

Are you considering home modifications indoors or outdoors? Time to think about fall prevention.

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Outline

- Falls and their prevention
- Why focus on the built environment?
- Home modifications to consider (stairs and bathrooms)
- Getting the right help

Slips, Trips, and Falls

https://www.ccohs.ca/oshanswers/safety_haz/falls.html;

<https://www.who.int/news-room/fact-sheets/detail/falls>

- **Slips** happen where there is too little friction or traction between the foot/footwear and the walking, standing, or supporting surface.
- **Trips** happen when your foot collides (strikes, hits) an object causing you to momentarily lose your balance.
- Slips and trips may be “near misses”.
- **Falls** are events, which result in a person coming to rest inadvertently on the ground or floor or other (usually) lower level.

The Problem

- Falls are a major global health problem
- Approximately 25% of all falls result in injuries
- Incidence of falls increases with age
- 1 in 3 seniors fall annually
- Approximately 50% of falls occur indoors.

Personal Risk Factors for Falls

- Polypharmacy (4+ medications, including over-the-counter medications)
 - Benzodiazepine sedative hypnotics
 - Peripheral neuropathy
 - Gait and balance impairments
 - History of a fall (last 6-12 months)
 - Vision changes (e.g. cataracts, glaucoma, macular degeneration)
- Falls are often multi-factorial - environment implicated in about 1/3 of all falls among seniors.

The Built Environment and Fall Risks

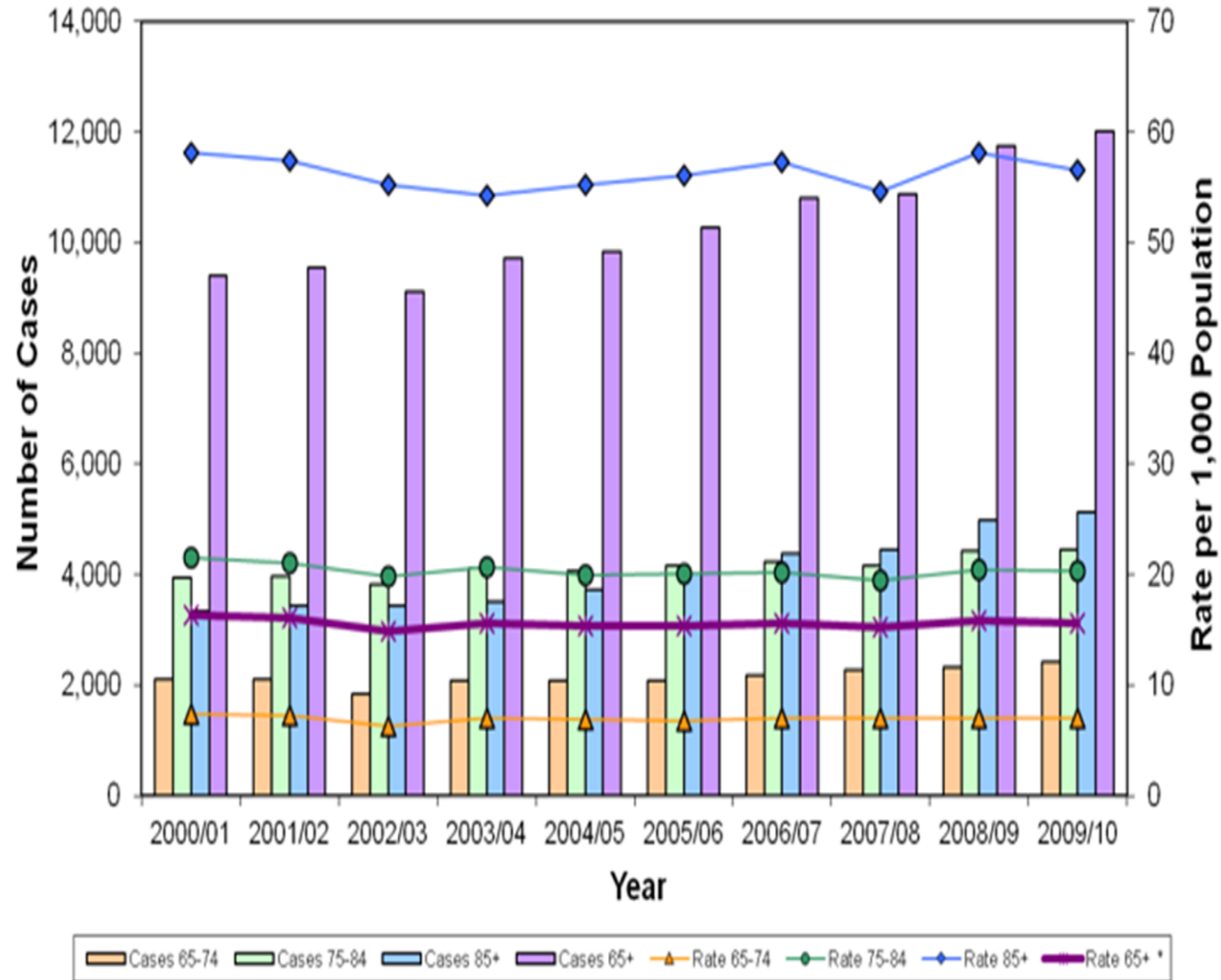
- We are constantly interacting with the built environment.
- Features of the built environment make it easier or more difficult for people to navigate safely.
- How the built environment increases risks for falls:
 - Transition points (changes in lighting, surface friction (traction), tread size, height or slope).
 - Physically demanding features requiring:
 - shifts in body position, balance, or centre of gravity (e.g. stepping into a bathtub, using bodyweight to open a heavy door)
 - an increase in effort expended (e.g. going up or down steps and stairs).

Falls are Costly

<https://parachute.ca/en/professional-resource/cost-of-injury-in-canada/>

- Falls (across all age groups) contribute substantially to Canadian health care and social costs (\$10.3 billion in 2018) (Parachute Canada, 2015 and 2021)
- Falls had a higher total cost than any other cause of injury in 2018, accounting for 35 per cent, of the total cost of injuries.
- Transport incidents: \$3.6 billion
- **The highest costs of injuries incurred, by age**
 - Children (0-14): falls, \$996 million
 - Youth and young adults (15-24): transport incidents, \$990 million
 - Adults (25-64): falls, \$3.0 billion
 - Seniors (65+): falls, \$5.6 billion

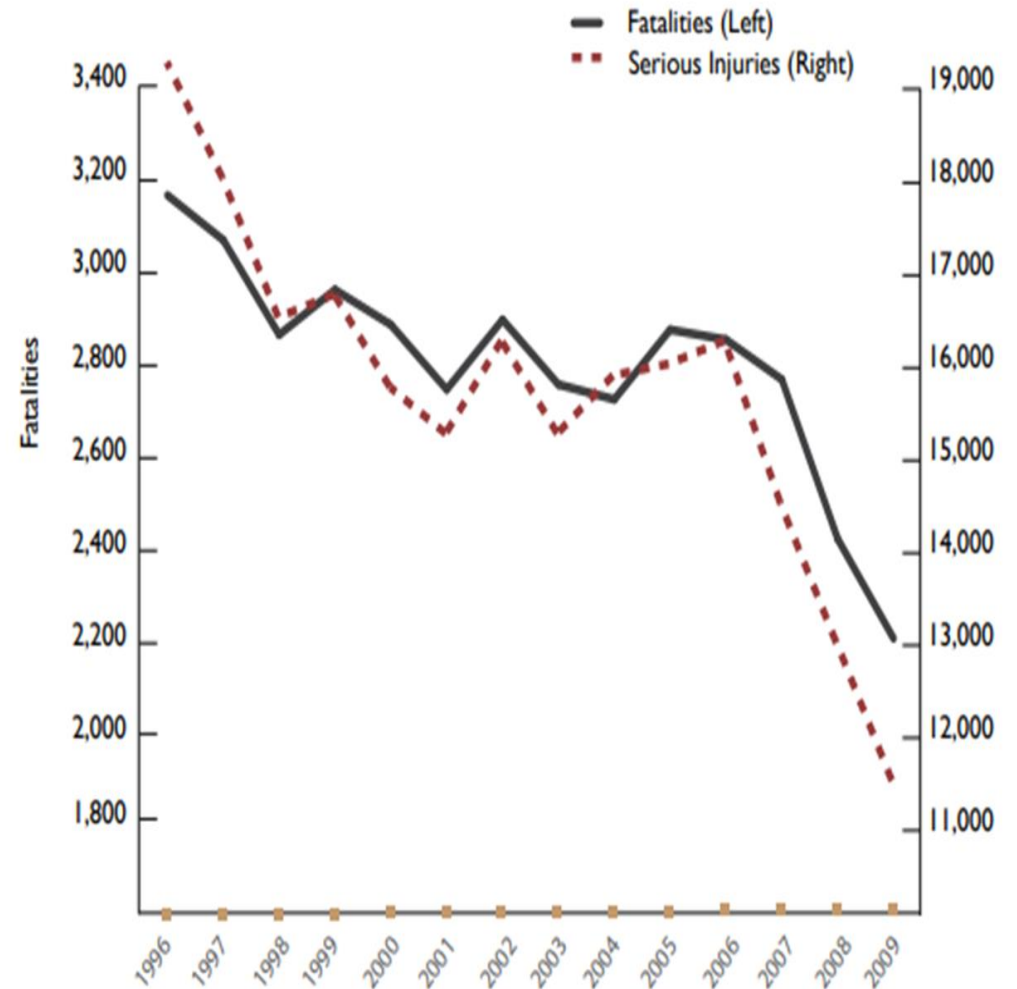
Fall-Related Hospital Cases and Rates Among Seniors, B.C., 2000/01 to 2009/10



* Standardized to the B.C. 1991 population.

Source: Acute/rehab. separations from the 2000/01 to 2009/10 Canadian Institute of Health Information Discharge Abstract Dataset.
Prepared by: Population Health Surveillance and Epidemiology, Ministry of Health Services, February 2011.

Motor Vehicle Accidents in Canada: Fatalities and Serious Injuries, 1996-2009

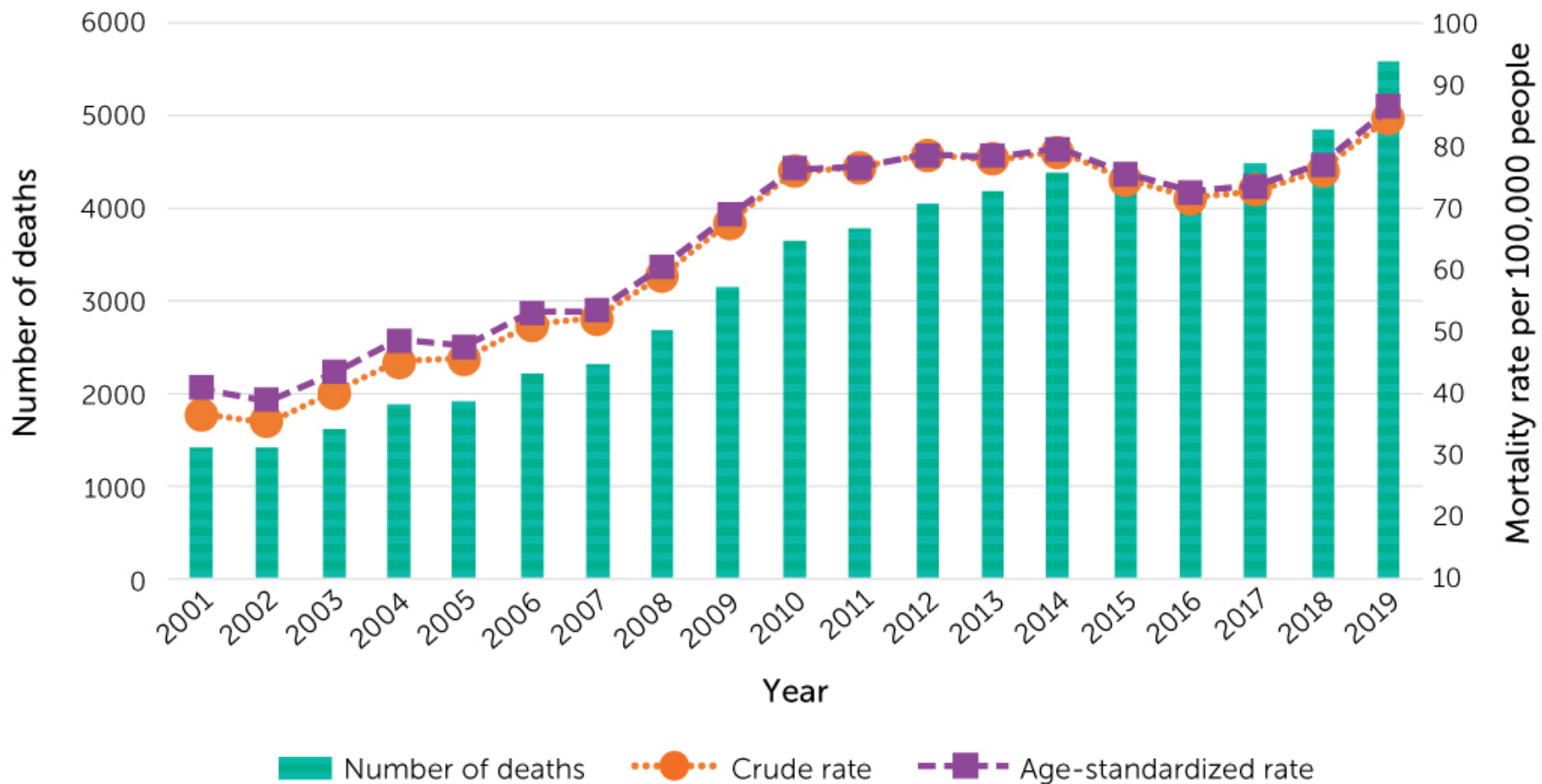


Source: Road Safety in Canada by Government of Canada.

<https://www.tc.gc.ca/media/documents/roadsafety/tp15145e.pdf>

Figure 24. Number and rates of deaths due to falls, population aged 65 or older, Canada, 2001–2019. In 2019, 5,581 older adults died because of a fall in Canada.

Source: <https://www.canada.ca/en/public-health/services/publications/healthy-living/surveillance-report-falls-older-adults-canada.html#a2.5>



What gets media attention: Fatalities from fires versus falls

- Approximately 222 deaths due to fires annually in Canada (all ages)
- Approximately 5,581 deaths due to falls annually in Canada (age 65 years and older)

Can Home Modifications Reduce Injuries from Falls?

Home modifications to reduce injuries from falls in the Home Injury Prevention Intervention (HIPI) study: A cluster-randomised controlled trial. (Keall et al., The Lancet, 2014)

- Home modification interventions:
- Handrails for outside steps and indoor stairs, grab rails for bathrooms, outside lighting, edging for outside steps, and slip-resistant surfacing for outside areas such as decks and porches.

- Primary outcome:
- Rate of falls at home per person per year that needed medical treatment (from administrative data for insurance claims).

- Results:
- After adjusting for age, previous falls, sex, and ethnic origin, relative rate of injuries in treatment versus control group was 0.74, (95% CI 0.58–0.94).
- Injuries specific to the home-modification intervention were cut by 39% per year exposed (0.61, 0.41–0.91).

Why focus on stair and bathroom falls?

- Injury rates from falls on stairs and in bathrooms are much higher than rates from falls in other locations (65% versus 25%)
- Safety improvements provide short- and long-term benefits
- Safety modifications to stairs and bathrooms improve visitability of your home for all age groups

The problem is big and costly

The evidence for prevention is strong

Common concerns and views that discourage people from making home safety modifications (The Cons)

- It's too expensive
- I can't find a (reliable) renovator
- I don't think my landlord will allow me to make changes
- I worry that a change will reduce property value
- Making renovations is a hassle

- I'm not old enough, I don't need to make any changes yet
- I'm healthy, I don't need to worry about falls yet
- I like my house the way it is.
- I know where the hazards are and I can avoid them.

Reasons for Making a Change (The Pros)

- Want to stay in your home (age-in-place) and be safe
- Want to reduce your risk of an injurious fall
- Want your home to be more visitable (for friends and family)

- Changes in your health status are making it more difficult to navigate around your home
- You've had a recent fall (any location)
- Someone has had a fall in your home
- A health provider or family member has suggested that you make a change
- Changes would make you feel safer in your own home

Stairs and Stair Falls

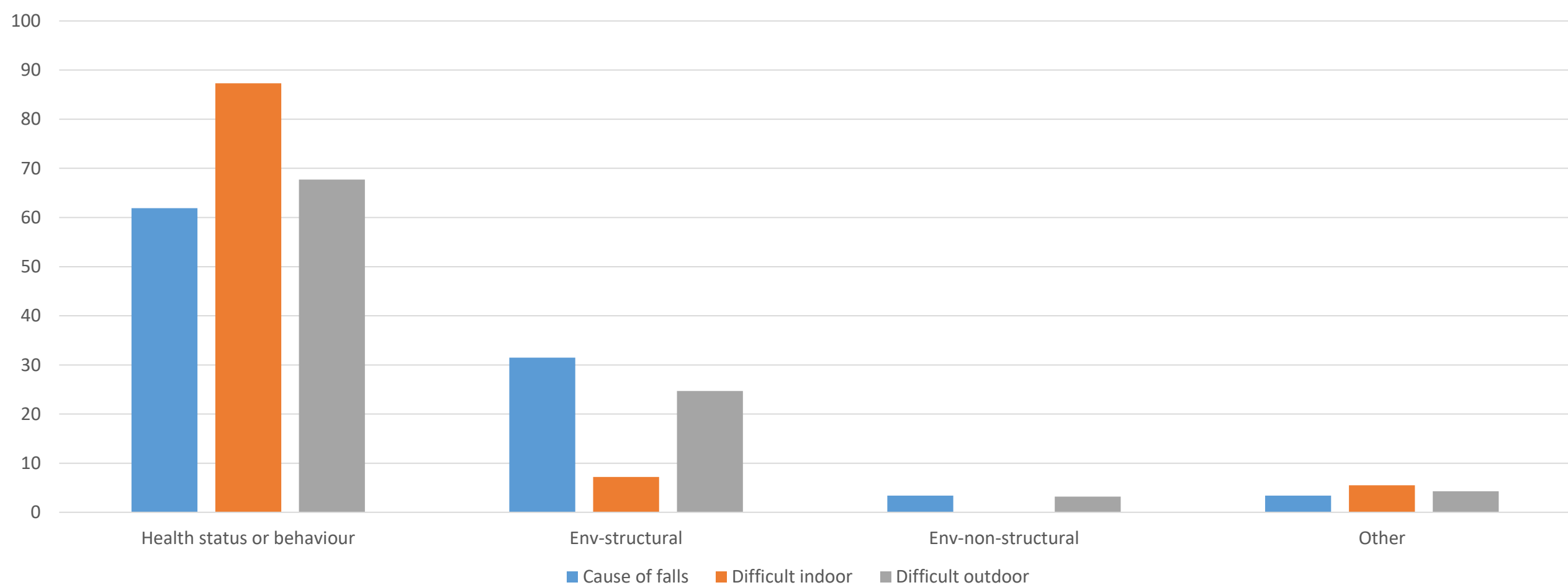
- 55% of Canadians 55 and older have difficulty climbing stairs
- Stairs are leading reasons for needing to move or restricting use to a single floor in the home but 89% of Canadian seniors want to age in place
- Indoor and outdoor stairs are common locations for falls - account for a higher proportion of injurious falls than falls in other locations
- When exposure (time spent on stairs) is taken into account, stairs are among the most hazardous of environmental features
- 10.1% of injury costs due to falls across all age groups are on stairs

References: AARP: Fixing to Stay, May 2000; Canadian Physiotherapy Association, 2002; Pauls 2003, Lawrence, B. A., Spicer, R. S., & Miller, T. R. (2015). A fresh look at the costs of non-fatal consumer product injuries. *Injury prevention*, 21(1), 23-29.

Seniors' self-reports of "What caused fall on stairs?" (n=93) and "What made stairs difficult to use?" (n=329)

(Analysis of qualitative reports, Ottawa-Gatineau, Edwards et al.)

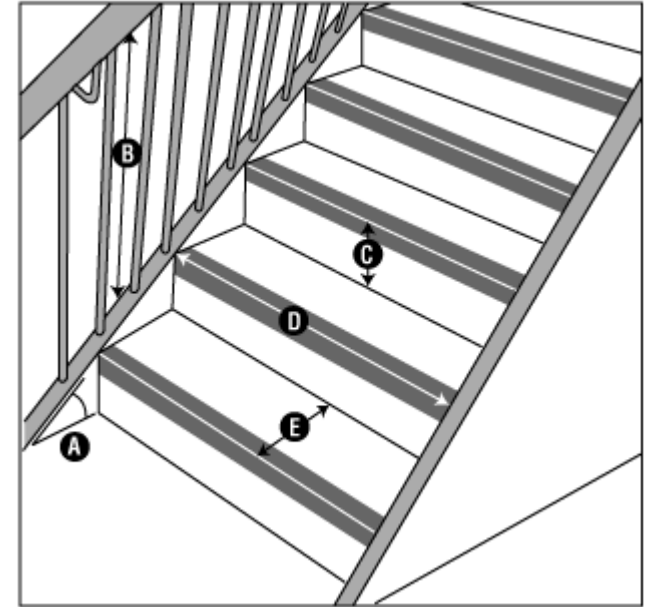
Chart Title



What makes for a safer set of stairs?

Source: CCOHS

- Not too steep - optimal slope: 30° - 35°
- Handrail height: between 86.5 and 107 cm*
- Riser height: between 12.5 and 18 cm*
- Step width: 90 cm min.*
- Tread run: between 25.5 and 35.5 cm*
- Uniformity: Within a staircase, treads shall have a uniform run and tread depth that does not vary more than 0.5 to 1 cm*.





Handrail obstructed, installed too close to wall, and not graspable.

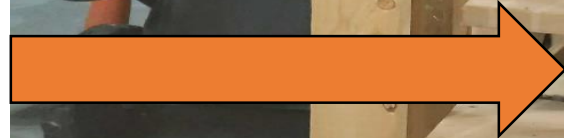
Risers are high, making steps steep and difficult to navigate.

Safety Hint: 7-11 is rule of thumb – no more than 7-inch rise and minimum 11-inch tread.

Plank-shaped handrail shape does not allow a power grip.



Open risers are visually distracting and allow foot to step too far forward on stair ascent.



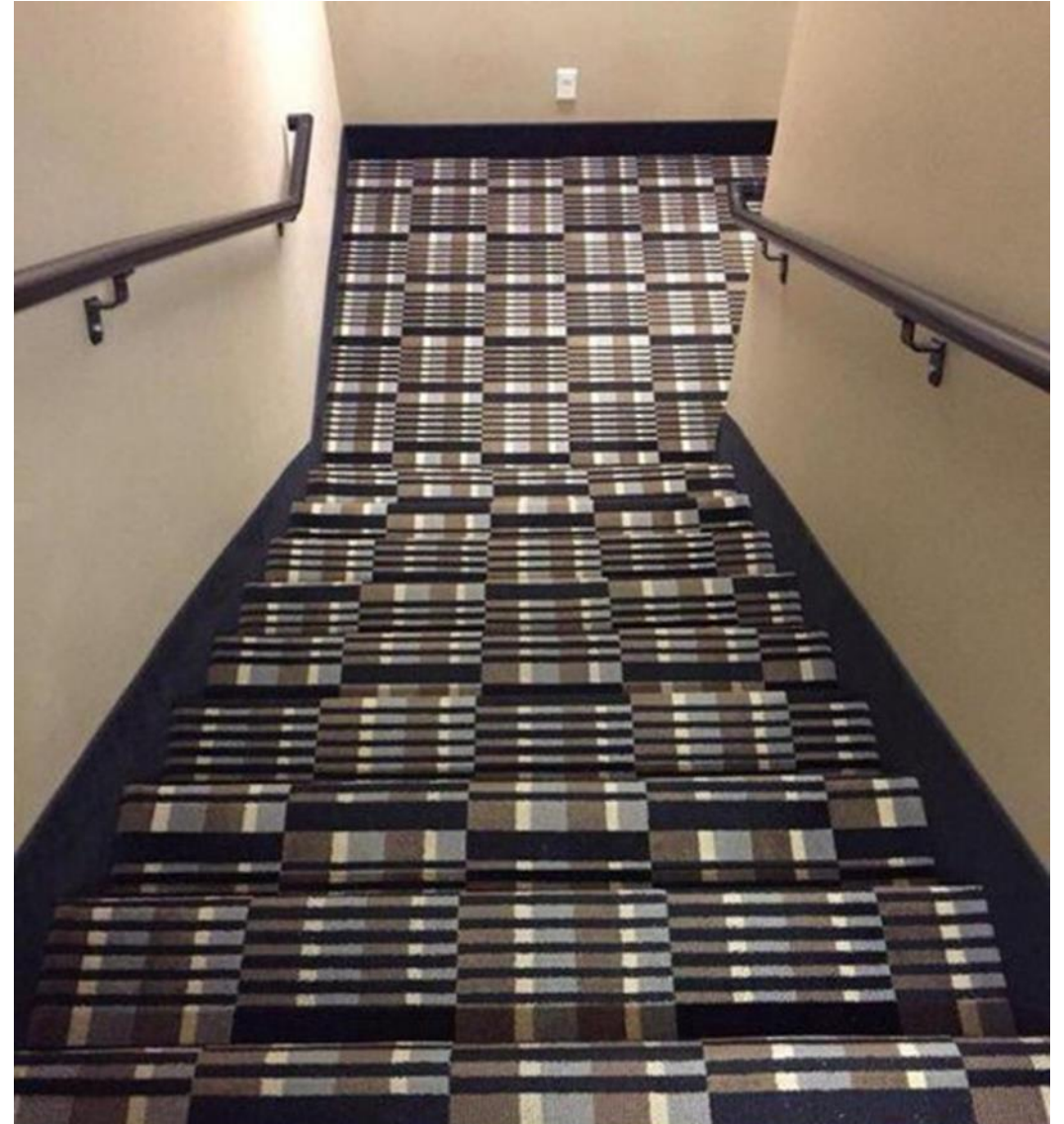
Navigating stairs when there is no landing is a fall waiting to happen.



“A volunteer with Meals on Wheels, walks up the stairs to deliver food. Fall prevention experts encourage installing [handrails] on both sides of staircases. (Josh Galemore/Savannah Morning News/Associated Press)

<https://www.cbc.ca/news/health/falls-seniors-cihi-1.5208253>

Patterned carpets make it difficult or impossible to see stair edges



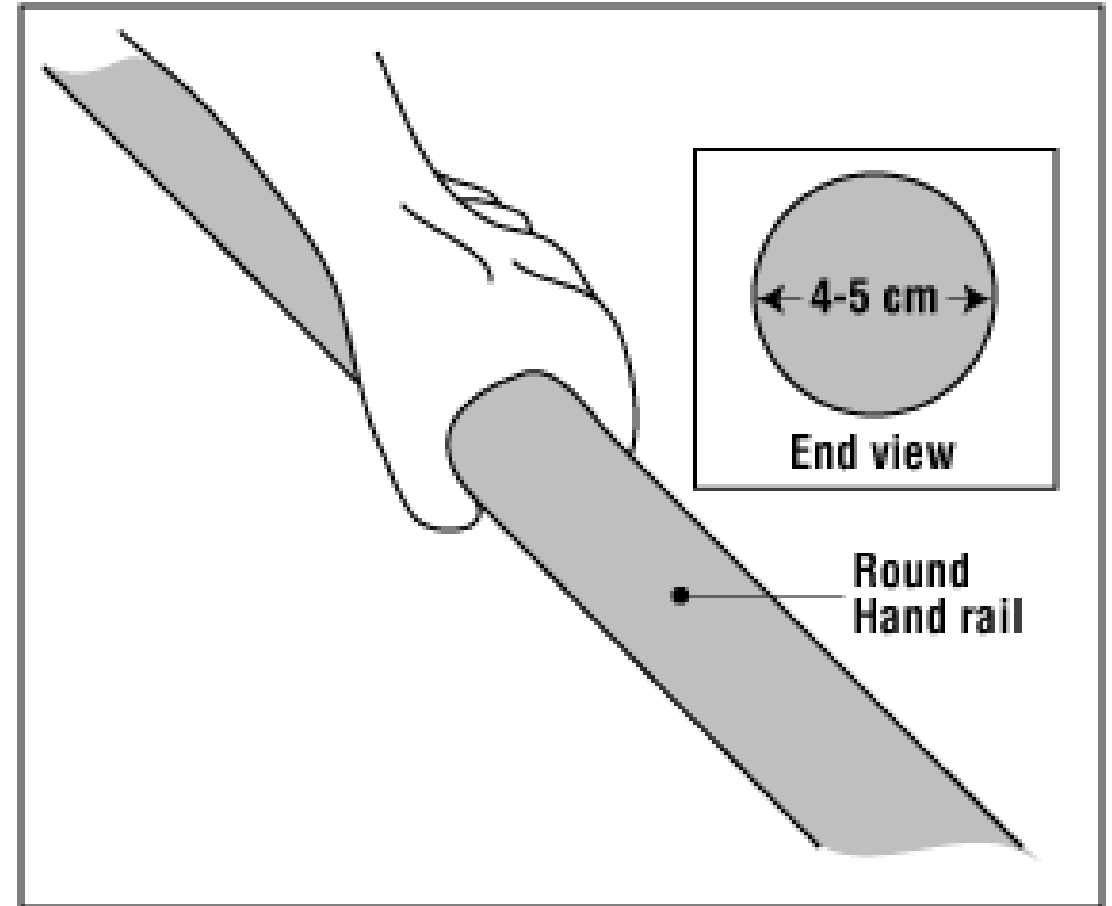
Examples of Changes to Building Codes Ontario, Jan 2022

- <https://www.ontario.ca/document/changes-2012-building-code/stairs-guards-and-handrails>
- Article 3.4.6.8. - Treads and Risers (New)
- Minimum run (tread) for stairs increased from 255 mm to 280 mm.
- Maximum rise (height) for stairs decreased from 200 mm to 180 mm.
- A new provision to restrict open stair risers.

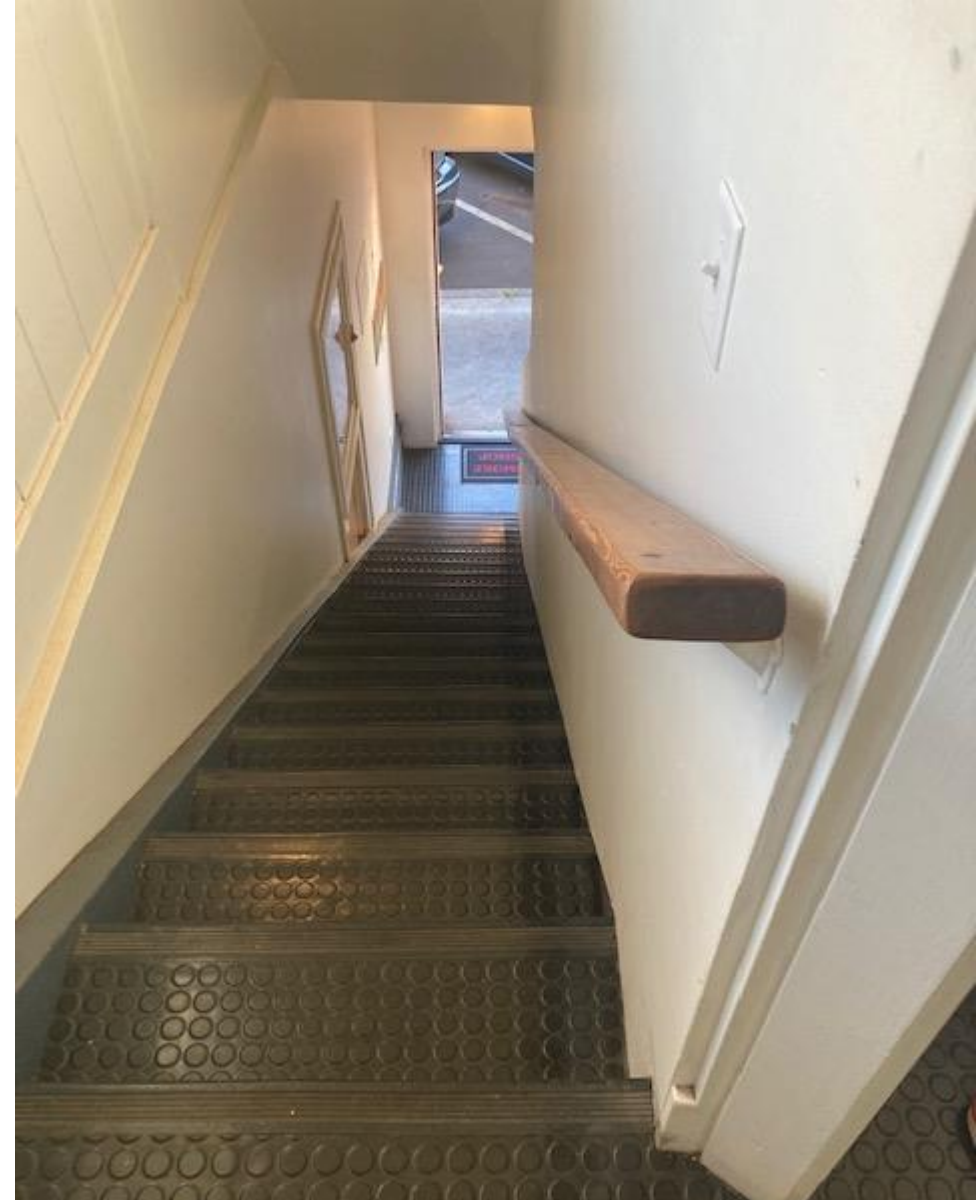
Graspable Handrails

https://www.ccohs.ca/oshanswers/safety_haz/stairs_fallprevention.html

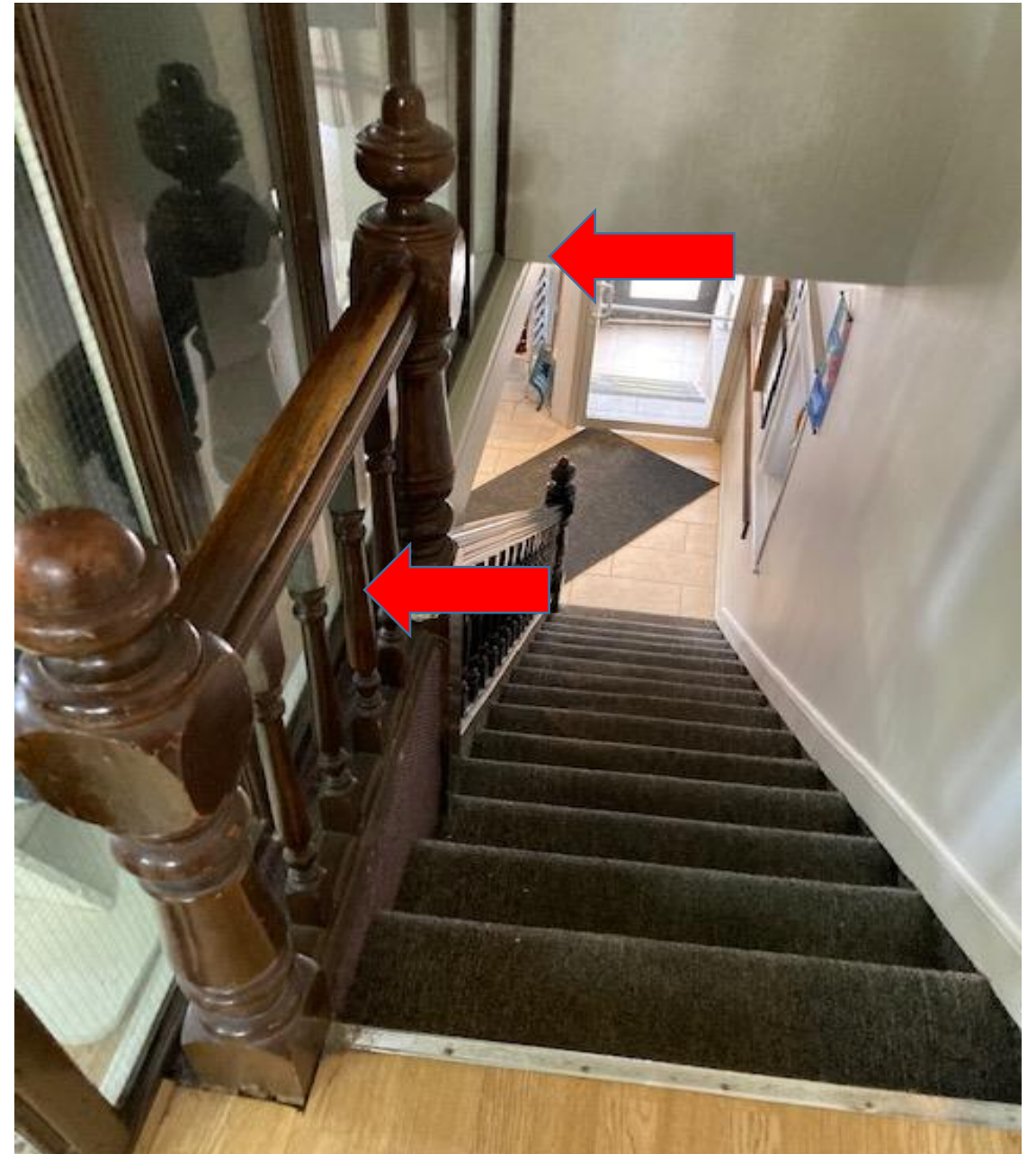
- Esthetics must not compromise functionality
- Handrails must be “graspable”.
- Must be able to grasp the handrail quickly, easily and firmly if you should start losing your balance.
- You should be able to run your hand smoothly along the entire length without having to adjust your grip. You should be able to apply a "tennis-racket grip" the full length of the handrail.
- Ballusters:
 - horizontal and vertical clearances prevent the risk of young children falling through
 - Lack of footholds help prevent climbing.



Examples of handrail designs that do not permit optimal grasp (power grip)



Newel posts may create handrail discontinuities



Handrail discontinuities and a triple jeopardy (wedge-shaped stairs, uneven lighting, open risers)



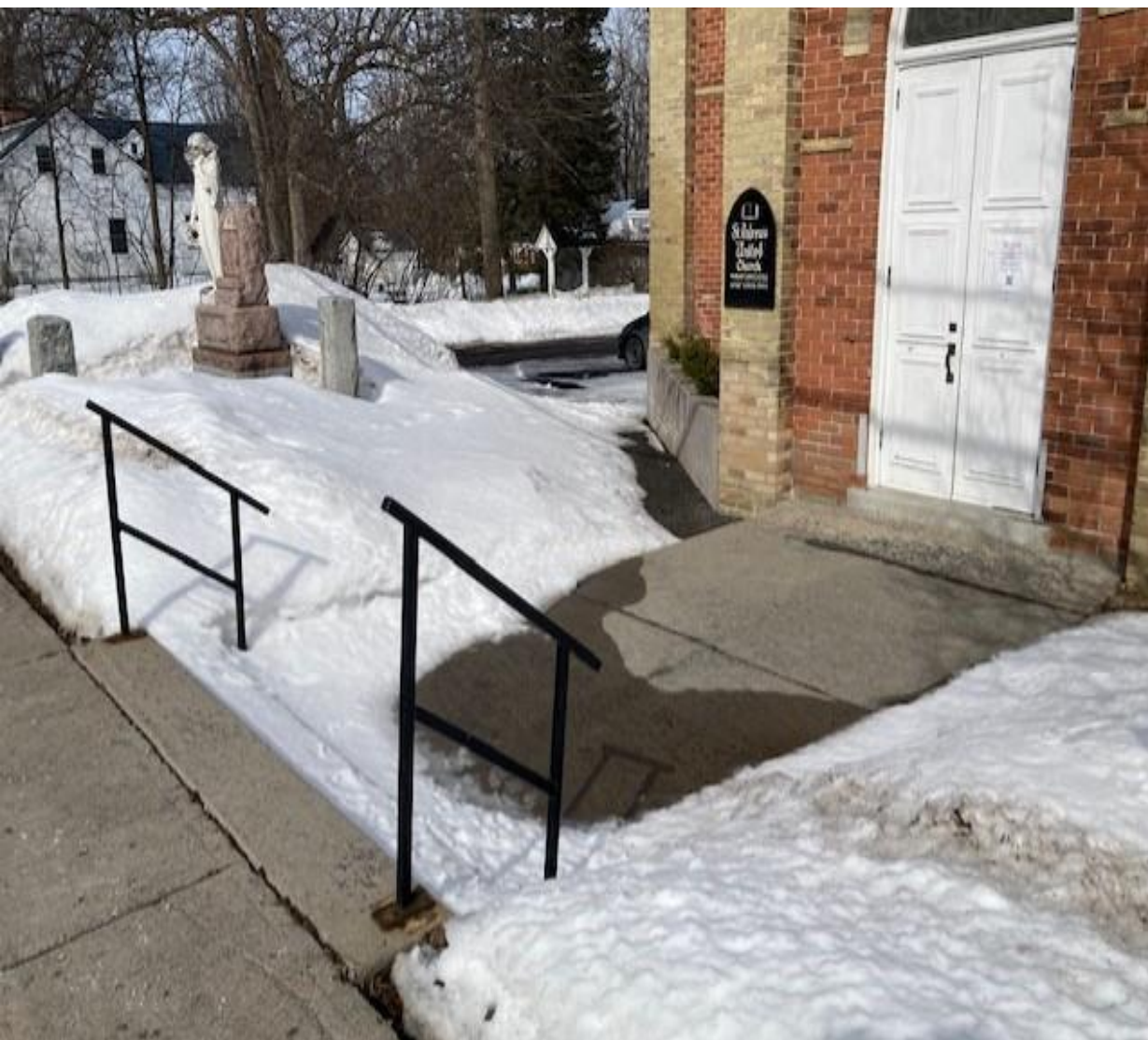
Even a small step can result in a serious fall



Handrails important for all stairs including those with only a few steps



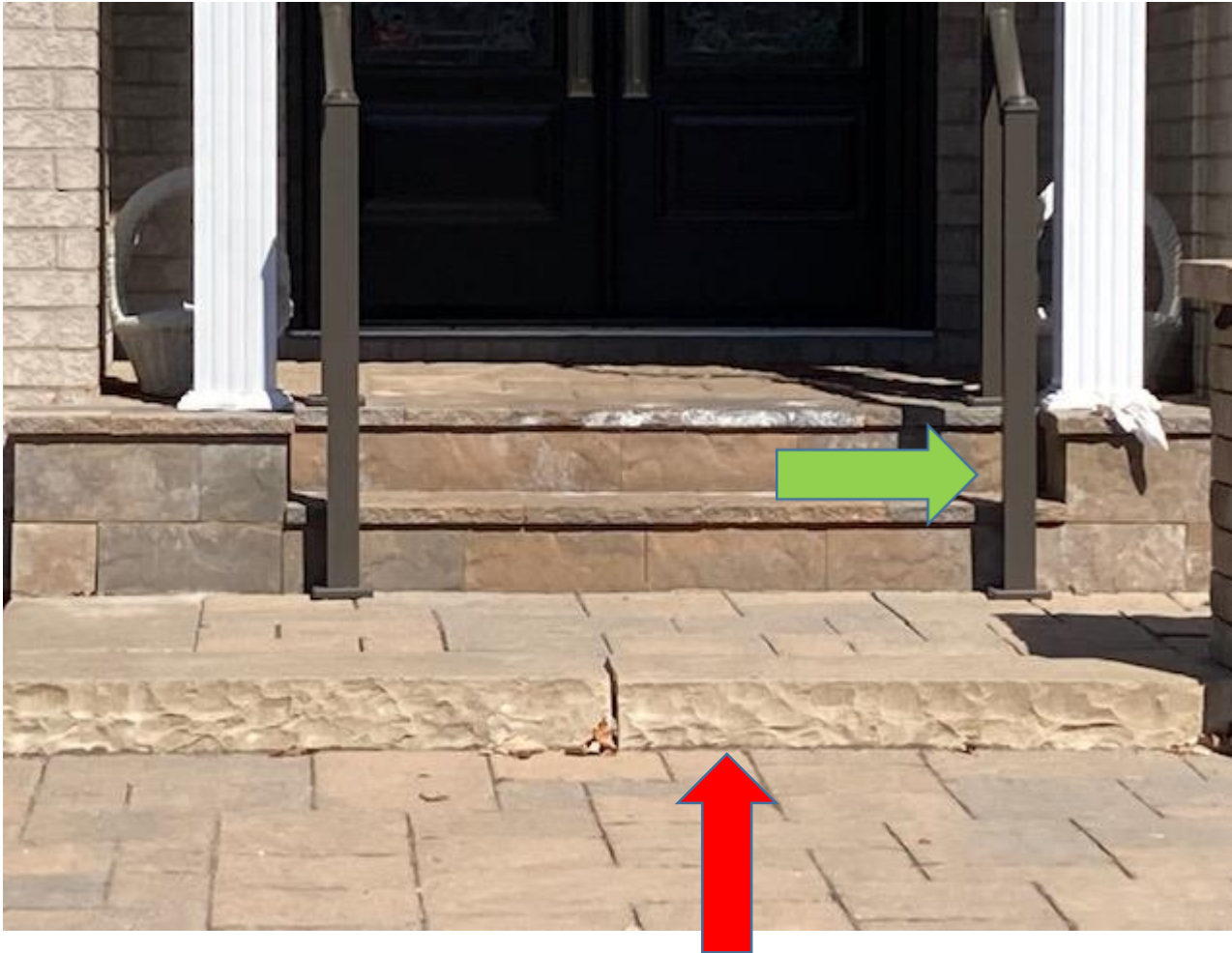
What about your place of worship?



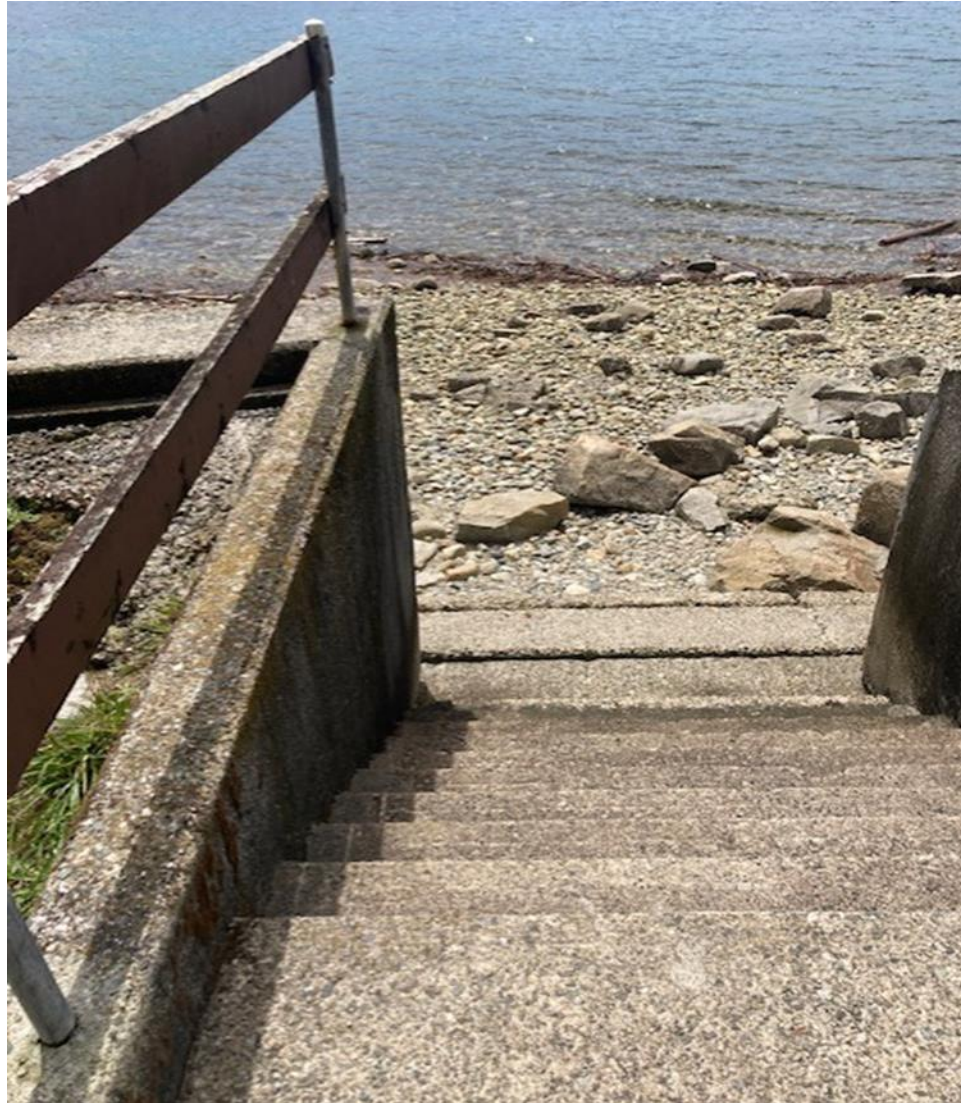
Step non-uniformity introduced with addition of interlock



Handrails provide visual and tactile cues and mis-cues



A guard rail is not a stair handrail



These make-do hand rails (grab bars) are not a good solution!



Handrails, getting it right



Marking stair edges – good visual cues



Getting it right: Tactile and visual cues provided by handrails and stair edging



Getting it Right:

Graspable handrail design. Handrail extends beyond first and last steps. Change in handrail slope provides tactile cues for top and bottom of stairs



Other Technology to Assist on Stairs

An occupational therapist can help you determine what technology best fits your needs and abilities

- Ramps
- Stair lifts
- “AssiStep (a stair walker) ... helps you climb stairs safely.”



Photos from CARP National website

Questions for landscaping, interlock and patio deck companies

- Do you offer the option of handrails when steps and stairs, walkways, and decks are being rebuilt?
- How do you deal with the problem of heaving ground?
- What standards/codes do you use to determine stair and handrail dimensions?
- What design features do you recommend to reduce the risk of falls (for persons of any age)?

Checklist for Stairways with special application to home stairways
Developed by Jake Pauls, CPE. Contact: bldguse@aol.com.
Permission is granted to reproduce with source identified.

Selected examples of Items on this checklist

- [] Avoid sudden changes of views and visual distractions, including glare, from stairways.
- [] Make sure risers and treads, measured nosing to nosing, are consistent in size (within 5 mm).
- [] Conspicuously mark flights having inconsistently sized steps so the non-uniformity stands out and is visually obvious.
- [] Carpets and padding on treads should not exceed 10 mm in total thickness.
- [] Fix tread coverings securely; coverings must be tight against the nosings.
- [] Provide slip-resistant (rough) finish on exterior stair treads subject to wetting.
- [] Install a handrail around which fingers and thumb can encircle, rather than merely pinching the railing. A measuring tape, wrapped completely around the railing, should measure < 160 mm.
- [] Provide at least one handrail on each stair—regardless of the number of steps.

In Summary: Common Correctable Stair Design Faults

- Non-uniform steps (within a staircase, treads shall have a uniform run and tread depth that does not vary more than 0.5 to 1 cm*).
- Risers that are too tall or open, narrow treads
- Insufficient landing at top or bottom of stairs
- Insufficient and/or variable lighting, no toggle switch
- Surface materials provide inadequate slip resistance
- No handrails
- Handrail discontinuities
- Handrails provide problematic tactile and visual cues
- Handrail shape and size do not allow a “power” grip
- Handrail heights are too high or too low

If we can improve playground safety for kids why can't we get public stairs right for all ages?

Taking Action

Public Stairs

- Contact your municipality or property owner when you observe or experience hazardous stair features
- Ask if the stairs meet accessibility standards

Private Stairs

- Ensure adequate lighting (install a toggle switch)
- Replace and/or install graspable and continuous handrails where there are steps
- Mark stair edges for better visibility
- Consider replacing staircases that are hazardous
- Hire a renovator who's knowledgeable (avoid weekend warriors)

Grab Bars in Bathrooms and Showers



Injuries Involving Bathtubs and Showers in U.S. (2010-2014)

Source: Data provided to Jake Pauls by Dr. Lawrence (Pacific Institute for Research and Evaluation); Supplementary to his 2015 Injury Prevention Article

Bathtubs and showers (2010-2014)

Location of Fall Injuries in bathtubs and showers	Frequency (%)
Not Recorded	209,936 (21.02%)
Home	754,831 (75.57%)
Public Property and schools	30,932 (3.01%)
Other	3,150 (0.04%)
Total	998,849 (100%)

Incidence of Medically Treated Injuries Involving bathtubs and showers (2010-2014)

Age	Doctor or Outpatient	Emergency Department (ED)	Hospital admitted via ED	Hospital admitted direct
0-9	37,209	43,340	1,332	666
10-19	35,633	23,065	550	193
20-29	69,978	35,853	1,363	483
30-39	111,103	36,699	1,498	444
40-49	128,478	37,743	2,340	707
50-59	122,562	37,818	2,807	1,332
60-69	70,334	24,507	4,954	1,649
70-79	50,248	18,727	5,880	1,832
80+	49,813	21,343	10,501	2,864

Why grab bars?

- Grab bars provide points of control for safe transitions (entry/exit – bathtubs and showers; sitting down/standing up – bathtubs)
- When grab bars are absent in bathtubs and showers, people of all ages use other surfaces/structures for balance and support:
 - soap dishes
 - towel bars
 - sink ledges
 - tiled surfaces
 - shower curtains

Properly Installed Bathtub and Shower Grab Bars Reduce the Incidence of Falls

- Seniors living in a home without shower and/or bathtub grab bars were more likely to experience a hip fracture than seniors living in a home with bathtub and/or shower grab bars (risk of hip fracture for no rails was 4.3 for showers and 2.5 for baths) (Clemson, Cumming & Roland, 1996)
- Hazardous grab rails (e.g. temporary bars with suction cups, bars not properly positioned, unstable bars) lead to injuries (Clemson, Cumming & Roland, 1996; Edwards, Lockett, Aminzadeh & Nair, 2002)

Laboratory Studies: Optimal Bath Grab Bar Configuration for Community-Dwelling Seniors



H. Sveistrup, D. Lockett, N.
Edwards, F. Aminzadeh

Funded by CMHC

J Technology & Disability, 2006

More recent lab research on grab bars
(Photo: Alison Novak and her team at Toronto
Rehabilitation Institute)



Age-friendly Checklists (Sample items from Housing Options in Ottawa)

<https://coaottawa.ca/wp-content/uploads/documents/COA-Housing-Guide-for-Older-Adults-EN-2021.pdf>

- Are stairs difficult to manage?
- Are grab bars installed in bathroom?
- Is there a walk-in shower?
- Is the home accessible for people with mobility devices (e.g. a walker or wheelchair)?
- Are the doorways wide enough for a wheelchair to enter?
- Is there a bathroom on the main floor?
- Can friends and family visit easily (Consider access to the building and visitor parking spots as well as stairs).

CMHC Consumer Home Buyer's Condo Guide

<https://www.cmhc-schl.gc.ca/en/consumers/home-buying/buying-guides/condominium/physical-evaluation-checklist-for-resale-units>

Physical Evaluation Checklist:

- Bathtub and shower walls are clean and solid.
- **Bathtub has solidly installed grab bars for safe entry and exit.**
- Floor of bathtub is non-skid.

Canada Safety Council

<https://canadasafetycouncil.org/home-adaptation-checklist/>

- **Bathroom**

- Install shelves beside basin for storage.
- **Install a grab bar within easy reach.**
- Install additional light fixtures near the mirror or medicine cabinet.
- Install non-slip flooring throughout the bathroom.
- Install lever-type faucets or a faucet with a single lever to control flow.
- Adjust the hot-water heater or install a device that will prevent the water from reaching too high a temperature.
- Install a hand-held shower on adjustable rod or high-low mounting brackets.

Transparent grab bars or grab bars with colours that match surrounds makes them more difficult to grab if you start to fall. Poor graspability of grab bar shown.





Would you categorize this as a “grab bar”?

Small diameter, slippery surface, transparent (no colour contrast), ergonomically poor (too low to assist adults getting up and down from bottom of tub).

Most advertisements for manufactured tubs and showers show no grab bars. Ask “Will warranty be voided if acrylic surround is punctured to install grab bars?”



How many grab bars and where to install them based on universal design principles?

- Using a bathtub requires user to:
 - Step into out of the tub
 - Sit down and stand up from bottom of bath
 - **Minimum of two grab bars are needed for bathtubs**
- Stand-alone showers require you to step into and out of the shower, often over a small raised ledge
 - **Minimum of one vertical grab bar for stand-alone showers**
- Installation must be into studs and/or backing behind the tiled wall.

Getting it right (and it's affordable): \$240 for purchase and installation of grab bar in apartment



AODA (Accessibility for Ontarians with Disabilities Act)
Compliant public bathrooms may have left public with
an institutional perception of grab bars and safety bars.





Floor to Ceiling Grab Bars (Example of Superpole, can also be used for free-standing bathtubs)



Canadian Standards Association – Accessible bathrooms

https://www.csagroup.org/wp-content/uploads/B651-12EN_ACC.pdf

6.2.5 Grab bars

6.2.5.1 Size and spacing

A grab bar shall

- (a) be slip-resistant;
- (b) have a diameter between 30 and 40 mm;
- (c) where mounted adjacent to a wall, have a space between 35 and 45 mm between the wall and the grab bar; and
- (d) not rotate within its fittings.

- 6.2.5.2 Structural strength

- A grab bar shall be installed to resist a force of at least 1.3 kN applied in any direction.

- 6.2.5.3 Surfaces

- A grab bar and adjacent surfaces shall be free of any sharp or abrasive elements.

Grab Bar Options and Instructions for Installation

<https://www.buildable.ca/post/grab-bars-what-you-need-to-know>

For a shower or tub enclosure:

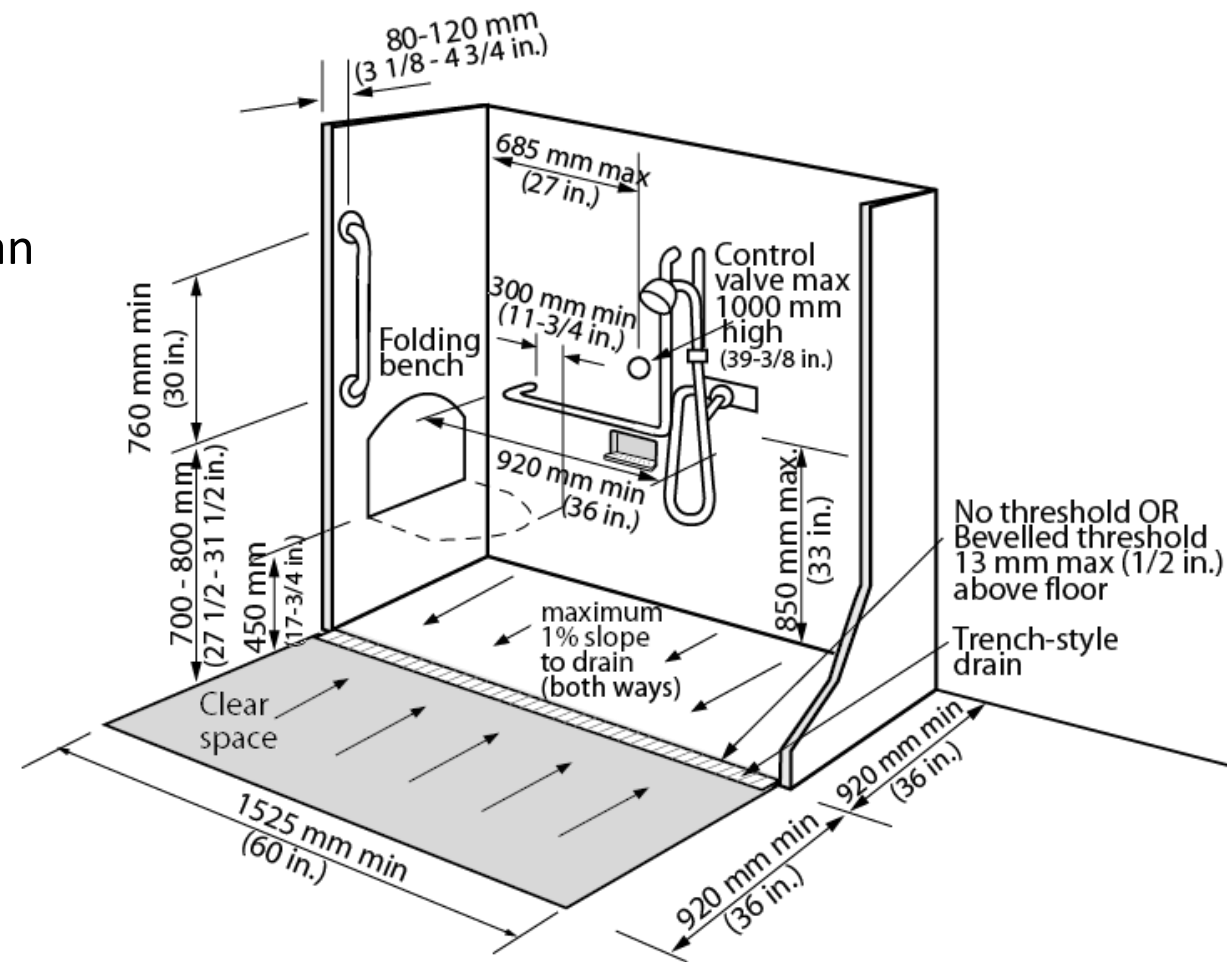
- A vertical straight bar (24") at the entrance to your shower/tub, AND
- L-Shaped (30" x 30") or Diagonal bar (36") on the back wall.

For a toilet:

- A horizontal straight bar (18-24") behind the toilet and an L-Shaped bar (30" x 30") on the adjacent wall is recommended.

ALL standard grab bars should:

- Be non-abrasive, slip-resistant, and have a high tonal contrast
- Have a diameter of 35 mm and 40 mm
- Withstand a force of 1.3 kN applied in all directions
- Not rotate in their sockets
- Must be properly installed/mounted.





Standards, Codes and Regulations

- National building code recommendations and provincial building regulations are based on minimum codes
- Codes are reviewed in 5-year cycles
- Accessible design for the built environment: B651-18 National Standards of Canada
- **Universal design makes the environment easier for everyone.**

Source: <https://www.section508.gov/develop/universal-design>

Universal design is a concept in which products and environments are designed to be **usable by all** people, to the greatest extent possible, without the need for adaptation or specialized design.

Proposed Building Code Requirement for Universal Installation of Grab Bars in Homes

- An advocacy foci for CARP's Ottawa Chapter
- Working with other partners including:
 - Parachute
 - CanAge
 - Age-Well (Canada's Technology and Aging Network)
 - Canadian Association of Occupational Therapy
 - Canadian Public Health Association
 - ParticipACTION
 - Researchers with KITE (Toronto Rehabilitation Institute) and Elisabeth Bruyere Research Centre (Ottawa)

You can exceed minimum codes

“Going one step beyond the current code requirements might cost a bit more upfront, but it can provide peace of mind for a property manager [or home owner] considering the safety of building [home] occupants and the fact codes could change in the near future.”

- Improving accessibility is a priority for Canada’s current code review cycle.
- From: <https://www.lowes.ca/ideas-how-to/inspiration/ensure-your-new-deck-is-up-to-code#:~:text=While%20codes%20do%20vary%20by,%3B%20deck%20boards%3B%20and%20handrails.>

Accessibility Legislation

- U.S. American Disabilities Act, 1990
- Ontario, 2005
- Manitoba, 2013
- Nova Scotia, 2017
- Federal Bill C-81 (Accessible Canada Act), 2019
- British Columbia, 2021
- <https://www.csagroup.org/article/research/a-canadian-roadmap-for-accessibility-standards/>

Funding for Home Modification Programs (Advocacy Foci for CARP's Ottawa Chapter)

- **Accessible Home Renovation Tax Credits & Grants**

- Federal tax credit for those with disabilities <https://www.buildable.ca/post/tax-credits-grants-to-help-with-your-renovation>

- **Ontario Home Renovates Program**

- <https://dnssab.ca/housing-services/programs/ontario-renovates-program/>
- provides up to \$25,000 in forgivable loan assistance to low and moderate income households to assist them in performing eligible major repairs, renovations and accessibility modifications to their homes. This program exclusively serves homeowners.
- Provides limited funding to landlords who are looking to modify their existing unit(s) or building(s) to comply with the [Accessibility for Ontarians with Disabilities Act of 2005](#).

- **Veterans Affairs**

- <https://www.veterans.gc.ca/eng/services/after-injury/disability-benefits/disability-pension>

- **March of Dimes:**

- <https://www.marchofdimes.ca/en-ca/programs/am/adp/Pages/Assistive-Devices-Apply.aspx>

Funding for Home Modifications

- See Parachute website for list of province- and territory-specific home modification programs:
- <https://www.parachute.ca/en/program/for-seniors-by-seniors-community-conversations/>

The screenshot shows a web browser displaying the Parachute website. The address bar shows the URL: [parachute.ca/en/program/for-seniors-by-seniors-community-conversations/](https://www.parachute.ca/en/program/for-seniors-by-seniors-community-conversations/). The page content is divided into a left sidebar and a main content area.

Left Sidebar:

- For Seniors, By Seniors: Community Conversations** (with a 88 icon)
- What aging in place means
- Barriers to aging in place
- Project partners
- Resources** (with a 10 icon)

Main Content Area:

INFORMATION AND MEETING SUMMARIES

Discussion Summary for Community Conversations: Challenges of aging in place healthily and independently (2023-02-02)	WORD ↓	+
Information Package for Community Conversation: Supports and services to age in place (2022-11-23)	WORD ↓	+
Discussion Summary for Community Conversation: Supports and services to age in place (2022-11-23)	WORD ↓	+
Information Package for Community Conversation: Getting and Staying Active (2022-10-19)	WORD ↓	+
Discussion Summary for Community Conversation: Getting and Staying Active (2022-10-19)	WORD ↓	+
Information Package for Community Conversation: Home (2022-09-21)	WORD ↓	+

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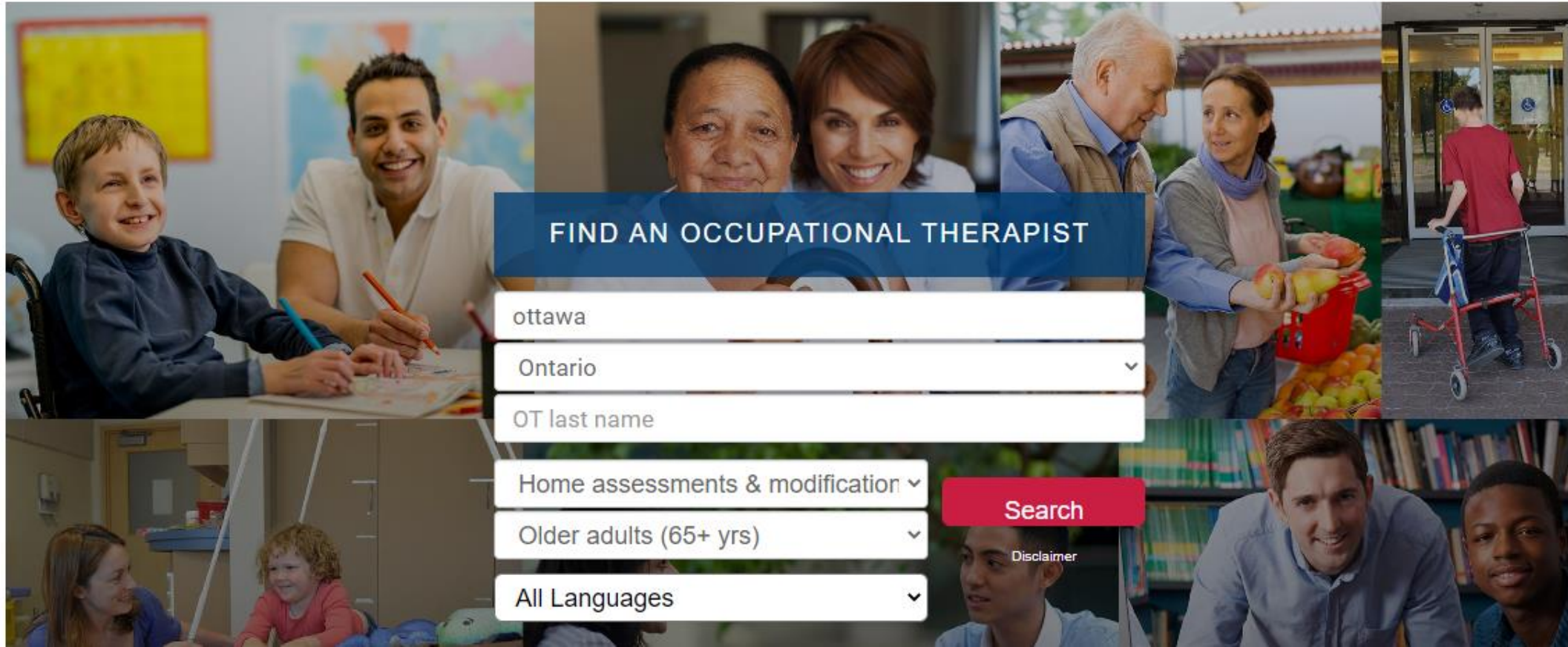
Key Questions to Ask a Renovator/Contractor to Assess Their Know-How

- What specific changes would you recommend to reduce the risk of falls?
- Do you build to accessibility rather than minimum code standards?
- What is the cost of making accessibility changes now, versus the cost of making the changes later (e.g. grab bars in bathtubs and showers)?
- Is an occupational therapist a member of your team?
- Is a building permit required (yes, for all structural changes)?

If you have special needs or you are planning a major bathroom renovation consider a contractor who specializes in renovations for more accessible housing

Finding an occupational therapist

caot.ca/site/findot



FIND AN OCCUPATIONAL THERAPIST

ottawa

Ontario

OT last name

Home assessments & modification

Older adults (65+ yrs)

All Languages

Search

Disclaimer

Key Messages

- Many falls are preventable
- Modifications to your built environment (e.g. stairs, bathrooms) can reduce your risk of serious falls and injuries
- There are resources available to help
- Safer stairs and safer bathrooms are better for everyone
- Advocacy is needed for further improvements to the built environment
- The time is now!

Links to other resources

- CCBFC Policy Position Paper on Accessibility in Buildings
https://nrc.canada.ca/sites/default/files/2021-07/ccbfc_policy_position_paper_on_accessibility_in_buildings.pdf
- <https://parachute.ca/en/injury-topic/fall-prevention-for-seniors/>
- <https://www.youtube.com/watch?v=wED1l1Vilho>

If you'd like more information about CARP's Ottawa Chapter fall prevention advocacy efforts please send a request to nedwards@uottawa.ca

Please use "Falls Prevention" in subject heading.

For photos of safe/unsafe stairs and bathtubs see:
Instagram: nancyedwardsauthor