

# A retrospective benefit-cost analysis of the 1997 stair-fall requirements for baby walkers<sup>☆</sup>

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## Abstract

Based on estimates from the U.S. Consumer Product Safety Commission (CPSC), there were about 25,000 baby walker-related injuries treated annually in U.S. hospital emergency departments during the early 1990s. This amounted to about 8 injuries for every 1000 baby walkers in use. Most injuries resulted from falls down stairs. After CPSC initiated a regulatory proceeding in 1994, the CPSC staff worked with industry to address the stair-fall hazard. This cooperative effort resulted in requirements designed to prevent stair-fall injuries that became effective in 1997 as part of a revised voluntary safety standard. This study presents a retrospective benefit-cost analysis of the 1997 stair-fall requirements. The benefits were defined as the reduction in the costs of injuries resulting from the use of the safer walkers. The costs were defined as the additional resource costs associated with making baby walkers safer. The study found that the stair-fall requirements were highly effective in reducing the risk of stair-fall injury, and that the benefits of the requirements substantially exceeded the costs. The expected net benefits (i.e., benefits minus costs) amounted to an average of about \$169 per walker, over the walker's expected product life. Given current U.S. sales of about 600,000 baby walkers annually, the present value of the expected net benefits associated with 1 year's production amounts to over \$100 million annually. A sensitivity analysis showed that the major findings were robust with respect to variations in underlying assumptions.

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## 1. Introduction

Baby walkers are products that support preambulatory children and allow them to move by means of their feet. They generally consist of fabric seats with leg openings mounted to rigid plastic decks. The decks are attached to bases that have wheels or casters to make them mobile. Children using walkers usually range from about 6 to 15 months in age.

Based on estimates from the U.S. Consumer Product Safety Commission's (CPSC) National Electronic Injury Surveillance System (NEISS), the number of children under age 15 months who were treated in U.S. hospital emergency departments for injuries involving baby walkers rose from 16,400 in 1982 to

26,200 in 1991, an increase of 60% in 10 years. While some of the increase was related to the increased use of baby walkers, injury rates indexed by the number of walkers in use rose by 18%, from 6.8 injuries per 1000 walkers in use in 1982 to 8.0 per 1000 in 1991. During this time period, injuries resulting from falls down stairs (or, in some cases, falls from one floor level to another) represented the predominant baby walker hazard: about 75–80% of the walker injuries resulted from falls down stairs (Boudreault, 1995; Shields and Smith, 2006).<sup>1</sup>

In 1994 the Commission initiated a regulatory proceeding to address the risk associated with stair-fall injuries (CPSC, 1994). At the same time, the Commission directed the staff to work with the American Society for Testing and Materials (ASTM) Walker Subcommittee, a voluntary standards group, to determine if requirements to prevent stair-fall injuries could be developed cooperatively with industry. These cooperative efforts led to the development of requirements (hereafter referred to as

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<sup>1</sup> Cited CPSC documents that are not available through the Internet can be obtained from the authors by request.

the “stair-fall requirements”) that were approved by ASTM in October 1996 (ASTM, 1996) and became effective in June 1997.

The stair-fall requirements include a performance test that simulates a child in a walker moving across the floor, through a doorway, and to a stairway. A dummy represents a child in the walker, and the walker is tested facing forward, backward, and sideways. The test uses a falling mass at the end of a rope extended over a pulley to pull the walker toward the edge of the test platform. If, during these tests, the walker passes through a 36-in. wide opening at the end of a test table and falls off the table, it fails the performance requirements. Alternatively, if the walker stops at the end of the test table, but any part of the walker extends over the table’s edge, a tip-over test is performed. To conduct this test, a specified downward force is applied to the walker tray at a specified distance from its edge. The walker fails the performance requirements if it falls off the table during the tip-over test (ASTM, 1996; CPSC, 2002; Kumagai, 2002). As described more fully below, manufacturers incorporated various design features into baby walkers to meet these requirements.

There appears to have been a high level of conformance to the stair-fall requirements of the voluntary standard. The major domestic manufacturers of baby walkers participated in the development of the requirements and have conformed to them from the outset. Major retailers have also generally required conformance for the walkers they sell. As of 2000, industry reported that more than 98% of the walkers being sold in the U.S. were certified as complying with the requirements. This high level of conformance was confirmed by an independent CPSC staff evaluation of the baby walker market (Leland, 2002; CPSC, 2002).

The new stair-fall requirements appear to have been effective. Between 1991 and 2001, the baby walker injury rate fell from 8.0 to 2.2 emergency department injuries per 1000 walkers in use. Moreover, a recent study concluded that the stair-fall requirements reduced the baby walker injury rate by an estimated 63% (Rodgers and Leland, 2005). Given the substantial reduction in the risk of walker-related injury, and the high level of conformance with the revised voluntary standard, the Commission terminated the regulatory proceeding in May 2002 (CPSC, 2002).

The purpose of this article is to present a retrospective benefit-cost analysis of the voluntary standard’s stair-fall requirements that went into effect almost 10 years ago. In the process, we illustrate the benefit-cost methodology used by the CPSC staff in the analysis of product-related hazards.

## 2. Methods

The benefit-cost analysis was conducted from a societal perspective, considering all of the parties affected by the standard and counting all significant costs and health outcomes (Gold et al., 1996). The benefits and costs were calculated on a “per-product-in-use” basis, an approach that CPSC has found useful in conducting benefit-cost analyses of regulations addressing product hazards (Rodgers and Rubin, 1989).

The benefits were defined as the reduction in the cost of injuries resulting from the use of the safer walkers. The costs

were defined as the added resource costs associated with making baby walkers safer. All benefits and costs are reported in year 2000 dollars.

### 2.1. Benefits assessment methodology

The benefits assessment was based on estimates of: (1) the effectiveness of the stair-fall requirements in reducing the baby walker stair-fall injury rate, and (2) the societal costs of stair-fall injuries. Because baby walker-related deaths are rare events (Sweet, 2002), calculated benefits were limited to reductions in the costs of nonfatal injuries.

#### 2.1.1. Injury rate reduction

We estimated the injury rate reduction associated with the stair-fall requirements with a time series regression model, based on annual data from 1981 through 2005. The response variable was the baby walker injury rate, defined as baby walker-related injuries involving children under age 15 months that were treated in U.S. hospital emergency departments, per 1000 baby walkers in use.

National estimates of injuries treated in emergency departments were derived from the CPSC’s National Electronic Injury Surveillance System (NEISS). NEISS is a stratified national probability sample of U.S. hospital emergency departments, consisting of about 100 U.S. hospitals that have at least six beds and provide 24-h emergency service. The sample is stratified by hospital size, based on the annual number of emergency department visits. Hospitals within each stratum are ordered by state and zip code and selected systematically to ensure a wide geographic coverage (Schroeder and Ault, 2001; Vyrostek et al., 2004).

Each participating hospital provides information on all injuries involving consumer products that are treated in the emergency department. This information includes the age and sex of the victim, the injury diagnosis, the body part injured, a description of as many as two products that were involved in the injury, and the disposition of the case. Each record also includes a free-text narrative field where the product and circumstances surrounding the injury can be described in some detail. In the case of baby walker injuries, this narrative generally provides sufficient information to determine whether the injury involved a stair-fall or some other scenario.

The number of walkers in use was estimated with CPSC’s Product Population Model, a computer model that projects the number of products in use given information on product sales and the product survival rate (Lahr and Gordon, 1980). Walker sales were based on industry estimates (Homan, 1992; Leland, 2002; R. Waller, President, Juvenile Products Manufacturers Association, Mt. Laurel, NJ, personal communication, November 2006). The walker survival rate was assumed to follow a gamma distribution, a commonly used distribution for the survival of products that last only a few years, with an expected product life of about 1.5 years.

No precise estimates of the average product life of a walker are available. While an individual baby is likely to use a walker for less than 1 year, we assumed that the average product life

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