Why, How, and How Effectively Do USA and Canadian Building Codes Address Two Leading Fall Sites in Homes?

Jake Pauls[1] and Daniel Johnson[2]

[1] Jake Pauls Consulting Services, Silver Spring, MD, USA
bldguse@aol.com

[2] Daniel A. Johnson, Inc., Olympia, WA, USA
dajinc1@mac.com

Abstract. Despite abundant evidence, the most effective, ethics-driven, fall prevention and mitigation interventions have *not* been widely employed for new home settings in the USA and Canada in the last five decades. The Canadian and the two US model codes organizations came into existence independently and more or less in isolation with different histories, influential constituencies and procedures that developed in different places. Progress on fall prevention and mitigation efforts has been influenced by what can be thought of as an organizational personality or culture. With one exception, the National Fire Protection Association, NFPA, these organizations' codes and standards have generally been, at best, slow and, at worst, opposed to adopting fall prevention and mitigation requirements. Also, these organizations affect not just safety, but usability of homes and all other built environmental settings. For example, for stairways serving people in their homes, the most appropriate, minimum requirements should be based on public building requirements for stairways. Most generally, the three organizations operate in three very different political and cultural contexts that greatly influence their overall activity which is focused on differing emphasis on organization-funded and facilitated research, education, training, safety document production, and quality control generally.

Keywords: Home Stairways, Home Bathrooms, Building Codes, Falls Etiology, Injuries, Usability

1 Main Message of this Chapter

Despite abundant evidence, *from etiology (including macro-ergonomics and ergonomics generally), epidemiology, and economics*, the most effective, ethics-driven, fall prevention and mitigation interventions have *not* been widely employed for new

home settings in the USA and Canada in the last five decades. There are multiple reasons for this state of affairs.

1.1 Key Questions

Why? The two US and one Canadian model codes organizations came into existence independently and more or less in isolation with different histories, influential constituencies and procedures that developed in different places. Progress on fall prevention and mitigation efforts has been influenced by what can be thought of as an organizational personality or culture. With one exception, the National Fire Protection Association, NFPA, these organizations have generally been, at best, slow and, at worst, opposed to adopting fall prevention and mitigation requirements—*affecting the movement of individuals in homes*, based on public building requirements for stairways.

How? The three organizations operate in three very different political and cultural contexts that greatly influence their overall activity which is focused on differing emphasis on organization-funded and facilitated research, education, training, safety document production, and quality control generally.

How effectively? As perceived by whom? To which constituencies does something matter (like broad goals and objectives) and what is that something? Is it *evidence?* Does the organization actively participate in *evaluation* of *effectiveness* plus the development of—and *employing*—meaningful information on *epidemiology*, *etiology*, *economics* (e.g., of fall-related injury events), etc. Generally, it is useful to examine each organization in terms of its focus on these seven italicized "e" topics—along with an eighth, *ethics*. There are other "e" terms that could be utilized as well in organizational comparisons such as constituent (member, industry "partner" or code user) *energy, effort,* and *enthusiasm*. These three measures of engagement vary widely and are less prominent, especially currently, in the NFPA process and the Canadian one. On evaluation, NFPA leads the others, partly through its Research Foundation.

So What? The foregoing issues matter—including, especially, in the development of effective, respected and consistently practiced fall prevention and mitigation measures in building codes. Indeed, just like there are said to be three factors affecting the price of real estate, "*location, location, location,*" there are three factors affecting the extent to which code development bodies address fall safety in homes; they are "*personality, personality and personality*."

The lead author of this paper is in his sixth decade of witnessing this, as an active participant observer of organizational and individual activities. Notably, the ages of the three organizations—NFPA, the Canadian Commission on Building and Fire Codes (CCBFC), and the International Code Council (ICC)—are over a century for NFPA, about seven decades for the CCBFC (mostly operating as a very similar ACNBC and ACNFC during the 20th century) and about two decades for ICC. (The acronyms of two Canadian organizations noted here refer to the Associate Committee

on the National Building Code and the Associate Committee of the National Fire Code which date back to the late 1940s.)

ICC is a mix of three earlier, *regional* code development organizations in the USA which had varying lives ranging, approximately, from five to seven decades, respectively for BOCA, SBCCI and ICBO. For completeness, these acronyms refer to Building Officials and Code Administrators, Southern Building Code Congress International and International Conference of Building Officials. Each of these three, so-called "Legacy Codes" developers had distinctive organizational personalities partly based on the geographical and cultural regions they operated in across the USA, i.e., the northeast, southeast and west. Their "personalities" or cultures are still readily observable—*and very relevant*. One of the informal expressions in code change deliberations, is to argue either explicitly or implicitly, "If it ain't broke, don't fix it." Surprisingly, this is still a mantra in code development processes, perhaps more so in the USA, even for as huge a problem as injurious falls are in built environmental settings, especially homes. Fall-related injuries exceed those from fire by orders of magnitude.

2 The Problem

Think of this as the opposite of "safety culture." Culture, generally, within a wide range of organizations and disciplines is a major aspect of the problem of impaired safety for new home stairways plus bathrooms and a key to achieving effective solutions. Responsibility for limited progress is shared widely over a spectrum of cultures dealing with national constitutional constraints severely limiting the powers of the national or federal government in matters of building control. Building industry culture (with tradition trumping technology) and constitutional traditions or laws have been factors over a long time scale including all six decades during which the author has been working on solutions to the problems, especially those involving home stairways, the more consequential of the two fall sites.

2.1 History

Stairway usability and safety have a long history, spanning millennia. Bathing and showering usability and safety have a much shorter history, on the order of a century; it tracks the growing incorporation of the related activities in increasingly lavish, space-consuming and technology-enhanced facilities and spaces in homes. While academic and technical books on stairways date back centuries (as documented in two volumes by John Templer [1992], *The Bathroom,* an early book, by Alexander Kira [1976], devoted to the ergonomics of bathrooms, dates back to only the 1970s.

This is about the same time the US Consumer Product Safety Commission, CPSC, began collecting hospital emergency department visit data which quickly revealed the stark epidemiological truth about stair and bathing/showering-related injuries. It is also the time that CPSC began funding some of the earliest comprehensive ergonomics research on both of these leading sources of injuries, especially in homes. The earliest publications on this work include a collection of etiological and epidemiologi-

cal insights commissioned by the US National Bureau of Standards, NBS, now the National Institute of Standards and Technology, NIST [Alessi, *et al.* 1978].

Part of the relatively recent impetus for greater attention to bathrooms came from the relatively new focus on usability of facilities by people with disabilities which, in the USA, was marked by the first edition of a national accessibility and usability standard, ANSI A117.1, in 1961 based on a meeting in 1959. Notably, in 1987, the Council of American Building Officials (CABO) took over the A117.1 secretarial role. In the 1990s, CABO morphed into the International Code Council [International Code Council, 2017]. ANSI A117.1 has provided some of the best criteria for not only usability of stairways, but for their safety as well (partly due to one of the two authors of this paper being appointed to the ANSI A117 Committee as its first *Individual Member* beginning with its 1992 edition).

These accessibility standards entail intervention mechanisms affecting both usability and safety *for all*, e.g., with attention to *universal design*. Moreover, falls are not just a problem for seniors and persons with disabilities although, clearly, injury consequences are more severe, life changing, and costly for older persons. Also, there are additional costs impacting families and society, for medical care plus public health.

3 Context

The lead author has worked on many aspects of stairways for five decades (with a shorter, several-year history with bathing/showering facilities). He has addressed them with research (in a national research agency, the National Research Council of Canada), 280 committee-years of model codes and safety standards activity in Canada and the USA, and forensics investigations plus analyses. (Note: as a measure of committee service, 280 committee-years represents, for example, 20 years of service—and active, voting participation—on 14 distinct committees of several organizations.)

Advocacy for building use and safety in mass media both before and during the Web era has been complemented by production of about 40 videos (with 30 freely streaming currently at www.bldguse.com/VideoPage.html).

One of these 40 videos was titled, "The Pathology of Everyday Things," focused on stairways and introducing ergonomists to the previously, largely ignored world of model building code development. The video was of an invited *Arnold Small Lecture* presented at the annual, 1996 conference of the Human Factors and Ergonomics Society, HFES [Pauls, 1996]. For his "punishment" in giving such a provocative, formal lecture, the author was appointed as Chair of several future, annual lectures in the series. This role was taken on with gusto, entailing the video production, and distribution, of all the lectures delivered under his chairmanship. Clearly, the blending of home stairways ("warts and all") and formal ergonomics was needed and undoubtedly valuable. There was a follow up revisiting the focus of the 1996 Arnold Small Lecture in a brief presentation and five-page paper in HFES 2013 proceedings [Pauls, 2013]. Here is the entire "Concluding Comment" from that 2013 paper.

"The Arnold M. Small Lecture in 1996 identified a pathology in everyday things, stairways, but it did not anticipate how important macro-ergonomics factors were to become—*especially for home stairways*, beginning about a year later in the US and

nearly two decades later in Canada. Clearly, while improved understanding of micro-ergonomic factors—*notably geometry of steps and handrails*—is important, a broader social/organizational perspective is needed. A revisit now, applying human factors more comprehensively, is very timely."

Among its legacies was the collaboration of the two authors of this paper plus a few others, on stairways, including one presented to the then *Institute for Ergonomics and Human Factors* in the UK and one prepared for an organization of trial lawyers in the USA. The former dealt with societal (or macro-ergonomics) factors in stairway safety ranging from model code issues to the role of the public health field [Johnson and Pauls, 2010]. The latter exposed the flawed teaching of stairway safety inspection methods by the ICC [Johnson and Pauls, 2012].

4 Actions

The 280 committee-years of experience have been documented with multi-format records. These records hold the full answers to the three questions posed in this presentation's title—"why, how, and how effectively." Revealed in the records are answers to other questions, e.g., who were the influential actors—individually and organizationally? The latter include the National Fire Protection Association (NFPA), the Canadian Commission on Building and Fire Codes (CCBFC), and the International Code Council (ICC). This listing is in decreasing order of achievement advancing improvements in stairway plus bathing/showering facilities' usability and safety in terms of published standards and model codes.

At this time (early 2021) there is some "jockeying" occurring that could affect the coverage and order of success with *application* of these organizations' codes and standards.

A clear leader, thus far, is not a model building code but, rather, the widely used *American National Standard for Accessible and Usable Buildings and Facilities* ("ANSI A117.1"), for which the first edition was published in 1961 and work has currently begun on its seventh edition—again with ICC as its Secretariat [International Code Council, 2017]. The latest, 2017, edition was developed by a committee of 48 organizations and 6 individual members. All editions of this standard have addressed usability and safety of stairways as well as bathing/showering facilities with state-of-the-art requirements. The latter are undergoing intensive, ICC Task Group examination relative to accessibility requirements as this abstract is submitted while a CCBFC Task Group is considering mainstreamed requirements focused on safety for all.

The CCBFC Task Group is proceeding less speedily than the ICC effort. However the Canadians are giving commendable, painfully detailed attention to all sides of the debate—including opposition from not only the home building industry, but also the North American plumbing products industry as well.

As this chapter is being submitted the Task Group has voted five to one—the housing industry representative being the "one"—to proceed with new requirements for grab bars in all bathing and showering facilities in new construction. Its final hurdles are with the CCBFC Standing Committee on Housing and Small Buildings and another governing committee, the Standing Committee on Use and Egress (which is also

the committee responsible for accessibility requirements in the *National Building Code of Canada*). Results should be known when this paper is presented at the IEA Congress.

5 Outcomes

Clearly (relative to the "how" and "how well" questions) committee member-driven development of expertise-based and evidence-based usability and safety requirements worked best with the ANSI and NFPA standards and codes. Second-best (so far), but only for bathing and showering safety, were CCBFC staff-dominated procedures, but here this might have been due partly to the "personality" of the particular mix of Codes Canada staff in charge. They expertly processed the code-change proposals with fairness to all, while resisting unrelenting, homebuilder and plumbing industry pressures to delay, if not stop any improvements to the code.

ICC's process, on both the home stairway and bathing safety issues, is still an open question the ICC Board of Directors has refused to address with regard to a requested examination of committee member ethics in a January 6, 2021, meeting on grab bar requirements for safety of bathing and showering. The date is highly important for another, much more public ethical lapse in the US. Results will be known, on at least the grab bar issue, later in 2021.

Generally, on the reasons behind these outcomes is the "Why" question. Anyone involved with legal court proceedings, e.g., as a testifying expert—appreciates that "why" questions have the longest and most arguable answer(s) if great respect for evidence and truth generally is maintained.

6 Discussion

The "why" question entails the best use of evidence, e.g., *etiology (including ergonomics), epidemiology, and economics* examined in a process pursued with the highest regard for professional ethics by both the sponsoring organization and participating individuals. The personalities, especially the egos of both an organization and most-involved individuals, have the largest impact on success, for example, with addressing built environment-related fall prevention and mitigation.

Especially in the US, some of the most active participants in the ICC code development process have oversized egos. This is perhaps more evident when, as with ICC, there are limits for each person testifying, of two minutes, in code development hearings—for direct testimony—and only one minute for rebuttal. Rapid-fire, dramatic testimony, delivered without sufficient ethical care and evidence, distorts—*and retards*—the search for the best-founded consensus on an issue.

Code development hearings should be less like theater and more like a competently managed court proceedings where the evidence is not arbitrarily limited by a clock but rather is limited only by its relevance to establishing the truth on a carefully limited question or set of questions.

The truth here is that our human capabilities are as limited, plus more challenged—*not less*—in domestic settings when we use stairs and when we shower or bathe. There is no good rationale behind the double, lower standard for stair and bathing safety in homes—*relative to other buildings*—with their code requirements kept lower by the deliberate bias of as many homebuilder representatives, on committees, as ICC has written into its code development process. This means that home builder interests need only get two votes—beyond their own four votes, to defeat any proposals by others; it also means anyone else needs to win seven votes to prevail.

Also, as addressed in the prior (2018) IEA Congress, an open-minded approach is important to scope—*semantically*—of the problem, *missteps and falls*, not just "slips, trips and falls." This is especially relevant if we are to address effectively the full range of missteps and falls such as those occurring during use of stairways and bathing/showering facilities (plus "toileting" with its stand-to-sit and sit-to-stand transfers posing balance and strength issues. The vast majority—about 90 percent—of these incidents occur in home (domestic) settings. To give this some historical context, start your own professional review by reading one of the very early accounts of the problem seen in an ergonomics context as well as a recent discussion of the historic terminology issues pervading decades of work on falls (Pauls, 1984, 2018).

7 Conclusion

Although the challenges we face could be monumental, careers building on the foregoing experience, working with built environment standards and codes in more than one country—addressing the age-old problem of falls—are worth pursuing. This holds especially for ergonomists who deal with a wide range of approaches including, for example, micro-ergonomics and macro-ergonomics—all pursued with the highest respect for evidence and all the other "e" terms covering other important concepts and approaches relevant to safety of built environments.

We look forward to further pursuits for the truth both *during* and *after* the COVID19 pandemic in which the rules and other conventions for where our daily activities occur have been completely upended since early 2020. How this is affecting everyone's propensity to fall, and how post-fall medical care plus epidemiology are affected, is discussed in the IEA presentation. The year 2021 is an exceptionally important one for all three of the model code development organizations addressed in this chapter, quite aside from the fact that it is also the first *full* year in which our world is being drastically altered by the pandemic.

For the Canadian code organization, the National Research Council of Canada, NRCC (along with its Canadian Commission on Building and Fire Codes), 2021 is especially important. As this chapter was being finalized (in February 2021), NRCC released a comprehensive evaluation of how its Codes Canada group was performing (NRCC 2021). It is an important document for those concerned with macro-ergonomics of building code development during this historic era, for example, to see the dearth of ergonomics addressed in the evaluation.

With this chapter's focus on homes, it is especially appropriate that most if not all participants in the IEA Congress will be participating from their homes which, if

examined with new insights, hold many lessons that ergonomists will quickly appreciate. As home-based participants look around them, they will better understand the absurdity of compromised home design plus construction requirements that exist largely because this is the tradition. It is what poorly informed home builders selfishly demand—*and get, for example, in the ICC process but not in NFPA's process*. We need to demand better from not only the builders, but also from code authorities empowering them in model building code development, especially in the USA.

References

Alessi, D., Brill, M. and associates (1978). Home safety guidelines for architects and builders. NBS-GCR 78-156, National Bureau of Standards, Gaithersburg, MD.

International Code Council (2017). *American National Standard on Accessible and Usable Buildings and Facilities*, ICC/ANSI A117.1.

Johnson, D.A. and Pauls, J. (2010). Systemic stair step geometry defects, increased injuries, and public health plus regulatory responses. *Contemporary Ergonomics and Human Factors 2010*, Anderson, M. (ed.), CRC Press, 453-461.

Johnson, D.A. and Pauls, J. (2012). Why should home stairs be less safe? *Trial News, 47(8),* Seattle: Washington State Association for Justice, 11-15.

Kira A. (1976). *The Bathroom*. New and Expanded Edition, The Viking Press, New York.

NRCC (2021). NRC'c Codes Canada Evaluation. National Research Council Canada, Office of Audit and Evaluation. Ottawa, Sept. 22, 2020; released Feb. 23, 2021. (https://nrc.canada.ca/en/corporate/planning-reporting/evaluation-nrcs-codes-canada Accessed Feb. 23, 2021.)

Pauls, J. (1984). Stair safety: review of research. *Proceedings of the 1984 International Conference on Occupational Ergonomics,* Toronto, 171-180.

Pauls, J. (1996). The Pathology of Everyday Things: The role of building design standards in injury prevention and the role of ergonomics—and ergonomists—in the standards-development process. *Proceedings of the Human Factors and Ergonomics Society 40th Annual Meeting, September*, 818-819.

Pauls, J. (2013). The pathology of everyday things—stairs—revisited. *Proceedings of the Human Factors and Ergonomics Society 57th Annual Meeting*, San Diego.

Pauls, J. (2018). Identifying Ambulation-related Missteps and Falls with Ergonomically Descriptive Terminology, Not as "Slips, Trips and Falls." Proceedings of the 20th Congress of the International Ergonomics Association (IEA2018), Vol II, Springer, 634-638.