Understanding and Detecting/Preventing/Mitigating Errors in Stair Fall-related Personal Injury Litigation Inspections and Other Legally Mandated Inspections

Jake Pauls
Certified Professional Ergonomist

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Through the entire 1960s, Jake Pauls had an eclectic academic life at the University of British Columbia, ending with an Architecture degree in 1969. Now a Certified Professional Ergonomist, he has 48 years of international experience in research, codes and standards development, plus consulting, focused on people’s movement, individually and in crowds, especially on stairways, a special expertise utilized worldwide.

Widely published, Jake excels at bridging among ergonomics, public health and development of codes and standards for built environment usability and safety. He serves on 13 national/international committees in the US, developing safety standards and model building codes, representing (*pro bono*) the American Public Health Association on over half of these.
Jake Pauls Consulting Services
Toronto, Canada, 2011—
Jake Pauls Consulting Services
Silver Spring, MD, USA, 1993—

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Jurisdictions where Work Performed in Relation to Civil (and One Criminal) Actions
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*Such work makes up less than 10% of professional activity which has occurred in 80 percent of US states, 80 percent of Canadian provinces, and over a dozen other countries worldwide over a 48-year career.
Professional Activities
Mid-2015
Professional Activities Mid-2015
Professional Activities
Mid-2015
Leading Up to 2017

Melbourne
Three Key Fields Pertinent to Jake Pauls’ Work

“Law” includes Administrative Law (e.g., standards, codes, legislation and regulation) and Personal Injury Litigation
Three Key Fields Pertinent to Jake Pauls’ Work
Professional Activity Consists of:

- Expert investigation of, and general research into, injurious falls in built environment, notably on stairs.
- Development, implementation of prevention and mitigation measures related to built environments.
- Improving efficacy of such measures when implemented in standards, codes, regulations for design, construction and management of facilities.
- Advocacy for improved investigation, documentation, reporting and use of information pertaining to the causes and contributing factors for injurious falls, especially those involving small elevation changes (e.g., stair steps, bathtubs, etc.) in pedestrian facilities.
Professional Activity Concerned with Injurious Falls Such as These
Three Selected Nonfatal Injuries* (ER-treated) in USA in 2010

* Sources: NFPA and CPSC/NEISS
US NBS (now NIST) researchers knew of, and reported, these dangers in 1975, but the 1978 and 1979 reports were the last scientific reports—on epidemiology, etiology & countermeasures—issued on stairway safety by the US Government.
Stairway safety research—plus activity to prevent or mitigate predictable and preventable stair-related injuries—was briefly addressed by universities in the US and, more substantially, by national institutes in Canada, Japan & England.

The presenter’s work in Canada, to which John Archea contributed (after his time as the stairway expert at NBS/NIST), was later applied—at the request of US safety standards & model building codes organizations—to US standards and codes from the 1980s to now. Canada is now the world center for stairway safety and usability research and the insights from that work continue to be exported into the USA for state-of-art codes and standards plus export services in forensics and to major organizations including the mass media.
This morning prime time broadcast item presented valuable information on stairway safety, especially for homes—where most of the stair-related injuries occur. The quality of the presented information and guidance—to which no US Government agency contributed directly or indirectly—significantly exceeded that displayed by many so-called “forensic experts” who are retained by attorneys (especially from the Defense side) in civil litigation cases based on faulty stairways leading to injuries.

The errors—including stairway geometry documentation and analysis errors—made by some “forensic experts” reflect a low level of education, training and relevant experience in the stairway safety field. It reminds one of the dismal state of much of the fire investigation expertise which was dramatically presented on the second day of the NIST-hosted conference on errors in forensics science/technology, July 21-24, 2015.
Prime-time, 5-minute piece on home stairway problems—Top Of Flight Flaw (TOFF) “Chunky Handrails,” and functional stair gates—to assess and improve safety of young children playing around or using stairs and being carried by adults.
Whereas nominal run dimension can increase risk within a factor of ten, dimensional nonuniformity can increase risk by one or two orders of magnitude (factors of ten to a hundred).
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*View to side of stair (at stringer)  View down the stair flight*
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*View to side of stair (at stringer)*  
*View down the stair flight*
Smart phone App under development to aid professional and consumer detection of Top Of Flight Flaw (TOFF)

Smart phone App in use with “crouch and sight test”
Smart phone App under development to aid professional and consumer detection of Top Of Flight Flaw (TOFF) comparing subject and reference photographic views of “crouch and sight” test—to see if all stair nosings line up.
Smart phone App under development to aid professional and consumer detection of Top Of Flight Flaw (TOFF) comparing subject and reference photographic views of “crouch and sight” test—to see if all stair nosings line up.

“TOFF” Reference  Smart Phone Photo  “Good” Reference

STAIR FAILS

STAIR FAILS

STAIR PASSES
Smart phone App under development to aid professional and consumer detection of Top Of Flight Flaw (TOFF) comparing subject and reference photographic views of “crouch and sight” test—to see if all stair nosings line up.

An additional role for the App is to collect data on the:
• Incidence of TOFF with a region, country, or larger area
• Jurisdictions where TOFF is more prevalent so that mitigation and prevention measures can be targeted.

Smart phones can readily determine locations and transmit that information to regional or national centres for data collection and analysis. Such options have been presented and discussed at a meeting of falls experts at the Toronto Rehab Institute (TRI), on June 5, 2015. Potential economic benefits are very large ($millions/day).
“Crouch and Sight” Test
Can Detect Most Top Of Flight Flaws (TOFF)

By sighting down the nosings, the Flaw can usually be detected.


Graphic Courtesy of Daniel A. Johnson
But “Crouch and Sight” Test May Not Detect This Flaw

- Rarely, the nosings may line up, but the runs could still be non-uniform

Graphic Courtesy of Daniel A. Johnson
But “Crouch and Sight” Test May Not Detect This Flaw

- Rarely, the nosings may line up, but the runs could still be non-uniform
- To rule this out, also measure A & B after doing Crouch and Sight Test.

Graphic from NBC “Today Show” video
Top Of Flight Flaw (TOFF) and other systemic or random nonuniformities in the dimensions of a stair rise and run are building code violations.
Top Of Flight Flaw (TOFF) and other systemic or random nonuniformities in the dimensions of a stair rise and run are building code violations, but officials and inspectors are doing a poor job in checking for flaws and requiring remedial measures.
Top Of Flight Flaw (TOFF) and other systemic or random nonuniformities in the dimensions of a stair rise and run are building code violations. Nonuniformities greatly increase one's risk of a misstep and fall during stair use—by factors of 10, 30, or more.
Table 2. Estimated relative annual risks per 100,000 population, of US hospital emergency department visits for home stair-related falls with various nominal run (going) dimensions and with various occurrences of Top of Flight Flaw (TOFF) non-uniformity

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Risk Increase due to nominal—*uniform*—run dimensions
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Small-sample, New Home Checks in Ontario, Alberta and BC

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For purposes of this Table, it is assumed that Top OF Flight Flaw (TOFF) increases risk of a fall-related injury on a stair by a factor of about 30 beyond other risks due to step dimensions. Further research is needed to determine actual risk with TOFF.
Good Stairways
- Death
- Hospital Admission
- Hospital ER-treated
- Doctor or Clinic
- Self Treated
- Non-Injury Misstep/Fall

Bad Stairways

Stair-Related Injury Pyramids

* Incident Rate per 100,000 Population per Year
Good Stairways

- Non-Injury Misstep/Fall: 10,000
- Self Treated: 800
- Doctor or Clinic: 70
- Hospital ER-treated: 35
- Hospital Admission: 1.8
- Death: 0.07

Bad Stairways

- Non-Injury Misstep/Fall: 90,000
- 7,000
- 700
- 350
- 18
- 0.6

*Estimated on order of 700 million flight uses
*Incident Rate per 100,000 Population per Year

Ratio: 5555
*Estimated on order of 700 million flight uses
*Incident Rate per 100,000 Population per Year
Good Stairways

Death
Hospital Admission
Hospital ER-treated

Bad Stairways

*0.6

*350
*700
*90,000

*Ratio: 743

*Estimated on order of 700 million flight uses

*Incident Rate per 100,000 Population per Year

Non-Injury Misstep/Fall

Self Treated

Doctor or Clinic
Major causes and contributing factors for the “Bad Stairway” pyramid were identified long ago; e.g. step dimensions.
US Home Stair Injury Treatment Data from Ted Miller, PhD, 2011

Place of first treatment—in number of cases—for 2.7 million US home stair-related injuries in 2007

- Doctor/Clinic: 1,873,774
- Emergency Department: 761,943
- Emergency Room Visitor: 54,429
- Fatality: 1,682
Place of first treatment—in number of cases—for 2.7 million US home stair-related injuries in 2007
(With societal costs, totaling $72 Billion, shown with key to chart)
Multiple, Improved-Stair Benefits—*Beyond Medical Treatment Averted*—Greatly Exceed Cost of Better Stair Construction

(According to Jake Pauls’ Benefit-Cost Analysis, 2002)
Entire circle represents on order of US$180 Billion in Year 2015 in USA
Societal costs of non-fatal, stair-related injuries are based largely from the work of a few researchers in the USA, especially BA Lawrence and TR Miller, 2000 & (with RS Spicer) 2015.*

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**Estimating the costs of non-fatal consumer product injuries in the United States**

Bruce A. Lawrence, Ph.D.,¹
Ted R. Miller, Ph.D.,¹
Alan F. Jensen, J.D., M.A.,¹
Deborah A. Fisher, Ph.D.,¹
William W. Zamula, M.A.²

¹Pacific Institute for Research and Evaluation, Landover, MD
²US Consumer Product Safety Commission, Washington, DC

**Abstract** This paper describes a data-driven injury cost model (ICM) developed to estimate the costs associated with non-fatal consumer product injuries. The modeling effort combines information by diagnosis from the US Consumer Product Safety Commission's National Electronic Injury Surveillance System (NEISS) and 17 other large data sets. The ICM contains four aggregated cost components: (1) medical costs, (2) work losses, (3) quality of life and pain and suffering costs, and (4) product liability insurance administration and litigation costs. The ICM estimates societal costs, which are broader than costs to any individual group, such as victims, insurers, or product manufacturers.

Costs associated with consumer product injuries are estimated to be approximately $500 billion in 1996, accounting for nearly one-third of the total annual injury costs. We examine injury costs in several ways.
Societal costs of non-fatal, stair-related injuries are based largely from the work of a few researchers in the USA, especially BA Lawrence and TR Miller, 2000 & (with RS Spicer) 2015. *

Stair-Related Injury Cost: $49 Billion in 1996
Stair-Related Injury Cost: $92 Billion in 2009

Increase in US Stair-related, ER-treated Injuries by Age

Stair-related injuries are not only a problem in the 65 + population.
Stair-related injuries are not only a problem in the 65+ population.
Increase in US Stair-related, ER-treated Injuries by Age

Stair-related injuries are not only a problem in the 65 + population.

Note: doubling of estimates for ages 50-64 in the 13-year period 1997-2010 in the US.

Stairs are a major Injury problem of the population generally!
The pattern of predictable, preventable injury tolls persists and grows. Here is the pattern in recent decades in the USA (shown here because comparable data for Canada are lacking).
What will be the future trend of home stair-related injuries in Canada?

What will contribute to this?

What roles will public health have?
Thank You

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