

# A Descriptive Epidemiology of Leisure-Time Physical Activity

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## Synopsis .....

*Eight national surveys conducted in the United States and Canada between 1972 and 1983 are reviewed for evidence of leisure-time physical activity patterns in the population. The authors' major conclusion is that it is difficult to make reliable gener-*

*alizations when definitions of exercise used in the surveys vary so widely. Nevertheless, the young and persons of relatively high socioeconomic status are definitely more active than average in their leisure time; this is probably also true of westerners and suburbanites. Males and females are about equally likely to be involved in conditioning activities, but males are more likely to participate in vigorous exercise and sport. It appears likely that exercise prevalence has increased in recent years, and a maximum of 20 percent of the population exercises at a level frequently recommended for cardiovascular benefit.*

*Major areas of uncertainty and ignorance remain, and the authors identify 15 such areas. Secondary analysis is recommended to help resolve several questions currently impeding a complete description of the exercise patterns of the population. For future surveys, five recommendations are offered on definitions and essential data items.*

*Existing time series studies are generally inadequate. The authors recommend that detailed surveys of exercise patterns be conducted every 5 years to supplement the continual monitoring that is also essential to detect shifts in this important health behavior.*

**R**ELIABLE INFORMATION ON THE PUBLIC'S USE of leisure time and, in particular, on patterns of leisure-time physical activity is fundamental to the development, implementation, and evaluation of public health policy to promote physical fitness in the population. Much information on this topic is available because of the population surveys and polls on leisure-time physical activity conducted in the last 12 years, a fact that may itself be evidence of a fitness boom. However, there has been little consistency among these surveys and polls in the crucial areas of question wording, sample design, and, indeed, of survey design in general. Thus, the information available is distinguished more by its quantity than its quality.

Despite this difficulty, we offer some generalizations drawn from the most reliable and relevant sources available, specifically eight national surveys (six in the United States and two in Canada) conducted between 1972 and 1983 (1-8). Our sources are the 1974 survey by the President's

Council on Physical Fitness and Sports (PCPFS), the 1975 National Health Interview Survey (NHIS) supplement, the Fitness and Amateur Sport Canada survey (F&AS), the Perrier study, the National Survey of Personal Health Practices and Consequences (NSPHPC), the Canada Fitness Survey, the Behavioral Risk Factor (BRF) survey conducted jointly by the Centers for Disease Control (CDC) and 28 states and the District of Columbia, and the Miller Lite survey.

We describe patterns of leisure-time physical activity for the U.S. and Canadian populations classified by age, sex, race, education, income, occupation, community size, and region. The available evidence on trends over time is reviewed, as are existing and proposed surveillance systems. We offer conclusions regarding what is known with reasonable certainty, what is suspected, and what is unknown, and set forth recommendations for secondary analysis, design conventions, and future surveillance.

Table 1. Principal national surveys of leisure-time physical activity

<i>Survey (acronym), date completed</i>	<i>Size (No. of persons)</i>	<i>Ages covered</i>	<i>Data collection methods</i>	<i>Agency conducting fieldwork</i>
President's Council on Physical Fitness and Sports (PCPFS), 1972 (1) .....	3,875	22 +	1 interview per household	Opinion Research Corp.
National Health Interview Survey (NHIS) Supplement, 1975 (2) .....	12,000	20 +	Face-to-face interview	Bureau of the Census
Fitness and Amateur Sport Canada (F&AS), 1976 (3) .....	70,000	14 +	Self-completed drop-off questionnaire	Statistics Canada
Perrier, 1978 (4) .....	1,510	18 +	Face-to-face interviews, telephone interviews of runners	Louis Harris and Associates
National Survey of Personal Health Practices and Consequences (NSPHPC), 1979 (5) .....	3,025	20-64	Telephone interview	Chilton Research Services
Canada Fitness Survey, 1981 (6) .....	21,500	10 +	Self-completed questionnaire during household visit	Canada Fitness Survey
CDC-State Behavioral Risk Factor (BRF) survey, 1982 (7) .....	22,200	18 +	Telephone interview	State health departments
Miller Lite, 1983 (8) .....	1,139	14 +	Telephone interview	Research Forecasts, Inc.

The eight surveys reviewed here were chosen because they met three essential criteria:

1. They provide detailed data on leisure-time physical activity and the demographic characteristics of survey respondents.

2. They have probability samples representative of entire national populations.

3. Informed judgments about data quality are possible because the samples and data collection methods used are well documented.

Although they were selected as sources of the most reliable and relevant data, the surveys nevertheless have their own flaws and limitations, a fact dealt with in the following sections. The six U.S. surveys were conducted for either public or private sponsors, and the focus ranged from exercise alone, to health behavior in general, to health in a broader context. Both Canadian surveys concentrated on exercise activity and were government sponsored. The sponsor, date, sample size, age coverage, and data collection methods for each survey are described in table 1.

Two notable sets of studies were excluded by our criteria. One was the community study or intervention trial, of which there are many significant examples from around the United States, including Massachusetts (9), California (10), Michigan (11), and Minnesota (12). However invaluable these studies have been (13), there is simply no way to generalize their findings to describe exercise patterns in the

population as a whole. Because of inadequate detail or documentation, we also excluded opinion polls; however, we made an exception when examining secular trends because of the paucity of other sources.

## Findings

**Prevalence of leisure-time physical activity.** The fundamental question "how active is the population in its leisure time?" is the most difficult to answer. While "it all depends on the definition of active" is probably the most scientifically responsible reply, it is not very satisfactory. Estimates of the active population in the eight surveys range from 15 to 78 percent. However, when the definitions are considered and classified into groups, a clearer picture emerges. Table 2 displays the 14 definitions of "active" used by the 8 surveys reviewed; these definitions were grouped into three categories with similar characteristics.

Definitions in the first category incorporate activity intensity or a frequency of several times weekly, and yield the lowest estimates of active persons—15, 19, and 12 percent. Significantly, this set of definitions comes the closest to describing the exercise regimen recommended for cardiovascular benefit (13) although the definitions are only roughly equivalent.

The second set of definitions refers to current activity or uses terms such as "regular" or "often"

for self-reported frequency. The surveys in this group have a median of 54 percent of the population categorized as active.

The third set, with a median of 58 percent active, employs generous definitions based on participation in any activity for reporting periods of up to 12 months. Results for the second and third sets are similar, suggesting that few people are active only once a year and that most engage in activities of unspecified intensity often or regularly (at least by their own definition).

In conclusion, the following seems to be the most definitive statement that can be offered regarding the prevalence of leisure-time physical activity in the United States and Canadian populations:

- Approximately 20 percent exercise with an intensity and frequency generally recommended for cardiovascular benefit.
- An additional 40 percent are active at a more moderate level or less frequently, perhaps sufficient to receive some health benefits.
- At least 40 percent may be considered completely sedentary.

These figures are similar to those of Chubb and Chubb (14), who arrived at their conclusions from a different perspective. After an exhaustive review of leisure-time use, they concluded that 15–20 percent of the population is meaningfully active, 35–40 percent engage in limited activity, and approximately 50 percent do virtually nothing of a physical nature.

Despite the fact that definitions of active or participant vary widely, complicating the estimation of prevalence of regular exercise in the population, it is possible to compare the activity levels of population groups. Data from several sources are available on activity levels as related to age, sex, income, and educational level. A few surveys have reported on occupation, community size, or region of the country. Data on race and ethnicity are very limited.

Despite the great range in prevalence estimates (table 2), the surveys reveal considerable agreement on the relative exercise levels of sociodemographic groups. This consistency in the face of diversity suggests that many of the findings reported here are quite robust.

**Activity and age.** Figures 1 and 2 plot the proportion of the population classified as active by age group. Three conclusions are immediately apparent: (a) the proportion of the population defined as active declines with age, (b) this decline is steepest in

Table 2. Proportion of population physically active during leisure time, grouped by rigor of definition, United States and Canada, 1972–83<sup>1</sup>

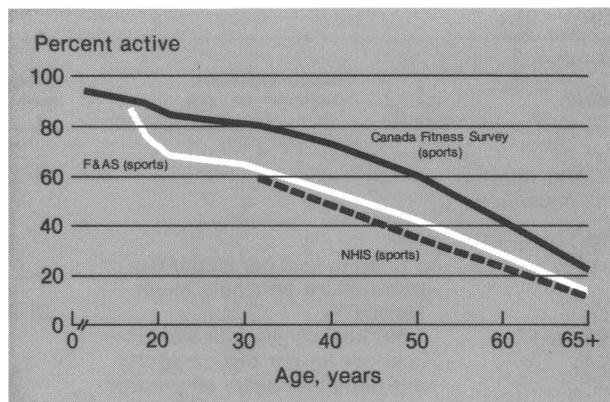
Survey	Definition of active (key terms in quotes)	Percent active
<i>Most rigorous definitions</i>		
CDC-State BRF survey	3 or more kcal per kg per day of expenditure on single major activity	21
Perrier-1 <sup>1</sup>	1,500 kcal per week or 3 or more kcal per kg per day on sports and conditioning for an average size person	15
Miller Lite	Athletic index score = 12 or above, where 1 point given for weekly participation, 4 points for "daily or almost daily" participation in 29 listed activities	19
<i>Less rigorous definitions</i>		
PCPFS-1	"Now participate" in 1 or more of 16 listed sports	51
PCPFS-2	"Now doing" 1 or more of 6 listed exercises	55
NHIS-1	Participation in 1 or more of 6 listed exercises "on a regular basis"	49
NSPHPC	"Often" participate in 1 or more of 7 listed activities	78
Perrier-2	Participated "on a regular basis any time during the past year" in 1 or more of 37 listed activities	<sup>2</sup> 53
Canada Fitness Survey-1	Participated in sport or conditioning for 3 or more hours per week during 9 or more months per year	56
<i>Least rigorous definitions</i>		
NHIS-2	Any participation in 1 or more of 14 listed sports in last 12 months	42
F&AS-1	Any participation in 1 or more of 8 listed sports in last 12 months	50
F&AS-2	Any participation in 1 or more of 8 listed conditioning activities in last month	59
Canada Fitness Survey-2	Any participation in 1 or more of 90 listed sports in last 12 months	68
Canada Fitness Survey-3	Any participation in 1 or more of 14 listed exercise activities in last month	58

<sup>1</sup> Numbers after studies indicate different definitions of "active" used.

<sup>2</sup> Excluding unknowns, which are treated as "low active" in report.

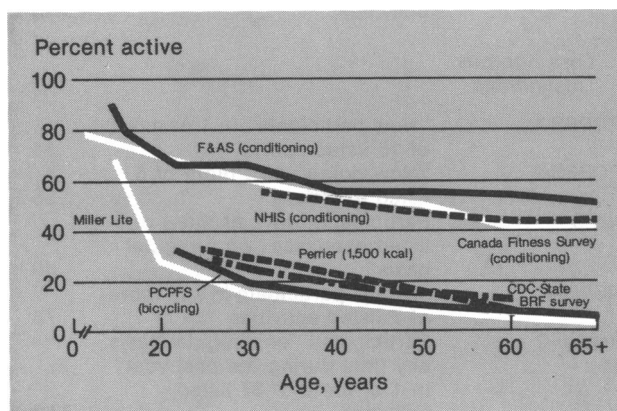
NOTE: Acronyms for studies are defined in table 1.

Figure 1. Sports participation and age, United States and Canada, 1972-83



NOTE: See table 2 for definitions of "active."

Figure 2. Leisure-time physical activity and age, United States and Canada, 1972-83



NOTE: See table 2 for definitions of "active."

adolescence and early adulthood, and (c) the decline is steeper when only sports are considered (fig. 1) in contrast to conditioning activities alone or combined with sports (fig. 2). In several of the surveys that deal with conditioning activities, a leveling off in the decline at ages 55-60 is apparent.

These patterns make it tempting to suggest that life events such as leaving school and retirement have an important impact on exercise patterns, detrimental in the first case and beneficial in the second. However, these cross-sectional surveys cannot distinguish between cohort and aging effects. For example, it is not possible to conclude from these data whether older people are less active because of the biology and sociology of aging or whether, being raised in a generation with less leisure time, they have never been physically active off the job. If there is a cohort or generational factor at work, which seems plausible, then figures 1 and 2 overstate the decline attributable to aging.

**Activity and sex.** Table 3 presents 14 male-female comparisons for various age groups from the eight surveys reviewed. In 9 of the 14 comparisons, males are more active by an absolute difference of 4 percent or more, while in 4 the sexes are virtually equal in this regard. Only in the case of the Canada Fitness Survey's conditioning activities are females more active in their leisure time.

Given the standard error that characterizes most of these surveys, the differences favoring males could be regarded as inconsequential because they are generally slight. However, grouping the findings according to the definition of active is instructive: there are substantial male-female differences when rigorous definitions incorporating intensity or frequency are used (table 3). When the definition is less rigid but restricted to sports, males are more active, but less dramatically so, than females. However, when the activities include conditioning (such as walking, calisthenics, jogging, and bicycling) and the definition is loose, the gender gap disappears.

In conclusion, males are more likely than females to be classified as physically active if frequency or intensity of activity is taken into account or if the activities are explicitly identified as sports. Otherwise, there is little difference in the proportion of each sex classified as active in its leisure time.

These generalizations about sex differences, while plausible, do not necessarily hold true at every age. Published evidence on this question is scarce; the only detailed data available are from the Canada Fitness Survey (15). This source indicates that, at ages 18-19 for example, young women are more active than young men, a reversal from the earlier years of adolescence. This raises important practical questions about the ways in which males and females change their exercise participation rates as they age.

**Activity and socioeconomic status.** The most complete data on the association between exercise and socioeconomic status (SES) come from six surveys that reported income (fig. 3). The overall pattern can be described as a modest positive relationship: in every case the activity level of the highest income groups exceeds that of the lowest, by factors ranging from 1.2 (2) to 2.3 (4). In only two cases is there a departure from a monotonic increase of exercise with income, presumably due to underreporting of household income by youthful (and active) participants in these surveys. The figure also shows that the activity-income relationship is most pronounced when the activities are restricted to sports.

The positive association between exercise and income is also apparently true of exercise and occu-

Table 3. Active male and female population, classified by definition, United States and Canada, 1972-83

Survey	Male (percent)	Female (percent)	Male to female ratio
<b>Rigorous definitions</b>			
CDC-State BRF survey	26	15	1.73
Perrier-1 (high active)	17	13	1.31
Miller Lite frequency index	22	14	1.57
<b>Looser definitions—restricted to sports</b>			
PCPFS-1 <sup>1</sup>	62	40	1.55
NHIS-2	47	37	1.27
F&AS-1	54	46	1.17
Canada Fitness Survey-2	73	64	1.14
<b>Looser definitions—including conditioning activities</b>			
PCPFS-2	56	55	1.02
NHIS-1	49	49	1.00
NSPHPC	80	76	1.05
Perrier-2	<sup>2</sup> 58	<sup>2</sup> 49	1.18
F&AS-2	60	58	1.03
Canada Fitness Survey-1	57	55	1.04
Canada Fitness Survey-3	55	60	0.92

<sup>1</sup> Numbers after studies indicate different definitions of "active" used; see table 2.

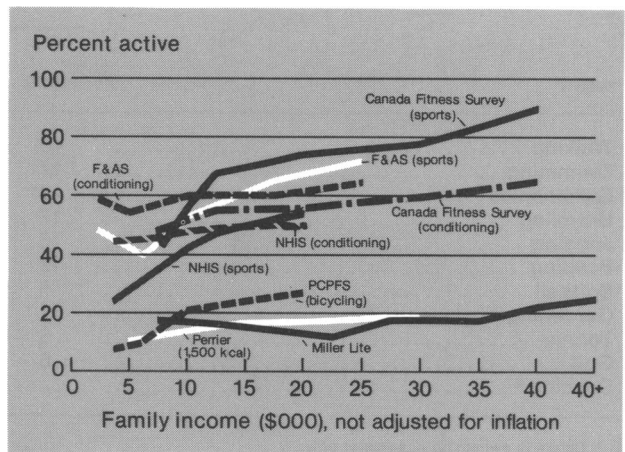
<sup>2</sup> Excluding unknowns, which are included with "actives" in Perrier report.  
NOTE: Acronyms for studies are defined in table 1.

pation, although only the two Canadian surveys have published results on this relationship (3,6). According to these surveys, managers and professionals are more active in their leisure time than other white-collar workers, who in turn exercise more frequently than blue-collar workers.

Five surveys, utilizing seven definitions of active, have published data on the activity level of persons according to the level of education they have completed (fig. 4). Four surveys involving six definitions substantially agree that leisure-time activity and education are positively related (1,3,6,7). The Miller Lite survey (8) is the exception, presumably because its index of activity puts a premium on frequency of participation and because it included some participants who were still in high school.

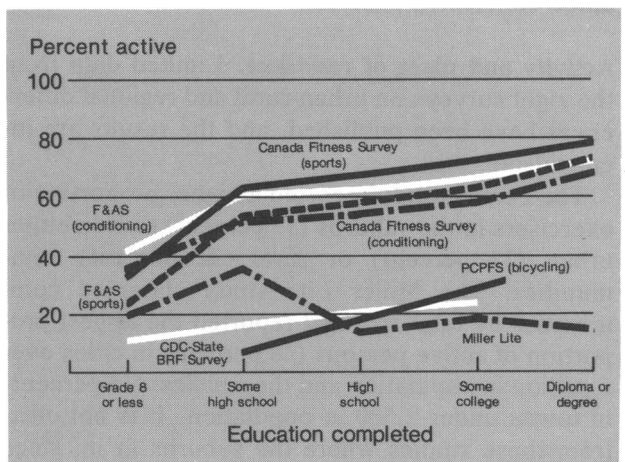
Our review of these three indicators of SES—income, education, and occupation—indicates that there is a positive association between exercise and SES. However, this association merely means that, with increasing income, education, or occupational status, there is a greater probability of classifying individuals as being active. Since definitions of active vary widely and many are quite loose, it is not possible to say with certainty that high-SES individuals are more active to an extent that benefits their health. Only the results of the CDC-State BRF survey, which is based on a rigorous definition and is standardized for age and sex, indicates that the

Figure 3. Leisure-time physical activity and income, United States and Canada, 1972-83



NOTE: See table 2 for definitions of "active."

Figure 4. Leisure-time physical activity and education, United States and Canada, 1972-83



NOTE: See table 2 for definitions of "active."

activity of high-SES groups is likely to benefit their health.

**Activity, race, and ethnicity.** Data on racial differences in activity patterns come from the NHIS supplement of 1975 (2), which shows 49 percent of whites and 43 percent of all others as regularly active, and the CDC-State BRF survey, which classifies 21 percent of whites and 20 percent of other races as active (C. C. White and K. E. Powell, unpublished data, 1984). Since the CDC-State BRF survey data are adjusted for age, sex, and SES (education), this suggests there are no differences between the races in this regard. More data on this question would clearly be useful.

No data on ethnicity have been published by our principal sources; indeed, most of the surveys did

Table 4. Percentage of population participating in specified leisure-time activities, United States and Canada, 1972-83

Activity	United States					Canada	
	PCPFS	NHIS	Perrier	NSPHPC	Miller Lite	F&AS	Canada Fitness Survey
Walking .....	40	34	22	37	...	40	57
Swimming .....	<sup>1</sup> 17	24	17	<sup>1</sup> 26	33	32	36
Calisthenics .....	13	14	14	27	29	19	28
Bicycling .....	17	11	13	11	28	13	38
Jogging .....	6	5	11	12	29	15	31
Bowling .....	12	16	13	...	10	4	8
Softball .....	5	9	7	...	21	2	11
Gardening <sup>2</sup> .....	...	...	...	...	...	...	30
Tennis .....	5	11	9	...	<sup>3</sup> 12	13	15
Golf .....	6	8	5	...	6	11	13
Dancing <sup>2</sup> .....	...	...	...	...	...	...	13

<sup>1</sup> Refers to swimming in summer only.

<sup>2</sup> Scarcity of data makes ranking very tenuous.

<sup>3</sup> Includes squash, other racquet sports.

NOTE: Acronyms for studies are defined in table 1.

not collect such information, and sample-size limitations from general population surveys would preclude conclusive analysis.

**Activity and place of residence.** Limited data from the eight surveys on urban-rural and regional differences have been published, and the results are inconclusive.

The Perrier study reported a higher proportion of exercisers in the suburbs (37 percent) than in either urban (31 percent) or rural (32 percent) communities. The Miller Lite study classified communities by total size and reported the largest proportion of active persons (28 percent) in cities over 1 million in population and the smallest (15 percent) in towns under 2,500 in population. It is not clear from these studies where the suburbs fit in, since population density was provided by the respondent for his or her community.

East-West and North-South variations in the United States are not easily summarized since the regional classifications are different in the two studies reporting such data—Perrier (4) and NHIS (2). However, in both studies the smallest proportion of exercisers was found in the South, the largest in the West, and an intermediate proportion in the East or Northeast. Interestingly, similar patterns hold true for Canada, with the proportionally most active population in the West (British Columbia), the least active in the economically depressed areas (Atlantic Provinces and Quebec in 1981), and an intermediate proportion in the industrial heartland (Ontario). Significantly, the Canadian results hold true for both sexes and all age groups.

This view of regional differences in activity patterns in the United States and Canada implies that

they have their basis in economic circumstances, a view shared by Chubb and Chubb (14) whose data on the geographic distribution of poverty in the United States show strong correspondence to the distribution of the active population. However, no analyses have been published to compare regional or urban-rural activity patterns that also take into account economic factors. Similarly, differences in the age-sex structure of populations in various regions or communities of different sizes have not routinely been factored into the analysis of exercise prevalence.

Differences between regions may well persist even after taking account of economic factors and population composition, and such differences may be attributable to climatic factors. However, it is unlikely that climate alone would explain regional differences. For example, while the temperate West in both the United States and Canada has the largest proportion of active residents, the intemperate Midwest and Canadian Prairies also have a relatively active populace.

**Activity choices.** All surveys in this review except the CDC-State BRF survey reported the estimated number of participants in individual activities. Although age coverage and definition of participation differ substantially between surveys, there is considerable agreement in the surveys on the most popular activities. In order of decreasing participation, these are walking, swimming, calisthenics, bicycling, jogging, bowling, and softball. Gardening and dancing, while not included on most activity lists, ranked high when they do appear (table 4).

The most striking characteristic of this list is the fact that it is dominated by conditioning activities,

whereas sports are low in the ranking, independent of the definition of participation.

Data on the activity choices of males and females (1-3,5,6) tend to corroborate the observations made earlier on activity and sex: sports and jogging are more popular with men than with women, while participation in other conditioning activities is roughly equal.

Although definitions may not have too much impact on the reliability of the overall rankings, they do make perilous any judgments about trends over time in activity choice. Nevertheless, it appears that some activities clearly gained participants during 1972-83, namely, jogging-running, calisthenics, and swimming (table 4). This trend is corroborated by Paffenbarger (16), whose study of Harvard alumni shows substantial increases in sports participation within cohorts and age groups for the period 1962-77. No increases are reported for walking and climbing stairs, however.

If there are indeed trends, they may well continue, judging by Canada Fitness Survey data (6) on the activities that have the most appeal to nonparticipants, that is, where the growth potential is greatest. These activities include jogging-running and calisthenics, whereas bowling is an activity that was dropped by many in the year previous to the Canada Fitness Survey. The Perrier survey corroborates the increase in jogging-running by identifying new participants, and classifies bowling as stagnant in regard to number of people participating (4). With the exception of bowling, the top six activities have three important features in common: they are inexpensive, can be done close to home, and are typically flexible in their scheduling. Newly popular activities will presumably have these features as well.

Although many of our conclusions regarding activity choices are necessarily tenuous, one thing is certain—prompting a respondent with a list of activities rather than an open-ended question leads to reporting of higher participation rates. Nowhere is this more apparent than in the F&AS survey (3a), which reported more participants for activities in the *last month* (for example, 12.7 percent for bicycling, when the activity was listed) than in the *last 12 months* (1.4 percent, when the activity had to be written in). In a similar fashion, gardening draws significant responses when it is included in an activity list (table 4), but it is overlooked otherwise.

**Secular trends.** Because of subtle but crucial differences in methods of collecting information on activity, meaningful comparisons among the U.S. sur-

*'With the exception of bowling, the top six activities have three important features in common: they are inexpensive, can be done close to home, and are typically flexible in their scheduling.'*

veys are not possible at this time. The two Canadian surveys, however, are sufficiently alike in wording of questions and sample design to permit comparison (3,6). They reveal that participation in conditioning activities remained essentially unchanged (59 percent versus 58 percent) over the 5-year period of 1976-81, while participation in sports grew from an estimated 50 percent to 68 percent of the household population. These findings hold both within and between age cohorts at the times of the two studies. However, since the definition of active in the Canadian studies was participation "in any sport or physical recreation activities within the last 12 months," the 18 percent increase may merely represent more people trying activities on a casual, infrequent basis.

A Gallup poll (17) provides evidence of an impressive 246 percent increase in activity during 1961-84. The question posed was "Aside from any work you do at home or at a job, do you do anything regularly, that is, on a daily basis, that helps keep you physically fit?" In 1961, 24 percent of respondents gave positive answers; in 1977, 47 percent; in 1980, 46 percent; in 1982, 47 percent; and in 1984, 59 percent. Equivalent increases over this period were reported for jogging.

Polls conducted for PARTICIPaction, the Canadian fitness-promotion agency, show an increase in the proportion of those who exercise two to three times per week from 25 percent in 1979 to 37 percent in 1982 (18). Though not nationally representative, more rigorous data from community studies (16) corroborate these indications of increased activity, at least for adult males.

While data on general population trends over time are rare, detail on changes by sociodemographic groups is almost nonexistent. Results from NSPHPC (5) that are based on self-reported changes in physical activity over a 2-year period, 1977-79, provide evidence for a slight increase in the proportion of women exercising, and none for men. More women described themselves as "more physically active" (25.6 percent) than "less physi-

cally active" (20.0 percent), although the majority reported no change. Men indicated no net change (21.4 percent increased and 20.7 percent decreased). This greater proportional increase on the part of women is also reported by the Canada Fitness Survey (6) for 1976-81, which brackets the years covered by NSPHPC. Similarly, the Canada Fitness Survey reports sharp increases in participation in exercise activities by older Canadians (age 55 or older) during 1976-81 (19).

This evidence on trends over time suggests substantial increases in the number of exercisers in both the U.S. and Canadian populations during recent years. According to Szalai's international study of time use (20), there was much room for such growth: as of the midsixties, adults spent an average of 5.5 minutes daily on sports and exercise as compared with 91.6 minutes watching television.

The trend data also hint that women and older people may have provided more than their share of the increased activity during this period. Indeed, this may be particularly true of women, since these surveys do not document the phenomenal growth of aerobic dancing.

Only two conclusions about secular trends can be made with certainty, however: (a) the generous and varied definitions of "active" make it all but impossible to judge the health significance of changing exercise patterns and (b) adequately detailed data on exercise activity over time, particularly for the United States, simply do not exist.

### Surveillance Systems

If, by surveillance, one means "ongoing scrutiny, generally using methods distinguished by their practicability, uniformity and rapidity to detect changes in trend or distribution in order to initiate investigative or control measures" (21), one must conclude that only the beginning of such a system exists in the United States, and there is none in Canada.

The CDC-State BRF survey provides an important source of data for a U.S. surveillance system, provided it continues to be conducted with reasonable consistency. Initiated in 1981 and now carried out on a continuing basis, it covers 28 States and the District of Columbia, accounting for 55 percent of the U.S. population. The survey is capable of providing aggregate statistics on a quarterly basis for the total area covered, and annual statistics for the individual States. If coverage were extended to all States and the detail on exercise increased slightly, the CDC-State BRF survey would be even more valuable.

Sections of two surveys are being planned by the National Center for Health Statistics in response to "Health Promotion/Disease Prevention: Objectives for the Nation" (22). This document implies at least two sets of compatible measurements, the first providing baseline data for some point in time before 1980 and the second measuring goal attainment by 1990. For this purpose, questions on the frequency, intensity, and duration of leisure-time exercise activities have been developed for the 1985 National Health Interview Survey. This survey will also collect data on self-rated activity level, a question posed in 1975 and 1977 on NHIS supplements. An improved set of exercise questions is currently being contemplated for inclusion in the National Health and Nutrition Examination Survey (NHANES III) in fiscal 1988, along with cardiovascular fitness testing.

These surveys, underway at the National Center for Health Statistics and the CDC, U.S. Public Health Service, will go a long way toward providing data for "regular monitoring of National trends and patterns of participation in physical activity, including participation in public recreation programs in community facilities" (22a). Similarly, if the Canada Fitness Survey is repeated in 1986, as is proposed, it will constitute a monitoring system for that country.

### Conclusions

Our main points are summarized in this section under headings indicating decreasing degrees of certainty. As might be imagined, what is known about exercise (based on agreement of several sources) is less than what is suspected (based on agreement of a few sources). No published data are available to support points classified as "unknown."

#### The known.

- Males and females are equally likely to participate in conditioning activities (such as walking, bicycling, and calisthenics), but males are more likely to be involved in sports, intense activities, or activities performed frequently.
- Decreasing proportions of the population are classified as physically active with increasing age, but this is not necessarily an inevitable outcome of aging.
- The proportion of the population classified as physically active in its leisure time is positively related to SES as indicated by income, education, and occupation.



- Six activities consistently account for the largest numbers of participants: walking for exercise, swimming, calisthenics, bicycling, jogging-running, and bowling.
- The proportion of the population that is physically active during its leisure time has increased substantially in recent years.

#### **Suspected.**

- Approximately 20 percent of the population exercises at a level generally recommended for cardiovascular benefit, another 40 percent is active at a lower intensity or frequency, and 40 percent is completely sedentary.
- Of the perennially popular activities, jogging and calisthenics have gained the most new adherents since 1972.
- When compared with other regions of the United States, the South has the lowest proportion of active residents; the West (in both the United States and Canada) has the highest proportion of active residents.
- Suburban residents are more active in their leisure time than those who live in large cities or rural areas.
- Whites and blacks are equally active in their leisure time, when age and SES are held constant.
- Women and older persons have increased their participation in leisure-time physical activities since 1976 to a greater extent than the population in general.
- The most rapid decline in participation rates occurs in adolescence and early adulthood.

#### **The unknown.**

- What is the true nature of differences between the sexes in total time spent on exercise and in level of intensity?
- Is the higher activity level of upper SES groups of sufficient frequency, intensity, and duration to provide health benefits?
- Are there differences among blue-collar workers in their leisure-time activity that relate to the physical demands of their work?
- Are there differences in activity levels between East-West, North-South, and urban-rural communities once age, sex, and SES are controlled for?
- What is the relative contribution of cohort and aging effects to the decline in activity associated with age?
- What is the relationship between leisure-time patterns of physical activity in childhood and in adulthood?

- How do life events such as leaving school, marriage, childbirth, and retirement affect physical activity patterns?
- Which activities are most popular in terms of total time devoted to them and which have the most faithful adherents (fewest dropouts)?

#### **Recommendations**

**Recommendations for further analysis.** To the extent that the uncertain conclusions and missing information summarized previously are relevant to public health (and most are), secondary analyses should be undertaken as a first step in search of firm conclusions. Every one of the suspected and unknown areas, except for life events and cohort versus aging effects, can be effectively examined with data from one or more of the surveys reviewed here. (All of the publicly sponsored surveys discussed can provide data in machine-readable form.) Each issue should be examined with at least two data sets, preferably three; those with large samples should be used whenever possible (table 1).

The suspected findings are listed in approximate order of declining certainty, based on the quantity and quality of evidence published to date. Thus, analyses motivated by a pure desire to provide new information could begin at the bottom of that list. However, the most important issue is a determination of the size and characteristics of the population receiving health benefits from its leisure-time physical activity.

*Recommendation 1.* Analyze existing data to answer the questions in the sections summarizing what is suspected and unknown.

*Recommendation 2.* Start by confirming the descriptive epidemiology of those who receive (a) cardiovascular and (b) other health benefits through their leisure-time activity.

**Recommendations for further surveys.** The major issues for surveillance or monitoring systems concern their content and periodicity. At this stage of knowledge about trends over time, it is premature to make definitive recommendations about periodicity. However, for surveys of the scale and comprehensiveness of the Canada Fitness Survey, repetitions more frequent than every 5 years are probably not justified.

Smaller scale surveys are another matter. The evidence of change over time reported in this paper, and the obvious value of current data to the annual

*'The proportion of the population classified as physically active in its leisure time is positively related to socioeconomic status as indicated by income, education, and occupation.'*

planning cycle of government, indicate that surveillance of broad but reliable indicators of population activity levels would be worthwhile on a continuing basis.

A monitoring system, by definition, must employ consistent procedures. The need for consistency is so important to interpreting trend data that it may often be reasonable to repeat a less-than-perfect question that has appeared on an earlier survey. Ideally, any such "obsolete" question will be accompanied by a new, improved version.

An important feature to build into a monitoring system based on repeated population surveys is a capability for collecting longitudinal data. Only the study over time of a representative sample, as in Paffenbarger's study of Harvard alumni (16,23), will make it possible to unravel the contributions of cohort and aging effects to the changes in activity level observed to correspond to age in cross-sectional data.

*Recommendation 3.* Conduct ongoing monitoring of population activity levels.

*Recommendation 4.* Carry out more detailed surveys of exercise patterns no less than every 5 years on a national scale, to obtain an understanding of the changes revealed by the monitoring system.

*Recommendation 5.* Give top priority to consistency of question wording and sample design in any repeated data collection.

*Recommendation 6.* Conduct a longitudinal study of a representative population sample to describe the "natural history" of exercise and especially to unravel cohort from aging effects.

Given all the interpretation problems encountered in reviewing the findings of eight national surveys of exercise, recommendations are in order for the activity questions and protocol of future surveys. Since the exercise stimulus required for cardiovascular health benefits is reasonably well understood (13) and since cardiovascular disease is

still of paramount importance, future surveys should collect detail sufficient for the calculation of energy expenditure values. If this is not feasible, an acceptable minimum is to determine whether an adequate amount of intense exercise is regularly obtained (for example, "Do you jog 10 miles per week?" or an equivalent question).

If this more modest approach is taken, it is important to avoid undefined use of the term "regularly" in question wording. In otherwise equivalent surveys of six midwestern communities, Jacobs and colleagues found that 48 percent of respondents claimed to engage in physical exercise "on a regular basis"; when this was explained as "at least once a week in the last month," the proportion rose to 65 percent (D. R. Jacobs and coworkers, unpublished data). While this is probably the only case on record of respondents having a more rigorous definition than the researchers, it illustrates the problems of imprecise wording.

If the goal is to estimate energy expenditure, it is necessary to determine activity type, frequency, average duration, and intensity. Achieving this detail with the required accuracy is analogous to the problem of estimating caloric intake, and some of the more successful solutions have been similar to dietary studies (24).

The work of Taylor and colleagues (12) and Montoye (25) clearly indicates the errors possible if sufficient detail is not obtained in physical activity assessment. Questions on mere participation, even when activities are specified, risk overestimating the extent of exercise. Ascertaining frequency, intensity, and duration improves accuracy, but requires probing by interviewers to determine the actual amount of physical work done. As noted earlier, providing the respondent with a list of the activities of interest is essential to establish the concept of exercise and to ensure reporting of such important activities as walking, gardening, and dancing.

The reporting period used in exercise questions represents the classic tradeoff between accuracy of recall and representativeness of the time period. Various solutions have been proposed and tested, ranging from the 3 days proposed by Bouchard and coworkers (26), through the 7 days of Sallis and coworkers (27), to the 12 months of Taylor and coauthors (12). Each of these solutions obtains the necessary detail on frequency, intensity, and duration, and has demonstrated validity, reliability, or both. The shorter periods are not necessarily representative of the respondent's usual activity pattern, however; this may attenuate the correlation

## Demographic Variables Recommended for Exercise Surveys

### Sex

### Age

Preferred: month, day, year of birth; confirm respondent's age

Acceptable: month and year of birth; confirm respondent's age

### Marital status

Single (never married)

Married (including common-law)

Separated or divorced

Widowed

### Education

Elementary or less

Some high school

Completed high school

Some college

Completed college or university

### Occupation (and industry)

The standard four-part, open-ended question is preferred. Once coded to occupation and industry, it is subject to aggregation in a variety of ways.

1. For whom do you work?
2. What kind of business or industry are you employed in?
3. What kind of work are you doing?
4. What are your most important activities or duties at this job?

### Income

Determine total family (household) pre-tax income from all sources including wages, salaries, retirement benefits, welfare, investments, etc.

Preferred: ask respondent to estimate income to the nearest \$1,000, with an optional top category of "greater than \$\_\_\_\_" (amount to be adjusted with time, but not less than \$40,000 presently).

Acceptable: provide categories, with smaller increments below \$25,000 and larger above.

### Race and ethnicity

For surveys being conducted by or for the U.S. Government, the following format complies with official recommendations:

Race	Ethnicity
American Indian or Alaska Native	Hispanic origin
Asian or Pacific Islander	Not of Hispanic origin
Black	
White	

For other surveys we suggest that consistent categories be utilized, while considering the sponsor's requirements and the characteristics of the proposed study population.

between estimated energy expenditure and measured physical fitness and make it impossible to study the importance of interruptions in a pattern. Long time periods, on the other hand, may suffer from reduced accuracy. The Canada Fitness Survey attempted to solve this dilemma (28) by adapting the approach of Taylor and colleagues, collecting more detail on recent or continuing activities and less detail on more distant or infrequent ones.

*Recommendation 7.* Collect information on the frequency and average duration of each type of physical activity and include information on activity intensity if space permits. One possibility is to use a reporting period of the previous 2 weeks and determine whether activity during this time was typical for the individual.

*Recommendation 8.* Provide the respondent in face-to-face surveys with a list of common activities including brisk walking, gardening, and dancing, with provision for write-ins in order to prompt more complete recall, and develop an equivalent procedure for telephone surveys. Avoid distinctions in such lists between conditioning activities and sports; save this for the analysis phase.

*Recommendation 9.* Collect detailed demographic data including age, sex, marital status, occupation, education, income, race, and ethnicity, using standard question wording as found in recent large-scale federally sponsored surveys. Consistency in these questions is no less important than in the activity questions. Proposed categories are summarized here (see box).

*Recommendation 10.* Record the respondent's place of residence using standard census definitions that permit later aggregation in a variety of combinations, for example, urban-suburban, regions, and community size.

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## The Determinants of Physical Activity and Exercise

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### Synopsis .....

*Evaluation and delivery of physical activity and exercise programs appear impeded by the substantial numbers of Americans who are unwilling or unable to participate regularly in physical activity. As a step toward identifying effective interventions, we reviewed available research on determinants relating to the adoption and maintenance of physical activity. We categorized determinants as personal, environmental, or characteristic of the exercise. We have considered supervised participation separately from spontaneous activity in the general population.*

*A wide variety of determinants, populations, and settings have been studied within diverse research traditions and disciplines. This diversity and the*