The XXVIII[th] Annual Occupational Ergonomics and Safety Conference
Chicago, Illinois, USA
June 9-10, 2016

Comparisons of Home Product Injuries in Three Time Periods from 1978-2014: NEISS Data

Sheik N. Imrhan

Industrial, Manufacturing, and Systems Engineering Department
University of Texas at Arlington
Arlington, TX 76019

Abstract: This paper presents a comparison of age-related differences in the home, in three time periods (1978-1982, 2006-2010, and 2011-2014), between the years 1978 to 2014. Data are from the National Electronic Injury Surveillance System (NEISS) in USA. The NEISS data are estimates (injuries per 100,000 persons) based on a sample of hospitals across the U.S., in five age-groups: 0-5, 5-14, 15-24, 25-64, and over 65 years. The eight most hazardous products (highest injury rates), identified in a previous publication by the author of the present paper, were compared. The results show that the trends across age groups were similar in the three time periods for most products. There were three general trends with age – bath tub, decreasing and flattening, and increasing. The bath tub trend across age groups was preserved, for products such as beds, bathtubs, and stairs where body balance and awareness of the environment were important; that is, where toddlers and the elderly may have been the worst affected. For some products the rates increased with age, and for others the rates decreased, when the three time periods are compared. The greatest injuries for most products were among 0-4 and over 65 years of age. There was a sharp increases in injury rates beyond the 1978-2002 for most products, despite the advances in and publicizing of ergonomics methods for safety in the home and at work. The reasons for these greater recorded injury rates are not clear but may be due to changes in reporting procedures, or to people developing a greater propensity for reporting injuries (more awareness), or poor design in new home products, or even to lack of impact of ergonomics intervention in the design, selection, and use of home products.

Keywords: Home products, Injuries, Age, Time Periods, NEISS

1. Introduction

Accidents and injuries in the home have not been given much attention by ergonomists despite the fact that they affect all age groups, and occur at all times. While we may be able to identify specific causative factors for accidents and injuries, in general, we can conceptualize that these accidents are often due to incompatible relationships between the people and (i) the equipment being used, (ii) method of task performance, and (iii) environmental conditions. In homes, toddlers and the elderly bear the highest risk. For toddlers, this is due to immature physical and cognitive developmental stage for world designed for adults; and, for the elderly, it may be deteriorated physical and cognitive capacities. Hayward (1996) explored the relationship between the risk of injuries related to various kitchen and home appliances and hours of exposure to these appliances. Bergland and Wyller (2004) found that, among elderly women, there was an association between cognitive impairment and the type of care received in fall injuries (fractures). Injuries due to overexertion and falls were found to be among the most frequently occurring injuries among home care service workers, in Sweden (Ono et al., 1995).

Home accident and injury data are reported to hospitals when the injured seek medical treatment. Though, the circumstances surrounding the injuries may not be recorded in enough detail for research purposes, certain useful information may still be obtained, such as the association between type of product, age, and injury rate. Injuries in the home, unlike injuries in the industrial workplace, involve all age groups, but are more frequent among young children and the elderly. Imrhan (1988) investigated home in juries and pointed out that the rate, for individual products, followed an approximate U-shaped (bath tub) distribution with the highest rates observed for young children (<5years) and the elderly (>65 years), and lower rates for the 5-64 year age range.

The Consumer Product Safety Commission (CSPC) operates the National Electronic Injury Surveillance System (NEISS) to collect data on consumer product-related injuries in the United States. It is one of the most important sources of data on home product injuries for researchers and consumers anywhere. NEISS tabulates injury frequency occurrence data from over 5,000 hospitals with emergency departments in the US and its territories. The

data are sorted according to type of product, year and age group. The tabulated data does not, however, do not state the causes or severity of the injury. Hence an ergonomist must be cautious in recommending changes in the engineering design of the product. NEISS uses a national probability sample of hospitals in the U.S. and its territories and collects patient information from the sampled hospitals for the consumer product related injury (NEISS, 2000). The total number of product-related injuries in the US may then be estimated from the sample data.

The injured person's age, race, ethnicity, affected body parts, and incident locale are also collected. These variables are not the focus of this paper. The purpose of this study was to compare the trends in consumer product related injuries in the US between two time periods, 1978-1982 and 2006-2010.

2. Method

2.1 Data Source and Time periods

The data up to year 2014 was selected because 2014 was the most recently available data from NEISS, and the period 978-1982 because the data from it was already analyzed in a previous publication (Imrhan, 1988). The figures used for the analysis were number of injuries per 100,000 persons within each of the following age groups: 0-4, 5-14, 15-24, 25-64, 65^{+} yr.

2.2 Products

The analyses focused on the same products used in Imrhan (1988). These were products with the highest number of injuries in the 1978-1982 period. The products with highest injury frequencies in the 2006-2014 period matched included most of those from 1978-1982, so comparisons were meaningful.

3. Results and Discussion

The analysis and comparison were made by examining the trends in the estimated number of injuries across age groups, in each period, for each product. Figures 1a to 1h show these trends for 8 of the worst home products, identified from the 1978-1982 analysis (Imrhan, 1988). Each figure a-h, below, deals with a different product. Since the trends were similar across the age groups for each year between 1978-1982, the 1982 data was taken as representative of the whole 1978-1982 period. The individual product analysis results is given below Figure 1.

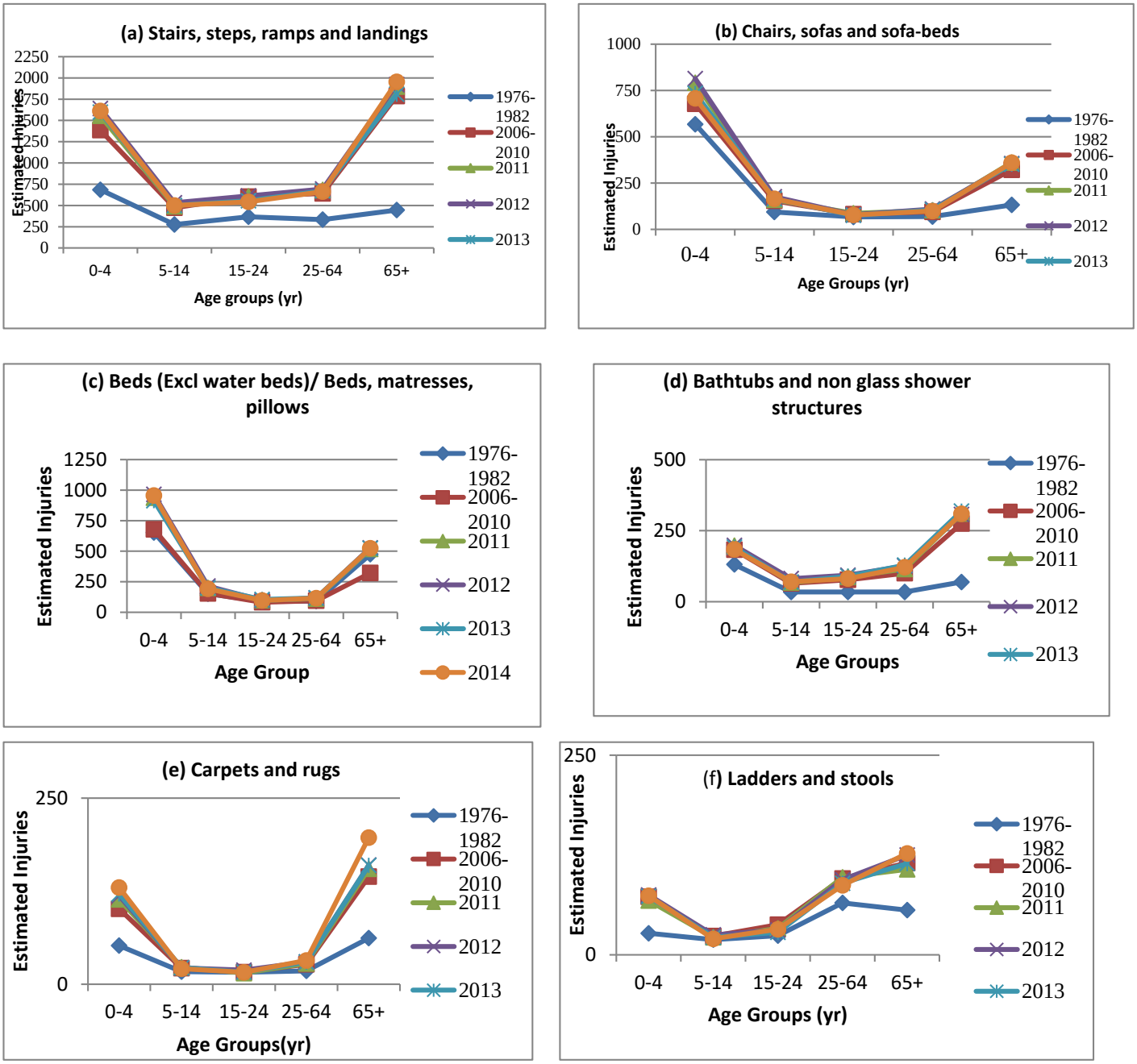
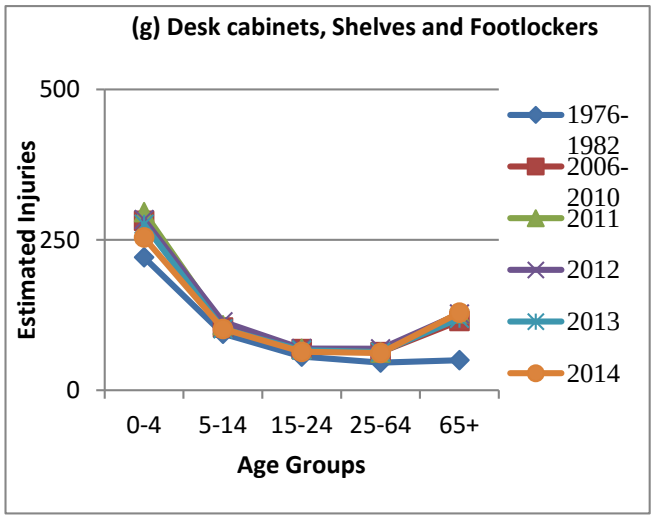


Figure 1. Estimated injuries across age groups and years for eight representative products:
1a. Stairs, steps etc., 1b. Chairs, sofas 1,, 1c. Beds, mattresses and pillows, 1d. Bath tub and non-glass shower structures, 1e.Carpets and rugs, 1f. Ladders and stools



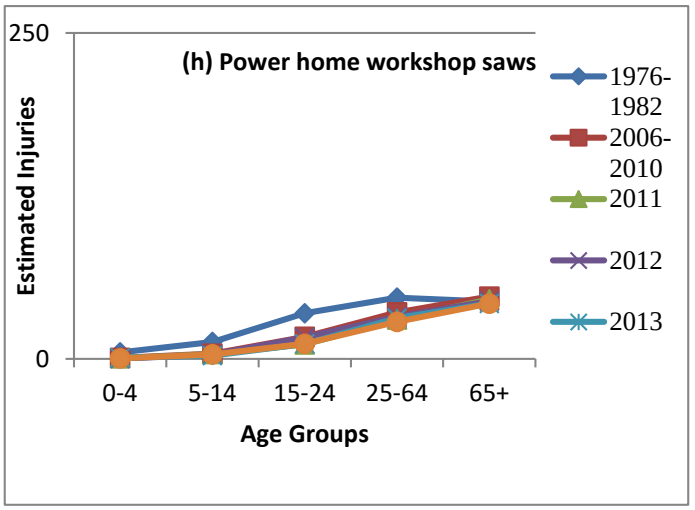


Figure 1 (cont'd). Estimated injuries (per 100,000) across age groups and years for eight representative products: 1h. Desk, cabinets etc., 1g. Power home and workshop saws.

- **Stairs, steps, ramps and landings**: Bath tub trend across age, with the highest injury rate in the oldest age group (65+); lower rates in the first time period at all age groups, with the greatest difference between the first and other two time periods occurring at the two extreme age groups (0-4 yr and 65+ yr). In other words, injury rates increased more sharply in these two extreme age groups.
- **Chairs, sofa and sofa beds**: Bath tub trend across age, with the highest rate in the youngest age group (0-4 yr); similar rates in the last two time periods at all age groups; lower rates in the first period for the 0-4 and 65 yr age groups.
- **Beds, mattresses, and pillows (excluding water beds)**: Similar trend across age groups as for 'chairs, sofas and sofa beds.' However, the lowest rates at the extreme age groups were for period 2006-2010.
- **Bath tubs and non-glass shower structures**: Similar trend to 'stairs, steps, ramps and landings, except that the magnitude difference between the 0-4 yr and other two age groups was not as great.
- **Tables**: Similar rates at all age groups for periods 2 and 3; higher rate in first period for 0-4 yr and lower rate for 65+ yr group. The magnitude differences among the different age groups, across time periods, were not as great as for other products.
- **Desks, Cabinets, shelves and foot lockers**: Similar rates for the 5-65 yr range for all periods; lower rates for 0-4 yr and 65+ yr in first period.
- **Carpets and rugs**: Similar rates at all age groups for 5-64 yr range, at all periods; smaller rates in first period for 0-64 and 65+ groups, compared to the other time periods.
- **Ladders and Stools**: This is one of the two products that whose injury rate did not follow the classical bath tub trend with age. The bath tub trend was evident only over the range 0-64 yr. The elderly injury rate was not much greater than the rate for the 25-64 yr age range. The rates for the latter two time periods was similar for all age groups. Significant difference in rates over the time periods did not occur in the 5-64 yr age range.
- **Desks, cabinets, shelves and foot lockers**: The 0-4 yr and 65 yr had higher rates at latter 2 periods, with little difference in the 3 groups from 5-64 yr.
- **Power, home, and work shop saws**: There was no bath tub trend at all. There was a somewhat linearly increasing trend over the age groups. The 15-64 yr olds showed a lower rate for the last 2 periods – an improvement among adult working population.

All except two home products ('**power home and work shop saws' and 'ladders and saws'**) showed bath tub trends across the age groups, with the two extreme age groups (0-4 and 65+ yr) experiencing a greater amount of injuries than the other groups in the 5-64 yr age range. In addition, the middle age range (5-64 yr) was where the

injury rates were more closely similar across the three time periods. Whereas there were clear magnitude differences (higher rates) for the second compared to the first period, there was little difference in the injury rates for the various home products between the last two time periods. In other words, for any of the age groups, injury rates from 2006-2014 were fairly stable. This implies that, under the assumption that the (known or unknown) processes that regulate injury occurrence from home products do not change, we should be able to predict accurately the rate of occurrence of injuries for a given product, at least in the near future.

In all three time periods the 0-4 and 65+ yr age groups were the age groups with the highest injury rates. There seems to be little difference in the injury rates in the two time periods, 2006-2010 and 2011-2014. However, the sharply lower injury rates for the 1978-1982 was puzzling. One would expect that, with time, the injury rate should not increase. Possible causes for the drastic changes include changes in reporting procedures, a greater propensity for reporting injuries (more awareness) by the injured, the effects of different designs in new home products, or even a lack of impact of ergonomics intervention in the design, selection, and use of home products.

In the elderly, declining cognitive, physiological and physiological capacities, (Lawton, 1977; Welford, 1981; and Fozard, 1981) may account for their inability to perform tasks or use home products safely. As pointed out by Proma and Imrhan (2014), the enhanced knowledge and decision making capabilities of older people may not be adequate to offset decrements in visual and auditory perception, psychomotor skills, memory, and muscular and cardiorespiratory strength and endurance, for using the products show in the figures. In the 0-4 year group, the reasons are different – undeveloped capacities required for task performance, unfamiliarity with home products and the environments in which they are used, and general lack of awareness of the potential dangers involved.

4. Conclusions

Home product injury rates seem to have stabilized over the last 10 years for almost all age groups, and in almost all of the worst products, unlike the period from 1978-2006, where the injury rates for many products increased sharply from 1982 to 2006. It seems that the advances in, and publicizing of, ergonomics in the home and at work, coupled with increased adherence to reporting injuries and seeking medical treatment may have had a positive impact. Trends in injury rates with age from 1978 to 2014 have changed little, with a bath tub curve occurrence from 0-4 to 65+ years of age. It may, therefore, be safe to make projections in injury rates for a specific product, at least in the near future based on the 2006-2014 data.

5. References

Lawton, M.P. 1977. The impact of the environment on ageing and behavior: in Birren, J.E. and Schaie K. W. (Eds.), *Handbook of the Psychology of ageing*, New York, Van Nostrand Reinhold, pp. 276-301.

Welford, A.T. 1981. Signal, noise, performance and age. *Human Factors*, 23, 97-109.

Fozard, J.L. 1981. Person-environment relationships in adulthood: Implications for human factors engineering. *Human Factors*, 23, 7-27.

National Electronic Injury Surveillance System Data Highlights, Directorate for Epidemiology, Consumer Product Safety Commission, Washington. 1978-2014.

Bergland, A. and Wyller, T. B. 2004. Risk factors for serious fall related injury in elderly women living at home. *Injury Prevention*, 10:308–313.

Imrhan, S.N. 1988. Age related differences in injuries in the home, *Trends in Ergonomics/ Human Factors*, V, 683-687.

Imrhan, S.N. 2014. A comparison of trends in injuries in the home in two different time periods. Proceedings of the 26th Annual International Occupational Ergonomics and Safety Conference 2014. Subramanian A, Ware BF, Ibarra-Mejía G., Wyatt, R and Fernandez JE (eds.)

Hayward, G. 1996. Risk of injury per hour of exposure to consumer products. *Accid. Anal. And Prev.* Vol 28 No 1, pp. 115-121.

Ono,Y., Lagerstrom M., Hagberg,M., Linden,A., and Malker, B. 1995. Reports of work related musculoskeletal injury among home care service workers compared with nursery school workers and the general population of employed women in Sweden. *Occup Environ Med*, 52:686-693.

NEISS. 2000. The National Electronic Injury Surveillance System: A Tool for Researchers. NEISS, Division of Hazard and Injury Data Systems, U.S. Consumer Product Safety Commission. Washington D.C.