns has been studied less. According to Rossow and Rise (22), the father's physical activity was positively associated with the adolescent's physical activity, but mother's physical activity was not. Lau et al. (15) reported no significant association between the mother's and the adolescent's physical activity.

The relative magnitude of genetic and environmental components of aerobic and anaerobic performance have been studied before (5). Aerobic performance seems to have low genetic variance, the correlations of $\dot{V}O_2max$ between parents and children (16) as well as between monozygotic (MZ) and dizygotic (DZ) twins (5) being low. The results from the latter study suggest that genetic effects might be inflated by shared environmental conditions, because DZ twins were more similar than normal brothers even though both types of sibpairs have about 50% of their genes identical by descent. Pérusse et al. (20) suggested that children can acquire from their parents certain customs regarding exercise behaviour and that the propensity toward being spontaneously active could partly be influenced by the genotype. The data also revealed that persons of the same generation, whether genetically related or not, tend to be more similar in their physical activity habits than the persons of two different generations. These results suggest that familial resemblance is probably associated with familial environmental factors shared by persons of the same generation, but not transmitted from generation to generation (20).

Gottlieb and Chen (8) found that parental exercise had a stronger influence on the frequency of exercise among girls than boys, but according to the study of Finnish school children (27) both parents' sport activities were correlated with boys' sports activities, but not with those of girls. Also according to Greendorfer and Lewko (9) only the father served as a significant influence on children's sport involvement.

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Intergenerational studies about physical activity concern mainly the influence of parental physical activity patterns on their child's or adolescents physical activity (4,8,9,14,15,20, 22–27). Three generation studies about physical activity have not been published before.

The Finnish society structure has changed rapidly during three decades. In 1945 50% of working-aged persons were farmers, while in 1975 only 15% were farmers, and by 1992 8.5% were farmers. The same structural change lasted five decades in Sweden, eight decades in Norway and 100 years in France. Also during 1960–1970 people moved from the countryside to cities over a short period of time (12). In 1947 under 30% and in 1987 over 60% of Finns lived in cities or suburban areas (19). The growth of the service sector parallels to a greater extent growth in the industrial sector, while the farming population has declined and both manual and non-manual strata have grown (21). These society-related factors are also related to physical activity habits, as heavy physical activity during farming work has decreased both because the proportion of farmers has decreased and because of the increasing mechanisation of farm and non-farm manual work. It is obvious that the relative importance of leisure-time physical activity has become greater than previously.

Familial aggregation of physical activity at leisure can be caused by environmental, cultural and/or genetic factors (13). These factors can be studied in family or twin studies by tracking the same genes and shared or different environments. MZ twins share 100% of their genes by descent with their co-twin, while DZ twins share 50% of the genes with their co-twin and can be considered genetically as a normal sib. Adolescent twins normally share their family and peer environment, but for example grandparents and adolescents only rarely share their environment. Parents and their offspring share 50% of genes, and only in intergenerational studies can the mode of transmission of a trait be studied. In the absence of more detailed genetic studies, descriptive genetic epidemiology serves to establish the degree and kind of familial aggregation of a trait.

The purpose of this study is to investigate familial patterns of physical activity at leisure. In particular we examined intra- and intergenerational correlations of leisure physical activity patterns among adolescent twins, their parents and grandparents. To account for the changes in society that may have had an effect on the changes in physical activity patterns, we also included socioeconomic data in our study.

Material and Methods

Twins from consecutive birth cohorts identified from the Central Population Registry of Finland form a study (FinnTwin16), on which this report is based (11). The baseline assessment is made within two months of the twins' 16 th birthdays. The assessment includes a survey of health habits and attitudes, a symptom check list and relationships with parents, peers, and the co-twin. The first assessment was in February 1991, when a health and lifestyle survey mailing was sent to twins born in October, November or December 1974. These twins served as a pilot sample to test the questionnaire and mailing procedures. After minor modifications of some items, the same questionnaire was mailed to twins born in 1975–1977 in 1991 through 1993, respectively. The data reported in these analyses is thus based on three years of responses.

During this period, 1858 families of twins (boys or girls) were contacted, and the total number of individual twins who answered was 3254 (girls n = 1697, boys n = 1557). The response rate was 91% for girls and 85% for boys. Parents were also sent a questionnaire with the same types of questions. The parental questionnaire was revised in April 1993, so the data on parental physical activity is based on two slightly different questionnaires. The parents' questionnaire included also questions concerning the grandparents' health habits, leisure time physical activity and socioeconomic status, so that maternal and paternal grandparents were distinguished. The number of families which had both parents was 1667 and the response rate among parents was 79%.

Measures

Leisure-time physical activity was assessed using different questions for adolescents, parents and grandparents. Families consisted of, at the maximum a pair of adolescent twins, father and mother and four grandparents. However, the analyses were not based only on whole families. The associations were studied between the relative pairs (Two persons related to each other such as sib, parent-offspring or grandparent-grandchild pairs), independent of missing data for other family members. Missing data could be due to the non-response of a family member (e.g. single parent family), or a missing response to a single item.

To make the different generations comparable, we developed indices of physical activity. We classified physical activity into five classes reflecting the distribution of physical activity in the parental and twin generation, and three categories for the grandparental generation. The highest and lowest classes in each generation correspond thus to the most active and inactive subjects of that generation.

Physical Activity

Adolescents

Two questions were used in measuring physical activity. The first question asked the frequency of leisure-time physical activity outside of school with seven response alternatives (not at all, less than once a month, 1–2 times a month, about once a week, 2–3 times a week, 4–5 times a week, about every day). The second question asked about the intensity of physical activity with five response alternatives (profuse sweating and breathlessness, moderate sweating and breathlessness, little sweating and breathlessness, no sweating and breathlessness, no leisure time physical activity). Based on these two questions we formed five physical activity groups. *Very active group*: exercise 4–5 times a week or more and intensity of profuse or moderate sweating and breathlessness. *Active group*: exercise 2–3 times a week or more and intensity of profuse or moderate sweating and breathlessness or exercise 4–5 times a week or more and intensity of little sweating and breathlessness. *Moderately active group*: exercise 2–3 times a week or more and intensity of no sweating and breathlessness or 2–3 times a week and intensity of little sweating and breathlessness or once a week and intensity of profuse, moderate or little

sweating and breathlessness. *Hardly active group*: exercise 1–2 times a month or less than once a month and intensity of profuse, moderate or little sweating and breathlessness or exercise once a week, 1–2 times a month or less than once a month and intensity of no sweating and breathlessness. *Inactive group*: exercise less than once a month or not at all and no leisure time activity.

Parents

Physical activity groups were based on two different questionnaire versions. The aim of the two questionnaires was the same and they differ from each other only structurally.

The first questionnaire version included one question with four items about physical activity. There were four items to describe the intensity of physical activity (leisure time physical activity is as intensive as walking, rapid walking, light jogging or running). For each item the amount of physical activity per week (none, less than half an hour, altogether one hour, altogether 2–3 hours or altogether 4 hours or more).

The second questionnaire version included four questions about physical activity. The first question asked about the amount of leisure time physical activity (none, hardly any, moderately, much, very much). The second question asked for the description of the intensity of physical activity (the intensity of leisure time physical activity could be compared to walking, rapid walking, light jogging or running). Third question asked the amount of time one leisure time activity lasts (less than 15 min, between 15 min and half an hour, between half an hour and one hour, between one hour and two hours, over two hours). Fourth question asked the amount of times per month of leisure time physical activity (less than once a month, 1–2 times a month, 3–5 times a month, 6–10 times a month, 11–19 times a month, over 20 times a month).

The intensity of physical activity was measured by estimated MET values. MET value is a multiple of the resting rate of oxygen consumption. One MET equals approximately 3.5 ml/kg/min, it represents the approximate rate of oxygen consumption of a seated individual at rest (3). Walking was estimated to 3 METs, rapid walking and a mixture of walking and jogging to 6 METs, light jogging to 10 METs and running to 13 METs (2, 29).

Total MET values were calculated in the first questionnaire by multiplying the time used in physical activity (using the class mid points) and the estimated MET value and adding the four values together (for example 3 METs × 60 min + 6 METs × 20 min + 10 METs × 300 min + 13 METs × 0 min). In the second questionnaire, total MET values were calculated by multiplying the estimated MET value (#52) and the time of one physical activity session and the time of physical activity per month using the class midpoint and then dividing by four to obtain weekly values. If the subject answered not participating in any leisure time physical activity the estimated MET value was 0.

Mothers' and fathers' total MET values were classified into five categories (20% of subjects in each class). Classification was made separately of those who answered the first and second questionnaire. The mean age of mothers and fathers was equal for respondents to both questionnaire versions. The mean age of the mothers was 44.2 years in the first and 44.6 years in the second questionnaire, and among fathers 46.5 years and 46.5 years correspondingly. Classifications of physical activity in both questionnaires were then combined. The highest 20% were considered as very active and the lowest 20% as inactive. In some analyses parents in these extreme classes were compared with adolescents' physical activity.

Grandparents

The physical activity of each grandparent was measured by the questions asked of the parents (their children). The questions measured whether the maternal and paternal grandparents had any leisure time physical activity (regular leisure time activity, every now and then but not regularly, no leisure time physical activity, I can't say) during their adult life. Based on these questions grandparents were classified into three categories: active, moderately active, inactive. The distribution of classes among grandmothers was active 15.4%, moderately active 31.7%, and inactive 42.3%, while 10.6% could not be classified. Among grandfathers there were 17.4% in the active class, 33.0% in the moderately active class, 38.0% in the inactive class, while 11.6% were those who could not be classified. Subjects in the fourth category (I can't say) were excluded from all analyses. In some analyses those in the active class were compared to the other two classes combined.

Socioeconomic status

We also took into consideration parents' and grandparents' socioeconomic status in considering familial associations of physical activity. The classification of socioeconomic status is based on the occupation of parents and grandparents by the following questions: "What is your occupation, or if you are not at work, your former occupation?" "What was your father's/mother's occupation?". The grandparents' main occupation during their lifetimes was chosen if possible. The parents were coded according to their present occupation. The parents' occupational mobility is not taken into account. However, because only about 15% of mothers and 6% of fathers are younger than forty, there will not be any larger shifts in socioeconomic status due to further education. When classifying parents, information on present employment (employee vs. self-employed) and education were also used. In this study pensioners have as far as possible been classified according to their former occupation. The coding into socioeconomic groups was done according to the Finnish Central Statistical Office's 1987 classification.

The main socioeconomic categories (6) are:

1. Self-employed persons (farmer employers, farmers on own account, small and other employers, and self-employed persons)
2. Upper-level employees with administrative, managerial, professional and related occupations (senior officials and upper management, senior officials and employees in research and planning or in education and training, other or unspecified senior officials and employees)
3. Lower-level employees with administrative and clerical occupations (supervisors, senior officials and employees with independent or routine work, other or unspecified lower-level employees)

4. Manual workers (workers in agriculture, forestry and commercial fishing, manufacturing workers, other production workers, distribution, service and unspecified workers)
5. Students
6. Pensioners (retired self-employed persons, retired upper-level and lower-level employees, retired manual workers, other pensioners)
7. Others (long-term unemployed, others not elsewhere classified, socioeconomic status unknown)

We wanted to take into consideration if farmers' physically demanding work compared to other socioeconomic groups has any effect on leisure time physical activity. We classified parents and grandparents into socioeconomic groups based on the distribution of the occupations by sex and generation. We grouped parents' socioeconomic status into four categories for the analyses: farmer employers, farmers on own account and workers in agriculture, forestry and commercial fishing were assigned to a *Farmers* group. Manufacturing workers, other production workers, distribution and service workers and unspecified workers were assigned to an *Industrial workers* group. Upper-level employees and lower-level employees were combined into an *Employees* group and the remainder of the socioeconomic groups were defined as the rest.

Grandmothers were classified into three categories, which were the three major categories:
1. Farmers (farmers on own account, workers in agriculture, forestry and commercial fishing)
2. Home-makers
3. The rest (the rest of the socio-economic groups, which were mainly employees, including 1% pensioners and 0.2% occupation unknown).

Grandfathers were classified into categories, which were:
1. Farmers
2. Manufacturing workers
3. The rest (the rest of the socio-economic groups, which were mainly employees, including 1.5% students, pensioners and unknown occupations).

We also checked the number of unclassified grandmothers, whose husbands were farmers in order to make sure that these grandmothers did not belong to farmers class. There were only 6.4% of such paternal grandmothers and 7.3% maternal grandmothers.

Statistical analyses

Intra- and intergenerational correlation cofficients were computed between relative pairs by using SAS procedures. The chi-square test was used to test the differences in frequency tables.

Results

Intragenerational and intergenerational physical activity

The intragenerational and intergenerational correlations of physical activity classes are seen in Figure **1**. For each family relationship the number of such relative pairs is given together with the estimated correlation of physical activity level in the entire data. The intragenerational correlations of adolescents' physical activity are seen in Table **1**.

Table 1 Intragenerational correlations of adolescent's physical activity classes. All correlations significantly greater than 0 with $p < 0.01$.

Relationship	Correlation	Number of subjects pairs
girl-girl	0.548	426
boy-boy	0.549	372
girl-girl (monozygotic)	0.638	231
boy-boy(monozygotic)	0.720	147
girl-girl (dizygotic)	0.410	179
boy-boy (dizygotic)	0.449	191
girl-boy	0.216	437

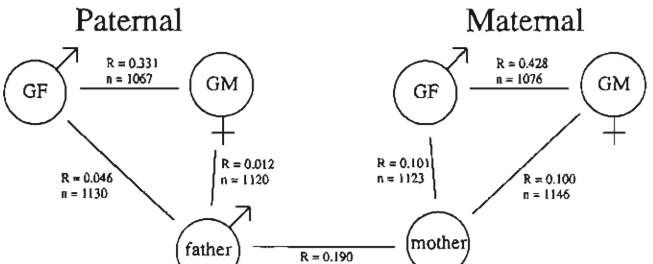

Fig. 1 Intragenerational and intergenerational correlations of physical activity classes. All correlations are significant ($p < 0.01$), except between father and paternal grandparents.

Intragenerational physical activity patterns were associated with each other, especially among adolescents and grandparents. Among adolescents the strongest correlation was between monozygotic boys (0.72) and girls (0.64) and the weakest between the pairs of opposite sex. Correlations were stronger between the like-sex pairs than for pairs of opposite sex. Correlations between girl pairs (0.55) and boy pairs (0.55) were similar. Among all girl pairs 69.6% of very active girls had a very active sister and 45.5% of inactive girls had an inactive sister. Among all boys 58.7% of very active boys had a very active brother and 39.4% of inactive boys had an inactive brother.

The correlation between parents themselves was 0.19. Among very active mothers 28.6% had a very active husband and among inactive mothers 32.6% had an inactive husband. Among those couples in which both were farmers, 20.0% of active mothers han an active husband and of those in which neither were farmers, 28.2% of active mothers had an active husband.

Table 2 Physical activity levels in adolescents according to extreme physical activity in parents

Parent	Adolescent	Parental physical activity	Adolescent physical activity very active %/n	active %/n	moderately active %/n	hardly active %/n	inactive %/n
mother	girl	very active	33.3% 41	27.6% 34	27.6% 34	11.4% 14	0% 0
		inactive	15.4% 23	36.2% 54	27.5% 41	14.1% 21	6.7% 10
mother	boy	very active	25.5% 30	27.5% 33	27.5% 33	16.7% 20	3.3% 4
		inactive	23.5% 35	17.5% 26	28.2% 42	22.3% 34	8.1% 12
father	girl	very active	25.2% 30	30.3% 36	22.7% 27	16.9% 20	5.0% 6
		inactive	25.2% 37	31.3% 46	23.8% 35	12.9% 19	6.8% 10
father	boy	very active	37.2% 45	24.8% 30	22.3% 27	10.7% 13	5.0% 6
		inactive	22.3% 29	24.6% 32	30.0% 39	16.2% 21	6.9% 9

Grandparents' own physical activity patterns showed that 55.5% of physically active maternal grandmothers had an active husband and 17.9% an inactive husband. In contrast, only 10.8% of inactive maternal grandmothers had an active husband and 64.2% of inactive grandmother had an inactive husband (correlation 0.43). Among active paternal grandmothers 43.7% had an active husband and 25.3% an inactive husband. Among inactive paternal grandmothers 11.5% had an active husband and 66.3% inactive husband (correlation 0.33).

Intergenerational physical activity patterns seem not to be associated, as these correlations were quite low in the entire family data. The correlation between father and adolescent (0.08) and mother and adolescent (0.09) are almost alike. The strongest correlation was between father and boy (0.10) and weakest between father and girl (0.05).

Grandparental physical activity was not associated with the parental or adolescent physical activity patterns. Because of the lack of associations across generations compared to within generation associations, we examined how persons at the extremes of the distributions of physical activity were associated. Table **2** shows cross-tabulation of the extreme classes (very active and inactive) of parents and children.

There was a significant difference between very active mothers and inactive mothers and their daughters' physical activity ($p < 0.001$), but not between extreme classes of mothers and their sons ($p = 0.142$). Very active mothers had more often (33.3%) very active daughters and very active sons (25.0%) than inactive daughters (0%) or inactive sons (3.3%). On the other hand, inactive mothers had less often (15.4%) very active daughters, but not less often very active sons (23.5%), and more often inactive daughters (6.7%) and inactive sons (8.1%).

No statistically significant association was found between extreme classes of fathers and their daughters ($p = 0.898$) or their sons ($p = 0.096$). A similiar pattern was seen for very active fathers: 25.2% of their daughters were very active as were 37.2% of their sons. Only 5.0% of their daughters and 5.0% of their sons were inactive. Inactive fathers had equally often very active daughters (25.2%) and very active sons (22.3%) or inactive daughters (6.8%) and inactive sons (6.9%).

Socioeconomic status and physical activity

Parents

Among mothers, 9.4% were farmers, 14.5% industrial workers, 59.1% employees and 17.0% others. Among fathers 12.2% were farmers, 11.6% industrial workers, 41.6% employees and 34.6% others. Farmers had the lowest proportion of very active subjects (mothers 9.0%, fathers 11.3%,) and the proportion of very active subjects in four other categories were between 16.9% and 22.7% as shown in Figure **2**.

Grandparents

Among paternal grandmothers, 41.4% were farmers, 19.4% homemakers and 39.2% others, while among maternal grandmothers 38.2% were farmers, 21.0% homemakers and 40.8% others. Among paternal grandfathers, 40.0% were farmers, 19.9% manufacturing workers and 40.1% others. Among maternal grandfathers 37.9% were farmers, 20.7% manufacturing workers and 41.4% others.

Because of the nature of farmers' work, we did the analyses separately for the parents of which both were farmers and neither were farmers. Among parents both of whom were farmers, 1.1% were both physically very active in their leisure time.

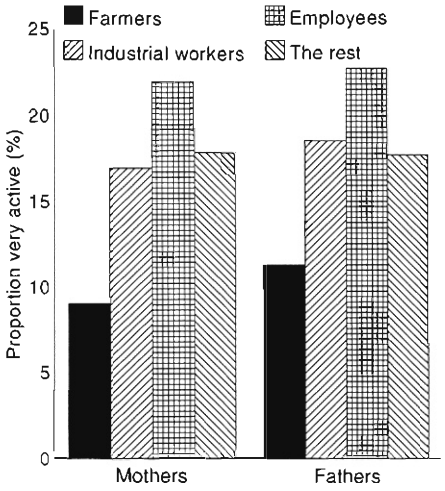

Fig. 2 Proportions of parents very active during leisure time physical activity by social class.

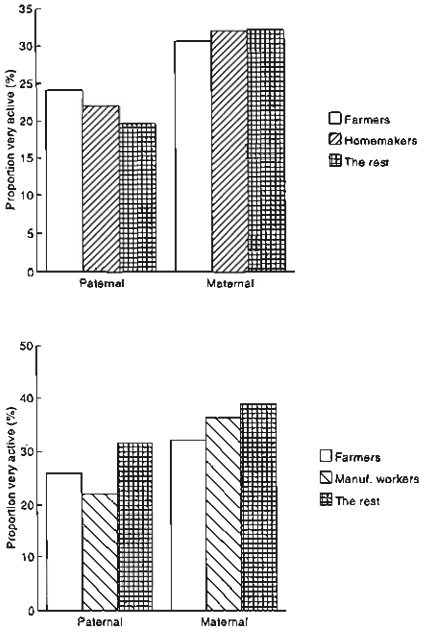

Fig. 3 Proportions of grandparents very active during leisure time physical activity by social class. Grandmothers (above) and grandfathers.

Among those parents neither of whom were farmers, 5.8% were both very active. We computed also the correlation of fathers' and grandfathers' physical activity when both were farmers ($r = -0.21$, $p < 0.05$) and when the grandfather was a farmer, but the father was not ($r = -0.06$, n. s.).

We also checked the data of the leisure time physical activity of the grandparents which parents had answered. The proportion of subjects for whom their children could not report on their parents' leisure physical activity was largest among farmers in the grandparental generation. The amount was between 15–17% among farmers and between 0% and 12% among other socioeconomic groups.

Among grandparents the proportion of very active subjects did not differ by socioeconomic class. The frequency of very active subjects among paternal grandmothers was between 19.7% and 24.1%; among maternal grandmothers between 30.6% and 32.2%; among paternal grandfathers 22.0% and 31.6%; and among maternal grandfathers between 32.0% and 38.8%. There was no indication that farmers would have been less very active subjects (Fig. **3**).

Discussion

Intragenerational physical activity patterns showed substantial correlations in all three generations of adolescents, parents and grandparents. The physical activity patterns of the twins of the same sex, in particular those of monozygotic twins, were highly correlated. This suggests that physical activity patterns are influenced by having a sib of the same sex, and also might have a genetic backround, However intergenerational physical activity patterns showed weak associations. When the overall data set was analyzed, the 16 year old adolescents' physical activity patterns were not associated with either parents' or grandparents' physical activity patterns.

When the extremes of physical activity patterns were considered, a significant association between mothers and daughters was seen. The corresponding association for fathers and sons was not as strong ($p = 0.096$), but suggests that parents affect most the physical activity patterns of their same-sexed children in adolesence, while opposite-sex offspring are less influenced. Also, very active or quite inactive parents appear to affect their children more than moderately active parents. However, it cannot be totally excluded that for families with adolescents aged 16 years, adolescent physical activity patterns influence parental habits. For example, a physically very active youth may have activated a previously less active parent into engaging in more physical activity. Longitudinal studies of children through adolescence and their parents would be necessary to examine the pattern of causation for these observed associations.

The material of this study is unique as physical activity patterns of three generations have not been reported in earlier studies. The response rate was high among adolescents and parents. The test-retest reliabilities have been measured among twin and singleton adolescents and considered satisfactory (correlations between 0.75–0.80), while the test-retest information is not available among parents and grandparents (1, unpublished). Grandparental information of their leisure time physical activity is based on parents' report and that might raise a question as to how reliable the information is. The lack of association of three generations physical activity might be due to the measures we used, which differed between generations. The parental and adolescent measures of physical activity reflected current activity patterns, which may be very age or cohort specific. On the other hand, the assessment of grandparents was more of a global lifetime nature. Hence, these may not be fully comparable if physical activity patterns vary a great deal over time. Therefore we based our analyses on computing relative activity levels within generations.

Intergenerational physical activity studies have concerned mainly parents' and adolescents' physical activity patterns. McMurray et al. (17) found also in their study of elementary school children and their parents that childrens' self reported

physical activity patterns were not correlated to parents' self reported physical activity patterns or attitudes towards exercise habits except mothers exercise habits correlated to child's maximal oxygen uptake. According to a study of children 4 – 7 years old, children of active mothers were 2.0 times more often active than children of inactive mothers and the relative odds ratio of being active for the children of active fathers was 3.5. When both parents were active, the odds ratio was 5.8 (18).

Stucky-Ropp and DiLorenzo (26) found different family variables to predict the level of physical activity among boys and girls in the 5 th and 6 th grades. Support and modelling from friends and family were predictors among boys, but not among girls. For girls only, physical activity appears to be more highly influenced by the number of exercise-related pieces of equipment at home and parental modeling of exercise. The father's occupation is significantly related to the frequency of exercise (8).

When socioeconomic status was taken into consideration among parents and grandparents there were fewer farmers who were physically very active in their leisure time in the parents' group, but not in the grandparents' group. Among grandparents the amount of missing data was clearly larger in the farmers' group than in the other socioeconomic groups, and that might affect the result. The data were based on parents' answers and it might have been difficult to estimate the leisure time of farmers. Some parents had answered the question about grandparents' leisure time physical activity by stating that he or she is a farmer. Vuolle et al. (30) found in their study of physical activity among Finnish adults that men in rural work have less leisure time physical activity than those in other kinds of work. The same kind of result was confirmed by Vasara (10). The result was the same when considering physical demands of work. The trend of the association was the same among women, but not as strong as among men. The correlation of physical activity between grandfather and father, when both were farmers, was statistically significant.

The difficulty of a three generation study is that Finnish society has undergone tremendous changes over the past decades. Farmers have become a minor socioeconomic class and the people have moved from the countryside to the cities. Weekly working time has become shorter. In 1945 the average workweek was 47 h and in 1966 – 70 40 h (28). During the last 40 years annual working time has decreased by 12 hours/year and leisure-time has increased. Leisure-time has increased also in the 1980s through increased unemployment (19) in particular since 1990. At the same time work has become less physically demanding.

As there is also more awareness of the health benefits of physical activity, leisure-time physical activity has become more important as a means to keep fit and to prevent the possible disadvantages caused by physical inactivity. One reason that intergenerational physical activity patterns do not seem to be associated, or at most weakly, within the family might be due to the social changes during three generations lifetime or that inactivity is not transmitted by genes. Also the opportunities for leisure-time physical activity are different in each generation. Adolescents of today have many different ways to exercise. At the end of 1950, there was one physical activity facility for every 1200 citizens, of which two-thirds were outdoor facilities. In 1990 there was a sports facility for every 200 citizens (10).

Despite a possible modest genetic component to our disposition to physical activity, environmental factors appear to be the prime determinant. Consequently the social and physical environment should be modified to increase the number of people adopting a physically active lifestyle.

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