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Building Code Development, Adoption, and Enforcement Problems Affecting Injury Prevention in, and Usability of, Homes and Other Buildings

Policy Date: 11/10/2009
Policy Number: 200913

Superseded (and archived) by this Policy Resolution are American Public Health Association (APHA) policy statement 99-16,1 Public Health Role of Codes Regulating the Design, Construction and Use of Buildings, and APHA policy statement 2000-19,2 Public Health Role of the National Fire Protection Association in Setting Codes and Standards for the Built Environment.
Problems addressed in the first of these policy statements continue to exist and thus they are addressed in this policy statement. The National Fire Protection Association (NFPA), which produces only American National Standards Institute (ANSI) recognized standards and model codes, has been relatively responsive in terms of code development; thus, most of Policy 2000-19's recommendations need not be repeated. Continuing challenges exist in 2 of the issues described previously, namely, injury prevention related to home stairway falls and home fire sprinklers, mostly in relation to code adoption and enforcement. Two new, paradigm-changing issues have emerged as nearly ready for model building code development deliberations, affecting both usability and injury prevention—visitability of homes and grab bars for bathtubs and showers.

General Role and Recent History of Building Codes and Related Building Control Instruments
Injuries and illness related to building design, construction, and use pose significant public health problems during normal use as well as in the event of emergencies, including fire and other disasters. Such injuries and illness can be eliminated or mitigated through environmental intervention, especially using the potent mechanisms of building, fire-prevention, and housing codes, in addition to related standards, regulations, and legislation.3–20
From the early years of the public health movement, sanitarians and other public health professionals have practiced environmental intervention through codes, standards, and regulations affecting buildings, especially housing, as evidenced by APHA's housing and health project, including publication, with the Centers for Disease Control and Prevention (CDC) of a model housing code.3,21–24
Beginning in the mid-20th century, public health professionals increasingly relinquished control of building codes (and related regulatory instruments) to the building industry. No US-based, peer-reviewed journal is published in the general field of building code development, adoption, and enforcement, although there are established specialty journals in engineering fields such as fire protection, and mechanical and structural engineering. In June 2009, a new journal, the International Journal of Law in Built Environment, under a UK university-based editor, began publication. This journal might help spur academic development in the building control field. For several decades, 3 US regional, private sector model code organizations (representing governmental code enforcement officials) have published model codes (for building design, construction, housing, property maintenance, fire prevention, plumbing, and related subjects). These 3 organizations combined to form the International Code Council (ICC) in the mid 1990s. Since 2000, ICC has published a full family of model codes (The International Codes or I-Codes) that became the predominantly adopted and enforced codes by government bodies across the United States. However, these codes are not used much outside the United States. With only a few exceptions, ICC standards and model codes are not ANSI documents.
From ICC's beginnings, there were indications that public health was not as high of a priority for the ICC, as was a dominating business presence in the US building regulatory field. This concern regarding the relationship between the ICC and the National Association of Home Builders (NAHB) was first addressed in APHA Policy 99-161 and reiterated in APHA Policy 2000-192 (www.iccsafe.org/AboutICC/Pages/Partners.aspx).
When the longer-established National Fire Protection Association (NFPA), with its very large set of widely used safety

standards, decided to develop a competing model building code, APHA adopted policy statement 2000-19 to help influence NFPA in a more public health–oriented approach to model building code development. This policy statement followed NFPA's expansion, in 1999, of its mission statement: "to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating scientifically-based consensus codes and standards, research, training and education."25 In 2001, NFPA responded positively by appointing APHA representatives to several of its leading committees addressing home and other building safety as well as usability (another less traditional public health goal). Much of what was recommended to NFPA in APHA's policy 2000-192 was implemented in NFPA codes and standards during the next several years, including, in 2003, mainstreamed safety and usability requirements for the most dangerous element in homes, the stairways.16,26–28

Particularly Important Issues in Recent and Upcoming Code Change Debates

The model code development process, especially within ICC's system of public hearings, is based on a model encouraging adversarial testimony and other formal input to the process. Certain issues typically pit advocates for public health goals (such as safety and accessibility or usability of the built environment) against certain industry representatives whose goals are to have little or no change in established, traditional practices; to experience minimal regulatory interference; and to claim often that housing affordability will be harmed. A few of those issues are highlighted in this APHA policy statement because their resolution within model code development, adoption, and enforcement could greatly affect these processes as well as having major public health ramifications. The issues are home stairways,16,26–28 home fire sprinklers, 29,30 visitability—the limited set of accessibility measures to make homes and communities work better for people with mobility disabilities,15,30 and the provision of grab bars in baths and showers in dwellings (as well as hotel rooms where they are increasingly the norm).310 All of these issues have major effects on the safety and usability of homes—and community-scale health—for the rapidly increasing proportion of the population who are elderly as well as the growing proportion of people at any age who have reduced fitness and thus compromised ability to move safely and effectively.

Home Stairways

According to the US Consumer Product Safety Association (CPSC), National Electronic Injury Surveillance System (NEISS), and NFPA, stairways serving US homes are currently associated with approximately 60 times more injuries than are home fires (with US national estimates of hospital-treated, home stair–related injuries for 2008 exceeding 800,000 versus approximately 13,000 nonfatal, home fire-related injuries to civilians—not firefighters.27,28 This ratio has increased by approximately a factor of 4 over the last 3 decades in the United States. Among apparent reasons for the increase in home stair-related injuries is the continued low standard for home stairway safety permitted under the widely used codes from ICC—contrasting with NFPA's better requirements (albeit not much adopted in the case of homes). The apparently lax enforcement by code authorities of key home stairway requirements appears to be another factor.27 Age effects do not appear to be responsible for the relatively rapid increase in home stair–related injuries.32 As with fire-related injuries, homes are the sites of the vast majority of the stair-related injuries—by a ratio, for stairs, of approximately 10 to 1—compared with nonhome stairs—in 2008.28 Also, as for fire, the more severe injuries, including fatalities, occur disproportionately to older adults.

As a general rule, there is no epidemiological or etiological basis for the traditional double, lower standard for home stair step geometry or for inferior handrail provision or functional quality; this was a point made explicitly in APHA's Policy 2000-19.2 NFPA has taken this issue to heart in its post-2000 revisions to its leading codes; ICC has gone in the opposite direction, increasing the gulf of safety and usability levels between home stairways and those in other settings.

Homebuilders have been very successful in stopping state and local adoption of even the IRC's significantly compromised requirements for home stairway safety. For example, NAHB maintains a policy (adopted circa 1995) to not allow adoption of any home stair step geometry requirements better than an outdated code (for 1- and 2-family dwelling units) from 1992.33 Moreover, even when IRC's requirements for home stairways are adopted (amended or not), they are not being diligently enforced.27

During the more than 10 years since 1997—about the time the ICC became the dominant model building code organization (with the help of the NAHB), home stair–related injuries as estimated by the CPSC NEISS increased by 55% in the United States.27,28 Even before this extraordinary increase (contrasting with a slight decrease in stair-related injuries in other settings between 1997 and 2007), leading injury burden experts estimated the total societal cost of stair-related injuries in the United States during 1995 was nearly $47 billion (in 1997 US dollars).343 Adjusting this estimate for the subsequent 55% increase in CPSC NEISS national estimates of home stair–related injuries (nearly 90% of stair-related injuries where the setting is known), as well as for inflation, the current annual cost of stair-related injuries is on the order of $100 billion (in 2009 US dollars) per year.32

During 2007 through 2009, on the basis of informal observations of many new homes as well as relatively detailed investigations of stair-related fall injuries (performed in the course of postfall litigation in the United States and Canada), there was mounting evidence of another major defect with home stairs—aside from their inferior, nominal step geometry

(interpreted by ordinary consumers as stair steepness because of the generally short treads combined with high risers). This defect is a systemic dimensional nonuniformity at the top of stair flights—with the top tread being longer in tread depth than all others in the stair flight (usually in newer homes) that could increase the risk of injurious falls, during initial descent by orders of magnitude.27,28,32,35

The available evidence is that, beyond builders incorrectly constructing the stairways, building code inspectors are not inspecting for this defect, which is prohibited by the national model building codes in Canada and the United States—including the IRC. Contributing to the flawed inspection is the publication by ICC of a Residential Inspector's Guide, which leaves out any mention of 2 critically important IRC rules intended to prevent the stair defect.36 Another flawed guide, Homebuilders' Jobsite Codes, also leaves out mention of these critical rules; this guide is published jointly by ICC and NAHB.37

Unless the occurrences of this stair defect are found and fixed (with the installation of a relatively small, off-the-shelf, $10 nosing piece), this defect will go on to injure millions of home stair users for several decades. On the order of 20% of the 1.2 million hospital-treated, stair-related injuries could be caused by this 1 defect according to the current national estimates by CPSC NEISS. Among the most serious consequences of such falls—typically beginning with an overstepping misstep at the second or third stair tread below a landing—are quadriplegia, traumatic brain injury, and death. Neither the ICC nor its Canadian counterpart (a government-funded commission) have responded to urgent pleas to assess the extent of this defect and initiate a massive program to retrofit the defective stairways at a cost (for the small nosing piece and for labor) on the order of $100 per defective stair flight. The assessment of the defect can be done with a 10-s, visual test, requiring only that the inspector crouch on the upper landing and sight down the stair nosings to make sure they line up visually, as they will when code requirements are met.28,35

Beyond reducing the risk of missteps,38 by building appropriately and uniformly sized steps, efforts must be made to improve the scoping and technical requirements for handrails, the main means of mitigating a fall and reducing the likelihood and severity of injuries. ICC's Type II handrails fail badly here because they do not allow users to wrap their fingers underneath the handrail, as is the case for other permitted handrail shapes.39 The latter are both more effective and less expensive than the Type II railings.

Home Fire Sprinklers

With APHA's encouragement in Policy 2000-19,2 in 2006, NFPA also took the lead in adopting requirements for automatic sprinkler protection for new homes. Building on much other evidence, the change also drew on evaluation of small-scale adoption showing effectiveness in reducing the human toll of fire in homes at a cost increasingly seen as acceptable for wide-scale adoption.40,41 Indeed, wide-scale adoption was key to providing automatic sprinkler protection for homes in a "cost-effective" way, a condition included in APHA's Recommendation 3 in Policy 2000-19 because of concerns expressed by an APHA section about housing affordability implications.2

In 2008, after opposition from NAHB and from many building officials, a coalition of fire safety professionals and some industry organizations succeeded in having ICC's governmental members (the only members allowed to vote on changes to the I-Codes) approve a code change for the International Residential Code (IRC) to begin requiring new homes to be sprinklered in 2011.42 After failing to have the change reversed on appeal to ICC's Board of Directors, NAHB initiated a campaign at the state and local level to prevent adoption of the new IRC sprinkler requirement.29,33 The NAHB action parallels 1 taken earlier to prevent the unamended adoption of the ICC-IRC in relation to home stairway step geometry. As early as 1997, ICC and NAHB formally agreed to initiate a strategic partner arrangement in which NAHB would help ICC gain a dominant role in model code adoptions across the United States—partly at the expense of NFPA.33 In exchange, ICC gave NAHB one third of the positions on the IRC code change committees, which gave the homebuilders extraordinary power to stop the development of code requirements that would improve safety and usability of homes. (This action was noted in APHA's Public Policy 2000-19.2) This situation occurred despite ICC's adoption of a Code of Ethics that had been developed by the Council of American Building Officials, the group that morphed into ICC beginning in the mid 1990s.43 Adherence to this Code of Ethics should have prevented the worst aspects of the strategic partner arrangement between NAHB and ICC.

Visitability

A national standard for visitability is included in the forthcoming 2010 edition of ICC/ANSI A117.1,44 the long-established national standard for accessible and usable buildings and facilities. This standard is widely adopted by mandatory reference in building codes as well as being the main source document for the Americans with Disabilities Act Accessibility Guidelines. This is yet another example of how building codes, which scope and reference standards like ICC/ANSI A117.1, are important instruments of public health policy, in this case, facilitating usability of the built environment by people with disabilities. Visitability is not intended to provide a fully habitable dwelling for a person using a wheelchair or otherwise unable to use stairs. It is intended only to permit the social intercourse that occurs in healthy communities, with friends and family able to visit with one another—something that has real societal value.15 The

visitability standard in the new ICC/ANSI A117.1 document sets out only a few essential criteria: a zero-step (or step-free) entrance to the home, a main-level toilet room with a water closet and a lavatory, and corridors and doorway widths sufficient for a wheelchair user to move on the main floor—most important between the zero-step entrance and into the toilet room. For exact criteria, refer to the Concrete Change Web site on visitability.30 Visitability has been implemented under various incentive and regulatory mechanisms across the United States,30 and the recently released report, The Surgeon General's Call to Action to Promote Healthy Homes, 2009 recommended implementing visitability for public health reasons.45

The elimination of steps at 1 or more entrance to a home is the most challenging aspects of the growing effort to make all new homes visitable.30 Such steps, commonly a single step down immediately outside the entrance door (with or without a storm or screen door swinging over the step) are typical in homes but are prohibited in all other new buildings. This setup makes the use of this entrance/exit relatively dangerous as well as very difficult if not impossible for anyone with mobility limitations—including users of mobility devices and many older users for whom the act of traversing a doorway, managing a door (and possibly a screen or storm door as well) while negotiating a step, is ergonomically challenging and dangerous. Proposals to have home entrances treated like entrances for all other new buildings have been unsuccessful in both the NFPA and ICC code development processes.

Grab Bars for Residential Baths and Showers

Baths and showers follow closely behind stairs as leading sites for injurious falls. They share the characteristics of being places where missteps and loss of balance are relatively likely while also being places that are very "unforgiving" when impacting various surfaces. Although widely discussed internationally, the public health case for providing grab bars at appropriate places in bathtub and shower enclosures—as a universal design feature (rather than a "home modification" when certain home occupants are considered vulnerable to falls)—has been made more effectively outside the United States (e.g., in Queensland, Australia),46 but most extensively in relation to a formal proposal in 2007 to the national model building code in Canada supported by a range of studies on epidemiology, etiology, biomechanics, cost, consumer acceptance, and the like.31,47–54 In Canada, the formal recommendation for the National Building Code of Canada55 to include grab bar requirements for all new dwellings appeared in a public policy motion in 2003 and in a policy resolution in 2007, both adopted by APHA's counterpart, the Canadian Public Health Association.

Other Public Health Issues Addressed or Addressable by Building Codes and Related Codes, Standards, Legislation, and Regulations

Inclusion of the foregoing problem areas should not suggest that these are the only issues where development, adoption, and enforcement of building codes (and related model codes, standards, and legal instruments such as legislation and regulation) are important. Building codes play important roles—or could play important roles—in problem areas such as environmental health generally, injury prevention generally (beyond the fire and fall problems described previously), facilitation of aging in place, promotion of improved physical fitness of the population, water, energy usage, climate change, reasonable security measures, and the like. Some of these issues are addressed by other APHA policies listed as follows:

• 1967: Enforcement of Sanitation and Housing Laws56
• 1985: Health Risks Related to Lead Exposure57
• 1988: Government Action Regarding Indoor Radon from Natural Sources58
• 1992: Support OSHA Reform and Strengthen Enforcement59
• 1993: Recognizing and Addressing the Environmental and Occupational Health Problems Posed60
• 1995: Global Climate Change61
• 1995: The Environment and Children's Health62
• 1997: Promoting Public Health Through Physical Activity63
• 1999: Injury and Violence Prevention and Control Programs in State and Local Health Departments64
• 2000: Creating Healthier School Facilities65
• 2002: Support of Healthy Aging through Health Promotion and Prevention of Disease and Injury66
• 2003: Supporting a Nationwide Environmental Health Tracking Network to Identify Links Between the Environment and Human Health67
• 2003: Strengthening the Fiscal Viability and Independence of Public Health While Responding to Terrorism68
• 2004: Reducing Health Disparities in People with Disabilities through Improved Environmental Programmatic and Service Access69
• 2004: Preventing Human Exposure to Polybrominated diphenyl ether (PBDE) Flame Retardants to Protect Public Health70
• 2004: Affirming the Necessity of a Secure, Sustainable, and Health-Protective Energy Policy71

• 2006: Addressing Potential Environmental and Occupational Health and Safety Risks of Nanotechnology72
• 2006: Urgent Call for a Nationwide Public Health Infrastructure and Action to Reverse the Obesity Epidemic73
• 2007: Environmental Injustices: Research and Action to Reduce Obesity Disparities74
• 2007: Addressing the Urgent Threat of Global Climate Change to Public Health and the Environment75
• 2007: Building a Public Health Infrastructure for Physical Activity Promotion76
• 2007: Calling for a Global Ban on Lead Use in Residential Indoor and Outdoor Paints, Children's Products, and All Nonessential Uses in Consumer Products77

Therefore the APHA recommends—
1. Local and state governments should carefully review ICC and NFPA model codes to ensure that public health is adequately served and, if not, amend the codes to better address public health problems.
2. ICC, NFPA, and code enforcement officials should work closely with public health professionals to develop policies (including codes of ethics), procedures, technical content, and enforcement practices for model codes and standards.
3. ICC should modify its policies and procedures to better support public health and safety by emphasizing the reduction of hazards on the quality of life through a public health approach; to fairly balance interest participation on committees; to develop, publicize, and enforce ethical rules for code development, adoption and enforcement; and to broaden voting rights for the approval of new model code requirements.
4. ICC and NFPA, in developing model codes and standards, should use generally a "universal design" or inclusive design philosophy, which maximizes safety and usability for the largest range of people, including elderly people or those of any age with disabilities. This includes scoping—for all new homes (subject to some very limited exemptions)—of ICC/ANSI A117.1-2009 requirements for "visitable dwelling units" as well as installation of grab bars, on the basis of ICC/ANSI A117, for all bathtubs and bathtub shower combinations of new dwelling units as well as hotel rooms.
5. ICC and NFPA should develop and maintain model codes and standards requiring home stairways to be designed and constructed so that stairs and railings provide at least the same level of usability and safety from falls as do stairs and railings in other buildings.
6. NFPA should build on its safety standards leadership role by continuing to provide clear alternatives to the International Codes produced by the ICC, by including public health professionals on NFPA consensus committees, by remaining true to the expanded NFPA mission statement, and by emphasizing the reduction of hazards on the quality of life through a public health approach.
7. The US Congress and the US Department of Housing and Urban Development should use development and enforcement procedures for manufactured housing regulations that make public health, rather than industry practice, a top priority.
8. Federal, state and local government organizations should adopt progressive, responsive, standards and model codes that make public health a first priority.
9. A coalition of public-interest organizations, including government agencies, should monitor, report, and advise on the development, adoption, and enforcement of codes, standards, and regulations affecting buildings.
10. CDC and other agencies should increase support for public health research on the roles of building-related codes, standards, and regulations.

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