Sports, Exercise, and Other Causes of Injuries: Results of a Population Survey

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Mortality rates and injuries requiring medical treatment associated with sports and exercise are generally low. However, higher injury rates are reported for athletes and members of sports clubs. This study focuses on the sport- and exercise-related injury rate for various age and sex groups in the general population and how sport and exercise injury rates compare with those for other activities. The data presented are based on telephone interviews. Of the participants (N = 6,596), 335 (5.1%) reported having sustained an injury in the previous month; 46% of injuries among males and 14% of those among females were sport or exercise related. The data show a downward trend in sport- and exercise-related injury rates with increasing age. It is concluded that, as a proportion of all injuries sustained, the sport- and exercise-related injury rate is high, particularly among males. Possible future research on sport- and exercise-related injuries is discussed.

Key words: injuries, exercise adherence, sport, gender

Engaging in exercise and sport has distinct benefits for health and well being (McGinnis, 1992; Turner-Warwick et al., 1991). However, not all effects are positive; injuries are considered to be one of the major health hazards of exercise and sport (Requa, DeAvilla, & Garrick, 1993). In addition to the costs of injuries (i.e., medical bills, days of work lost), is the problem that fear of injuries might cause people to stop exercising or form a negative view of sports and exercise. To better prevent injuries among sport and exercise participants, detailed data are needed regarding lowering the costs of injuries and addressing any unjustified concerns about the risks of exercise and sport.

Many different sources provide information on exercise- and sport-related injuries, such as death certificates, accident reporting systems, emergency room records, and data from surveys and prospective studies. Data from reporting systems, death certificates, and newspaper articles, reveal that the mortality rate in relation to sport and exercise activities is low. For example, for a 6-year period between 1982 and 1988 the American National Centre for Catastrophic Sports Injury Research counted 44 fatal injuries among 2.5 million participants in popular high school sports such as football, soccer, wrestling, tennis, swimming, and ice hockey (Mueller & Cantu, 1990). More than half of these fatalities were related to an unlucky combination of a previously nonsymptomatic coronary problem and an injury obtained while engaging in a sport activity. In Ontario, Canada, the number of fatalities in 1986 was estimated at 87 for all age categories for competitive and recreational sports activities, such as walking and cycling (Tator & Edmonds, 1988).

Data from emergency and casualty treatment centers are widely available and provide valuable insight into the medical burden and treatment regarding sport and exercise injuries. These data show that 4-16% of such cases resulted from a sport- or exercise-related injury (Pelletier, Anderson, & Stark, 1991; Pickard, Tullett, & Patel, 1988; Sahlin, Stene, Lereim, & Balsad, 1990).

Prospective studies also provide insight into activity-related injury rates (i.e., frequency of injury within a specific time or distance covered). Members of athletic or sports clubs, or their trainers, have completed questionnaires or kept detailed diaries about all injuries over a period of time. Such data show that, for example, top Irish athletes engaging in various types of sports get injured an average of 2.1 times per year (Watson, 1993); 24% percent of members of a Dallas running club reported sustaining injuries in a 12-month period (Blair, Kohl, & Goodyear, 1987); 50% of runners registered on a mailing list for road races reported injuries within a 12-month period (Macera, et al., 1989); and members of 15 Bay Area fitness clubs, who were involved in a wide range of activities, sustained approximately 2 injuries per year (Requa, et al., 1993).

As the above examples show, data are available regarding exercise- and sport-related mortality, the medi-
cal aspects of injuries, particularly those treated in hospitals, and injuries sustained within the context of organized sport and exercise groups. However, much less data are available concerning injuries which do not receive medical treatment, and the more individual, recreational, and nonorganized activities (British Medical Association [BMA], 1987; Macera et al., 1989; Requa, et al., 1993). Further, as these data often concern “convenience samples,” there are problems in placing the results in a wider context (e.g., in comparing sports- and exercise-related injuries with other causes of injuries or health problems, or in generalizing the findings to populations of active and nonactive individuals [BMA, 1987]). It is difficult to generalize the findings for athletes and sports club members to the “average” member of the population (Jones, Cowan, & Knapik, 1994).

In this study, data on injuries reported in the context of an extensive lifestyle and health survey are presented in a way which allows three different comparisons. First, to show the relative importance of sport and exercise as a cause of injuries, data on injuries sustained while involved in sports and exercise are compared with data on injuries sustained while involved in other activities, such as work, recreation, or travel. Second, the data are presented separately for males and females to study gender differences in injury rates. Third, the data are presented by different age groups to study changes in injury rates over the lifecycle. The data by sex and age are also presented in a way to study differences in injury rates while considering differences in activity patterns between these groups.

Method

Sampling Design

The data in this study were collected within the context of a project aimed at estimating changes in health risk factors such as smoking, alcohol use, exercise, diet, sexual behavior and accidents and injuries over time. The data were collected by Computer Assisted Telephone Interview between February 1993 and May 1994 in residential households in two Scottish cities, Glasgow and Edinburgh. Data collection and questionnaire design followed the example and philosophy of the Centers for Disease Control and Prevention behavioral risk factor surveillance surveys (Hogelin, 1988). The data were collected by a team of specially trained telephone interviewers, 6 days per week, during the day and evening. The data collection method used a random-digit dialing procedure to contact households; thus, unlisted telephone numbers were included in the sampling procedure. Within each contacted household one household mem-

ber age 18–60 years was selected randomly for the interview, which contained approximately 90 questions on health-related behaviors and risks and took approximately 15 min to administer.

Participants

Prior to continuing the interviews, informed consent was obtained from 6,596 participants. The response rate during the period of data collection was calculated monthly, according to the procedure suggested by the Council of American Survey Research Organizations (CASRO, 1982), and fluctuated around 75%.

Previously (Uitenbroek & McQueen, 1991) when the data collected in 1989 using the same methodology were compared with census data, there was a slight, not statistically significant, overrepresentation in the sample of participants ages 30–39 years while the group ages 20–29 years was underrepresented. Females, who constituted 56.8% of the sample, were overrepresented; therefore, estimates in this study are provided separately for males and females. Differences in telephone ownership relative to various social groups also proved to be small (Uitenbroek & McQueen, 1991).

Injury and Activity Assessment

The question on injuries was based on one asked previously in the National Centre for Health Statistics (NCHS) injury surveys (NCHS, 1991), but for this study the recall period was extended to 1 month: “Was there any time during the past month that you had to cut down on the things you usually do because of an accident or injury?” Those who reported being injured were asked: “What activity were you involved in when this accident or injury happened?”

In this study, injury rates are shown primarily for the full population sample. However, not all members of the population are similarly active and, therefore, not at similar risk for sustaining injuries. This discrepancy causes problems if injury rates between different population groups are compared, because a difference in the injury rate observed between groups might be explained by a different activity level in each group. Therefore, to consider differences in the activity levels between gender and age groups, an assessment of the proportion of active individuals in different gender and age groups was made in this study.

Two questions on physical activity were used to assess the number of participants involved in sport or exercise: (1) “During the past month, did you take part in any physical activity for exercise?” (2) “How many times per week did you exercise for at least 20 minutes?” For this study participants are categorized into two groups: one that exercises at least once a week for at least 20 min per session, and one that exercises less often. This cat-
egorization resulted in 1,619 males (56.9%) being classified as active, while 1,228 males (43.1%) were classified as nonactive; for females 1,890 (50.4%) were active, and 1,859 (49.6%) were nonactive.

Data Analysis

For statistical testing, data analysis concentrated on cross tabulations, t tests, and chi-square tests ($\chi^2$). General Linear Modeling, as implemented in the computer package GLIM (Healy, 1988), was used to study the relationships among age, exercise behavior, and injuries. Because the dependent variable was dichotomous (injured or not injured), a logistic regression was used. To test for statistical significance, $\chi^2$ and t ratios were used. T ratios were calculated by dividing the regression coefficients by their standard errors to test whether the trend relationships among age, exercise behavior, and injuries were statistically significant. T ratios have the same distribution as the student t used for testing differences between means (Wonnacott & Wonnacott, 1977).

Results

Causes of Injuries

Table 1 shows the percentage of participants, by gender and activity, who reported having to interrupt their daily activity due to an injury during the previous month. Of the 6,596 participants, 335 (5.1%) reported being injured during the previous month. Of those, 32.5% were injured while engaging in sport or exercise, which represents 1.65% of all participants.

Gender and Injuries

Nearly half (46.4%) of the male participants sustained injuries while involved in sport or exercise, equivalent to 3.16% of all males reporting a sport- or exercise-related injury in the month prior to the interview. For females, 13.5% of all injuries were sustained while involved in sport or exercise, which is equivalent to 0.51% of all females reporting being injured while engaging in sport or exercise during the month prior to the interview. Sustaining injuries while involved in sport or exercise was the most prevalent cause of injuries among males and the fourth most prevalent cause among females. The difference between males and females is statistically significant; $\chi^2 (7, N = 6,956) = 47.3, p < .001$.

Age and Injuries

Figure 1 shows the percentage of participants, by age, who reported sustaining an injury during the previous month. (The figure does not include nine participants who had a missing value for age.) The data indicate that work-related and other injuries increase with age, while the travel injuries decrease, except in the age group 40–49 years. The sharp decrease in sport- and exercise-related injuries as age increases is consistent over the age groups and statistically significant in the logistic regression analysis, $t(6,586) = 4.05, p < .0001$. The decrease in sustaining sport- and exercise-related injuries with increasing age is observed among both males and females; however, the difference is statistically significant only for males, $t(2,841) = 5.52, p < .0001$; and $t(3,746) = 1.42, p > .05$, for females.

The decrease in sport- and exercise-related injuries with age might be due to the decrease with age of individuals actively involved in sport or exercise, as reported

| Table 1. Proportion of respondents reporting an injury in the previous month by the activity which caused the injury, with the number Injured, percentage of all respondents (in parentheses), and percentage of the number injured (in brackets). |
|--------------------------------------------------|---------------------|---------------------|---------------------|---------------------|
| | All respondents | Males | Females | |
|Sport & Exercise | 109 (1.65) | 90 (3.16) | 19 (0.51) | |
|Work | 52 (0.79) | 25 (0.88) | 27 (0.72) | |
|Travel Motor Vehicle | 39 (0.59) | 17 (0.60) | 22 (0.59) | |
|Travel Foot/Cycle | 38 (0.58) | 17 (0.60) | 21 (0.56) | |
|Housework | 16 (0.24) | 4 (0.14) | 12 (0.32) | |
|DIY-hobby* | 7 (0.11) | 5 (0.18) | 2 (0.05) | |
|Gardening | 5 (0.08) | 1 (0.04) | 4 (0.11) | |
|Other | 69 (1.05) | 35 (1.23) | 34 (0.91) | |
|Total | 335 (5.08) | 194 (6.81) | 141 (3.76) | |
in other studies (Uitenbroek, 1991). Table 2 compares the injury rate of participants who reported exercising the previous week, relative to age-specific and exercise rates.

Table 2 shows the percentage of people who reported sustaining an injury in a sport or exercise activity during the previous month. The decrease in the percentage of injuries with increasing age is clearly observed. The table also shows that sport- and exercise-related injuries are six times more common among males than among females \( \chi^2 (1, N = 6,956) = 70.2, p < .0001 \). Table 2 also shows the proportion of participants who reported exercising at least once during the previous week. Again, there is a statistically significant decline with age \( t(6,586) = 6.3, p < .0001 \); and significantly more males than females who reported exercising \( \chi^2 (1, N = 6,956) = 27.1, p < .0001 \). The last column of Table 2 shows the number of injuries sustained while engaging in sport or exercise relative to the number of participants who exercised at least once during the previous week and could be considered “at risk” for a sport- and exercise-related injury. Statistical testing was done by using the number of people who reported exercising in sport or exercise at least once in the past week as the denominator for the number who reported being injured. Both the decrease with age, \( t(3,507) = 2.9, p < .01 \), and the difference for genders, \( \chi^2 (1, N = 3,510) = 47.3, p < .0001 \), remain statistically significant.

Discussion

This study shows that sport and exercise are the most prevalent cause of injuries in an urban adult population. However, there is a large difference between males and females, with about half of all injuries among males caused by sport and exercise occur and 14% among females. Of interest is the strong decrease in the injury rate with increasing age, a decrease also observed considering the number of participants engaging in sport and exercise with increasing age.

As discussed in the introduction, mortality data generally show a low number of fatal accidents related to sport and exercise activities. Data from accident and emergency treatment centers show that a relatively low proportion of accidents can be attributed to sport and exercise. The studies related to athletes and members of sport and exercise clubs show much higher injury rates, with at least 25% of sport club members being injured each year and those engaged in top sports being injured an average of twice per year. One may argue that because members of these groups are very active, exercise- and sport-related injury rates among the general population will probably be much less prevalent. However, the data presented here show that such optimism is not justified; in the population surveyed, injuries related to exercise and sport are high relative to other causes of injuries, particularly for males.

Given the high level of exercise- and sport-related injuries reported by the participants, learning more about the causes and consequences of those injuries is paramount. What activities cause the most injuries? What is it about these activities and the way they are performed that cause injuries? What are the type and seriousness of the injuries? By whom is care provided, (i.e., medical professionals, trainers, those trained in first aid, the victim, or the victim’s family or friends)? What are the quality and outcome of the care provided? To what extent do sport- and exercise-related injuries lead to absence from work and otherwise influence the ability to be involved in daily activities? It is crucial to learn more about such issues if the aim is to promote exercise and sport in a way that minimizes any negative health and other outcomes related to injuries.

Table 2. Self-reported sport and exercise injury rates by age and sex, proportion of respondents reporting to have been physically active for exercise, and proportion injured relative to the number of exercisers

<table>
<thead>
<tr>
<th>Percentage injured per month [a]</th>
<th>Active once or more per week [b]</th>
<th>a/b</th>
</tr>
</thead>
<tbody>
<tr>
<td>All respondents</td>
<td>1.7</td>
<td>53.2</td>
</tr>
<tr>
<td>18–21</td>
<td>3.9</td>
<td>69.5</td>
</tr>
<tr>
<td>22–29</td>
<td>2.4</td>
<td>63.5</td>
</tr>
<tr>
<td>30–39</td>
<td>2.0</td>
<td>56.8</td>
</tr>
<tr>
<td>40–49</td>
<td>1.1</td>
<td>46.9</td>
</tr>
<tr>
<td>50–59</td>
<td>0.2</td>
<td>39.1</td>
</tr>
<tr>
<td>Males</td>
<td>3.2</td>
<td>56.9</td>
</tr>
<tr>
<td>Females</td>
<td>0.5</td>
<td>50.4</td>
</tr>
</tbody>
</table>

Figure 1. Injuries sustained by age for four activity groups.
However, considering the data on mortality and morbidity discussed in the introduction, it is reasonable to assume that such research would demonstrate the relatively small costs of sport- and exercise-related injuries. It should be considered that many of the injuries reported are probably relatively minor, not needing treatment or having lasting health effects. Higher levels of more serious injuries would indeed be discovered by monitoring mortality and morbidity using the data sources mentioned above. However, it is also necessary to consider the psychological and social consequences of injuries, e.g., the effect of injuries on the image of exercise and sport, motivating exercise and sports participants to continue exercising, and motivating sedentary individuals to start exercising. The occurrence of regular light injuries might have a highly detrimental effect on this aspect of exercise; psychological study shows that the grinding effect of regularly occurring “hassles” can be as effective in changing attitudes and behaviors as the occurrence of major “events” (Landreville & Vezina, 1992; Williams, Zyzanski & Wright, 1992). Research into the psychological effect and possible adverse image of exercise, therefore, seems necessary to gain insight into the effect of regularly occurring small injuries on the long-term maintenance of exercise behavior and the extent such injuries present a barrier to exercising more.

In this context, the strong decrease in the injury rate with increasing age seems to be particularly significant. The data show that, among males, exercise- and sport-related injuries decrease dramatically with increasing age, even considering the decrease in activity with age. If this effect is caused by a response to high injury rates, it may be positive, as people limit the possible health hazard and social inconvenience of injuries by shifting to less risky sport and exercise activities as they age but continue their involvement in sport or exercise. However, there is also a pronounced decrease in exercise and sport participation with increasing age, which indicates that maintaining exercise behavior throughout the lifecycle is problematic. Although this decrease in physical activity probably can be attributed to many factors other than sustaining injuries, promoting activities with a low risk of sustaining any kind of injury might be necessary to convince people to maintain high levels of physical activity in older age.

References


Williams, R., Zyzanski, S. J., & Wright, A. L. (1992). Life events and daily hassles and uplifts as predictors of hospitaliz-
tion and outpatient visitation. *Social Science and Medicine, 34*, 763–768.

**Author's Notes**

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