Non-Equipment Exercise-Related Injuries Among U.S. Women 65 and Older: Emergency Department Visits from 1994-2001

Ches S. Jones, PhD
Lori W. Turner, PhD, RD

ABSTRACT. The objective of this study was to estimate the relative frequency, types of injury, types of exercise, and mechanism of non-equipment exercise-related injury among women 65 and older. Methods included a descriptive analysis of emergency department (ED) visits to hospitals participating in the National Electronic Injury Surveillance System (NEISS). Researchers identified 851 exercise-related injuries to women 65 and older. Estimates are that 37,729 older women were treated in emergency departments for injuries related to non-equipment type exercise activity from 1994-2001. Although there are many benefits to exercise, injuries due to overuse and existing physical conditions such as osteoporosis are a concern for active older women. Promotion of safe exercise activities and programs for older women are recommended. [Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <http://www.HaworthPress.com> © 2005 by The Haworth Press, Inc. All rights reserved.]

Ches S. Jones is Associate Professor of Health Science in the Health Science, Kinesiology, and Recreation Department, University of Arkansas, Fayetteville, AR.
Lori W. Turner is Associate Professor of Health Science in the Health Science, Kinesiology, and Recreation Department, University of Arkansas, Fayetteville, AR.
Address correspondence to the authors at: University of Arkansas, 308 HPER Building, Fayetteville, AR 72701 (E-mail: ches@uark.edu or lori@uark.edu).
**KEYWORDS.** Exercise, injury, fractures, walking

**INTRODUCTION**

Exercise is a popular activity for many older women. Recent data from the National Center for Health Statistics (Ni, Schiller, Hao, Cohen, & Barnes, 2003) suggest that at least 1 of 4 older women regularly engaged in some type of leisure time physical activity. The most common exercises for older individuals include exercise walking, aerobics, running/jogging, and calisthenics (NSGA, 2000).

Exercise has many benefits for older women. Some of the benefits include, but are not limited to, improved quality of life (Chodzko-Zajko, 1998) decreased risk for hip fractures (Feskanich, Willett, & Colditz, 2002; Holdrup, Sorense, Stronger, Laurtizen, Schroll, & Gronback, 2001), a reversal or slowing of age-related bone loss (Ebrahim, Thompson, Baskaran, & Evans, 1997), decreased risk for early mortality (Andersen, Schnohr, Schroll, & Hein, 2000), reduced risk of falls (Carter, Kannus, & Khan, 2001; Feder, Cryer, Donovan, & Carter, 2000; Gardner, Robertson, & Campbell, 2000; Shumway-Cook, Gruber, Baldwin, & Liao, 1997; Skelton, & Dinan, 1999), and improvement in muscular strength, muscular power, endurance, flexibility, functional ability, improvement in gait (walking), and posture (Bassey, 2000; Buchner, Cress, de Lateur, Esselman, Margherita, & Price et al., 1997; DiPietro, 2001; Eyler, Brownson, King, Brown, Donatelle, Heath, 1997; George & Goldberg, 2001; Schroll, Avlund, & Davisden, 1997; Skelton & Beyer, 2003).

However, negative consequences of exercise to older women exist. Research has indicated exercise as a potential risk for injury and disability for older women. Injury from exercise has been related to falling (Ebrahim, Thompson, Baskaran, & Evans, 1997), the fear of falling (Bruce, Devine, & Prince, 2002), a lack of confidence in exercising (Bruce, Devine, & Prince, 2002) and sports and physical activity participation (Jones, Christensen, & Young, 2000; USCPSC, 1998). Jones (2000) identifies weight-training equipment and related exercises as a potential hazard. However, the hazard posed by non-equipment exercises including walking, jogging, and aerobics remain unknown. The objective of this study was to estimate the relative frequency, types of injury, types of exercise, and mechanism of non-equipment exercise-related injury among women 65 and older.
METHODS

Subjects for the study were obtained from a sampling of all women ages 65 and older who were injured from January 1, 1994 through December 31, 2001. These women reported experiencing injury from exercise that did not involve exercise equipment. After their injuries, they sought treatment from hospital emergency departments (ED) that were participating in the National Electronic Injury Surveillance System (NEISS) (product codes 3299).

Non-equipment-related exercise was defined for this study as any physical activity program not involving exercise equipment. Exercises included were aerobic activity such as walking, jogging, and aerobic dance, relaxation activities such as yoga, or self-defense activities such as karate and judo.

NEISS is a national probability sample consisting of 101 hospitals, drawn from more than 5,000 hospitals nationwide with 24-hour emergency departments (USCPSC, 1997). Since data collected for NEISS is only a sample and not from all hospitals, the data is weighted based on the sample design to produce national estimates of the number of injuries treated in all hospital emergency rooms. The sample includes hospitals of varying sizes and locations, and also includes children’s hospitals and trauma centers. NEISS was developed in 1971 by the Consumer Product Safety Commission to track injuries related to consumer products. It has been updated several times to maintain its statistical validity. Many studies have reported on the NEISS validity and it has been found to be representative of product-related injury incidents nationwide (USCPSC, 1997).

Participating hospitals were selected for each of 4 strata designed to increase the probability of obtaining a sample of hospitals that represented comprehensive geographic distribution within each of the 4 strata. The strata were selected based on hospital size (small, medium, or large), defined by the total number of emergency department visits. Hospitals representing large inner-city locales with trauma centers, urban, suburban, and rural areas were included in the stratification design.

Information extracted by NEISS included the product or products related to the injury; descriptions of the injury, which includes primary diagnosis of the injury and anatomical location of the injury; the severity of the injury; descriptions of the ED visit, such as date and discharge disposition; general demographic characteristics of the injured person; whether patient was hospitalized; and a brief narrative of the injury inci-
dent. The narratives for records reported for this study were reviewed to verify consistency with the research questions of this investigation.

Anatomical location of injury was categorized into five different body regions: the head, upper trunk, lower trunk, arm, and leg. The head region consists of the head, eyes, ears, forehead, face, mouth, and neck. The shoulder and upper trunk comprised the upper trunk. The lower trunk consisted of the lower trunk and pubic region. The arms included the upper and lower arms, hands, and fingers. The legs consisted of the upper and lower legs, ankles, feet, and toes.

The type of injury was also categorized into groups for this study. Soft tissue injuries included the NEISS categories of contusions, abrasions, crushing injuries, hematomas, and strains or sprains. Lacerations included lacerations, punctures, and avulsions. Fractures and dislocations were combined for analysis. The other injury category included concussions, dental injuries, foreign bodies, nerve damage, internal organ injuries, hemorrhage, burns, dermatitis or conjunctivitis, and other injuries.

Statistical analysis included a variance computation that accounted for the stratified sample design of the NEISS (USCPSC, 1997). Frequencies and univariate analyses were conducted to describe basic demographics and injury characteristics. We used the NEISS data and weightings to calculate injury estimates. Calculation of a 95% confidence interval (CI) for the estimated number of injuries was based on the generalized estimated sampling error for NEISS data provided by the CPSC (USCPSC, 1997). Sampling errors for estimates below 1,200 injuries were not calculated. U.S. Census (2003) estimates for 1994-2001 were used to calculate injury incidence rates. The data were analyzed using the SPSS version 11.0 for the Macintosh statistical program.

RESULTS

From 1994 through 2001, NEISS identified 851 injuries that were treated at ED related to non-equipment exercise to women 65 and older. Estimates are that 37,729 (95% CI, 31,706-50,100) injuries occurred nationwide to older women. The average annual increase from 1994-2001 was 30%. The overall prevalence rate for injury per 100,000 population for the study period was 26.8 (95% CI: 21.0-32.6). Figure 1 provides a breakdown of the rates by year and age groups. The age group accounting for most injuries was women between the ages of 65 and 74, with almost 60% of the injuries; the median age was 72 years.
Examining the data by body part, the lower trunk that includes the pubic region was the site most injured (17%), then ankle/feet/toes (16.5%), knee (14.3%), and head/neck region (13.4%). The most common diagnoses at the emergency room were sprains and strains (36.4%), then fractures (31%), and lacerations (8%). Table 1 highlights the most common injuries experienced by the women in this study.

The estimated number of older women sustaining injuries serious enough to be admitted to the hospital was 4400 (11.8%), (95% CI, 3106-5694). The most common location of injury was the street, highway, or other public property with 25.2% followed by a place of sports or recreation with 22%. The home was cited as the third most common location for injury with 16% of injuries.

The most interesting information revealed that the exercise activities most often cited in the incident reports were walking or hiking (58%) followed by exercising or calisthenics (23%). Aerobics was next with 9% and jogging with 7%. Four of five of the injuries were due to either falling (44%) or overuse (40%). The next common cause was heart/respiratory conditions (5.7%) followed by syncope or dizziness during exercise (4.3%).

FIGURE 1. Injury Rate Per 100,000 Population for Non-Equipment-Related Injury Among Women 65 and Older

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DISCUSSION

Data from NEISS reveals that ED-treated injuries from non-equipment exercise-related activity has increased among women 65 and older over the past decade. Injury rates for all age groups have increased substantially. Most injuries seen in the ED were for sprains/strains and other soft tissue injuries. However, the number of fractures is a concern. One of three women in this study was seen in the emergency room for a fracture, dislocation, or crushing injury. Furthermore, the most common site of injury and fracture involved the leg and trunk regions. This may suggest that latent skeletal disorders such as osteoporosis might have been present prior to injury.

Walking was indicated as the activity most related to injury. Research Data from the National Sporting Goods Association (2002) indi-

<table>
<thead>
<tr>
<th>Injury Diagnosis</th>
<th>Body Site</th>
<th>No (%)</th>
<th>95% CI*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft Tissue</td>
<td>Knee</td>
<td>3421 (9.1%)</td>
<td>1948-4894</td>
</tr>
<tr>
<td>Soft Tissue</td>
<td>Trunk/Pubic Region</td>
<td>2826 (7.5%)</td>
<td>1608-4043</td>
</tr>
<tr>
<td>Soft Tissue</td>
<td>Ankle/Feet/Toes</td>
<td>2802 (7.4%)</td>
<td>1594-4010</td>
</tr>
<tr>
<td>Fracture/Dislocation</td>
<td>Trunk/Pubic Region</td>
<td>2367 (6.3%)</td>
<td>1347-3387</td>
</tr>
<tr>
<td>Soft Tissue</td>
<td>Head/Neck</td>
<td>2298 (6.1%)</td>
<td>1307-3288</td>
</tr>
<tr>
<td>Fracture/Dislocation</td>
<td>Arm</td>
<td>2206 (5.8%)</td>
<td>1254-3157</td>
</tr>
<tr>
<td>Fracture/Dislocation</td>
<td>Wrist/Hand/Fingers</td>
<td>2163 (5.7%)</td>
<td>1230-3095</td>
</tr>
<tr>
<td>Fracture/Dislocation</td>
<td>Ankle/Feet/Toes</td>
<td>2029 (5.4%)</td>
<td>1154-2904</td>
</tr>
<tr>
<td>Laceration/Cut</td>
<td>Head/Neck</td>
<td>1878 (5.0%)</td>
<td>1068-2688</td>
</tr>
<tr>
<td>Other</td>
<td>Shoulder/Upper Trunk</td>
<td>1780 (4.7%)</td>
<td>1012-2548</td>
</tr>
</tbody>
</table>

*Indicates 95% confidence interval
cate that exercise walking is the most common non-equipment exercise for older women (see Table 2). Another study that looked at various levels of walking indicated 50% participation at low, moderate, or high intensity levels (Barnes & Schoenborn, 2003). The study’s finding that walking was the activity related with the most injuries would be expected. But does this excuse walking as an appropriate form of activity for older women? In some cases, being accompanied by a dog was a cause for the injury.

Our study also indicated falling as the most common mechanism for the injury. Falling is a likely consequence of walking for individuals of any age, but can be a more serious risk for injury among older women. Past studies have called for the use of hip protectors for older women at risk for exercise-related falls (Kannus, Parkkari, Niemi, Pasanen, Palvanen, Jarvinen, & Vuori, 2000).

If walking puts women at risk for falling and injury, then more appropriate forms of exercise should be prescribed. Studies have found that an exercise program that combines balance, stability, and walking activities in the home can counter falls from physical activity (Campbell, Robertson, Gardner, Norton, & Buchner, 1999; Campbell, Robertson, Gardner, Norton, Tilyard, & Buchner, 1997; Gardner, Robertson, & Campbell, 2000; Gardner, Buchner, Robertson, & Campbell, 2001). Tai Chi has been suggested as a beneficial exercise due to its focus on im-

**TABLE 2. Non-Equipment Exercise Participation Rates** Among Women 65 and Older, 2002

<table>
<thead>
<tr>
<th>Exercise</th>
<th>No.</th>
<th>Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise Walking</td>
<td>7,334,000</td>
<td>35.6%</td>
</tr>
<tr>
<td>Aerobics</td>
<td>1,883,000</td>
<td>9.1%</td>
</tr>
<tr>
<td>Hiking</td>
<td>832,000</td>
<td>4.0%</td>
</tr>
<tr>
<td>Tai Chi/Yoga</td>
<td>548,000</td>
<td>2.6%</td>
</tr>
<tr>
<td>Running/Jogging</td>
<td>102,000</td>
<td>&lt; 1.0%</td>
</tr>
</tbody>
</table>

**Data obtained from National Sporting Goods Association, Sports Participation in 2002: Series I. Mount Prospect, IL
proving balance (Forrest, 1997; Skelton & Dinan, 1999). Therefore, some activities can be beneficial if an individualized tailored plan for exercise has been developed for a patient that combines both strength and balance activities.

The comments variable revealed some interesting information on the types of exercise and mechanism of injury. In more than one case, a woman was lying in bed exercising and sustained an injury. In these cases, the injury was not due to weight-bearing activity but to repetitive motion. Perhaps these individuals were at risk for injury and told not to exercise. But, due to the fear of not being active, did what they could to exercise. More research is needed regarding exercise injuries in bed.

With the increase in women 65 years of age and older (U.S. Bureau of the Census, 2003), the trend is that injuries will most likely continue to increase. Therefore, emergency departments will probably see increased numbers of older women for injuries related to non-equipment exercise activity. This could be due to the aging process as a woman’s risk for fractures and other skeletal problems due to osteoporosis increases with age and other aging issues. It could also be attributed to the fact that many women have not exercised recently and are more likely than younger women to experience overuse injuries. Older women who begin workout programs with unknown conditions such as osteoporosis are at risk for severe injuries.

The retrospective nature of the study and lack of documentation accounts for the lack of information that might have provided more insight and detail about each injury. The data analyzed were based on case reports by emergency departments participating in NEISS. The frequencies of injuries were calculated national estimates based on visits to statistically representative emergency departments, resulting in a degree of uncertainty concerning true injury incidence. Because not all injuries were treated in emergency departments, it is likely that the actual number of injuries associated with non-equipment exercise was higher than estimated. Using NEISS injury diagnosis information to estimate injury severity is also imprecise.

Additionally, not all older women in the U.S. are exposed to non-equipment exercise activity. This study used the entire population for injury rate calculation. It is certain that rates will be much higher if a more accurate measure of older women’s exposure to non-equipment exercise was available.
RECOMMENDATIONS

This study investigated the epidemiology of non-equipment exercise-related injuries among U.S. women 65 and older. As longevity of older women lengthens, it provides for more years of active life. However, a consequence of an active lifestyle is the risk of injury. Our study indicated that non-equipment exercise-related injuries had a 30% annual average increase. Walking is a common activity among senior women. But our study indicated that walking was a major risk for falling and consequential injury. Reasons for the falls were due to potential age-related bone disease, and environmental conditions such as weather, animals, road surface, and insects. It is first recommended that older women seek early detection of osteoporosis. If negative, then older women should be advised to find activities that are most appropriate and limit exposure to environmental hazards discussed in this article.

Finally, if exercise-related activity is prescribed and promoted to older women, care and caution should be used when selecting the appropriate physical activity (Christmas, & Andersen, 2000). Information about risks of activity as well as the prevention of non-equipment exercise-related injuries could be distributed and recommendations for types of exercise provided. Research is needed to define the types of activity that older women participate in and clearly identify the injury risk for each activity. Future research should also provide suggestions for the best alternative activities that are most appropriate for older women considering age, exercise experience, and current health status.

REFERENCES


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