A Citizen Science Approach to Decrease Residence-Based Fall-Related Injuries

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Disclosure Statement

We have no affiliation (financial or otherwise) with a pharmaceutical, medical device or communications organization.

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The Problem

- Falls (across all age groups) contribute substantially to health care and social costs ($4.5 billion in Canada in 2010)[1]

- Indoor and outdoor stairs are common locations for falls - account for a higher proportion of injurious falls than falls in other locations

- 10.1% of falls across all age groups were on stairs[2]

- Policy changes (e.g. amending building codes and accessibility legislation) are needed to improve the built environment to reduce the risk of falls.

- There is an absence of consumer awareness about this situation and the role they can play to advocate for improved built environment codes.

1. Parachute. (2015). The cost of injury in Canada.
2. 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.

Source: 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.

Table 3 Leading products by age group, ranked by non-fatal injury cost, USA, 2009–2010

Rank	<1	1–4	5–9	10–14	15–19	20–24	25–29	30–39	40–49	50–59	60–69	70–79	≥80	All ages
1	Beds and bedding	Beds and bedding	Bicycles	Football	Football	Stairs	Stairs	Stairs	Stairs	Stairs	Stairs	Floors	Floors	Stairs
	22.2%	9.1%	7.7%	14.3%	12.8%	9.8%	11.1%	12.9%	14.1%	14.5%	14.5%	21.8%	28.7%	10.1%
2	Floors	Floors	Monkey bars	Bicycles	Basketball	Basketball	Basketball	Floors	Floors	Floors	Floors	Stairs	Beds and bedding	Floors
	13.8%	7.2%	6.8%	8.4%	11.3%	6.8%	4.4%	5.0%	6.6%	9.8%	13.8%	12.4%	11.9%	8.9%
3	Sofas	Stairs	Beds and bedding	Basketball	Bicycles	Bicycles	Floors	Bicycles	Bicycles	Bicycles	Beds and bedding	Beds and bedding	Stairs	Beds and bedding
	6.6%	7.1%	4.6%	8.3%	4.8%	4.6%	4.4%	4.0%	5.0%	5.2%	5.7%	8.1%	8.5%	4.9%
4	Stairs	Tables	Floors	Soccer	Soccer	Football	Bicycles	Basketball	Ladders	Ladders	Ladders	Chairs	Chairs	Bicycles
	6.0%	5.1%	4.0%	4.9%	4.7%	3.7%	4.3%	2.8%	3.6%	4.3%	4.5%	5.0%	5.9%	4.3%
5	Car seats	Chairs	Football	Baseball /softball	Stairs	Floors	ATVs	Ladders	Beds and bedding	Beds and bedding	Chairs	Bathtubs /showers	Crutches /canes /walkers	Football
	5.1%	4.6%	3.4%	4.7%	4.5%	3.4%	2.9%	2.7%	3.4%	4.1%	3.6%	3.6%	5.7%	3.0%
6	Tables	Sofas	Trampolines	Skateboards	Baseball /softball	ATVs	Football	Beds and bedding	Bathtubs /showers	Bathtubs /showers	Bicycles	Crutches /canes /walkers	Wheelchairs	Basketball
	3.2%	4.0%	3.4%	3.9%	4.1%	3.2%	2.7%	2.7%	2.8%	3.2%	3.5%	3.3%	5.0%	2.8%
7	Chairs	Drugs and medications	Stairs	Stairs	Skateboards	Ceilings and walls	Exercise	Exercise	Exercise	Exercise	Bathtubs /showers	Wheelchairs	Bathtubs /showers	Chairs
	2.8%	3.7%	3.1%	3.0%	3.2%	2.8%	2.6%	2.7%	2.7%	2.7%	3.3%	3.0%	3.1%	2.5%
8	Baby strollers	Doors	Doors	Floors	Ceilings and walls	Exercise	Baseball /softball	Furniture, NS	Furniture, NS	Chairs	Wheelchairs	Ladders	Toilets	Bathtubs /showers
	2.4%	3.7%	2.8%	2.1%	2.5%	2.5%	2.6%	2.4%	2.3%	2.4%	2.2%	2.6%	2.6%	2.2%
9	Cribs	Ceilings and walls	Swings/ swing sets	Sports and rec, NEC	Floors	Baseball /softball	Beds and bedding	ATVs	Containers, NS	Containers, NS	Exercise	Toilets	Rugs/ carpets	Ladders
	2.2%	2.3%	2.8%	2.0%	2.1%	2.2%	2.5%	2.3%	2.1%	1.6%	2.0%	1.9%	2.6%	2.1%
10	Shopping carts	Shopping carts	Slides	Trampolines	ATVs	Beds and bedding	Ceilings and walls	Bathtubs /showers	Chairs	Wheel-chairs	Toilets	Rugs/ carpets	Tables	Exercise
	1.9%	1.9%	2.5%	1.9%	2.0%	2.2%	2.3%	2.3%	1.9%	1.5%	1.5%	1.9%	1.9%	1.8%
11	High chairs	First aid equipment	Baseball /softball	Ceilings and walls	Wrestling	Soccer	Bathtubs /showers	Baseball /softball	ATVs	Porches/ balconies	Doors	Doors	Doors	Doors
	1.8%	1.8%	2.2%	1.7%	1.9%	2.1%	2.0%	2.0%	1.7%	1.5%	1.5%	1.5%	1.5%	1.7%
12	Baby bouncer seats	Bicycles	Scooters	Skating	Dirt/trail bikes	Doors	Knives	Containers, NS	Porches/ balconies	Horseback riding	Porches/ balconies	Tables	Ceilings and walls	Ceilings and walls
	1.6%	1.8%	1.9%	1.7%	1.7%	2.1%	1.9%	1.8%	1.5%	1.4%	1.4%	1.5%	1.4%	1.7%

ATVs, all-terrain vehicles; NEC, Not elsewhere classified; NS, Not specified.

Why a Citizen Science Approach?

- Gaps in injury surveillance data
- Inability to link stair falls to specific structural features (e.g. handrail height, rise and tread dimensions)

Citizen Science: Definition & History

- Allowing citizens to participate in scientific research process through the use of public engagement and outreach strategies to assist in data collection[3]

- Earliest uses in ornithology by bird watchers assisting scientists in counting birds during migration in the US[4]

- Other early citizen initiatives took place in the fields of astronomy[5] and lepidopterology (study of moths and butterflies)[6]

3. Riesch, H., & Potter, C. (2014). Citizen science as seen by scientists: Methodological, epistemological and ethical dimensions. *Public Understanding of Science*, *23*(1), 107-120.

4. Silvertown, J. (2009). A new dawn for citizen science. *Trends in Ecology & Evolution*, *24*(9), 467-471.

5. Mims, F. M. (1999). Amateur science--Strong tradition, bright future. *Science*, *284*(5411), 55-56.

6. http://www.ukbms.org/

Examples of Citizen Science in Public Health

- Air quality monitoring[7]
- Cycling safety[8]
- Neighbourhood features that promote or hinder health[9]
- Identification of disease carrying insects[10]
- Mapping influenza-like-illness[11]

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8. Ferster, C. J., Nelson, T., Winters, M., & Laberee, K. (2017). Geographic age and gender representation in volunteered cycling safety data: A case study of BikeMaps. org. *Applied geography*, *88*, 144-150.
9. Den Broeder, L., Lemmens, L., Uysal, S., Kauw, K., Weekenborg, J., Schönenberger, M., ... & El Baouchi, S. (2017). Public health citizen science; perceived impacts on citizen scientists: a case study in a low-income neighbourhood in the Netherlands. *Citizen Science: Theory and Practice 2017; 2 (1): 7*.
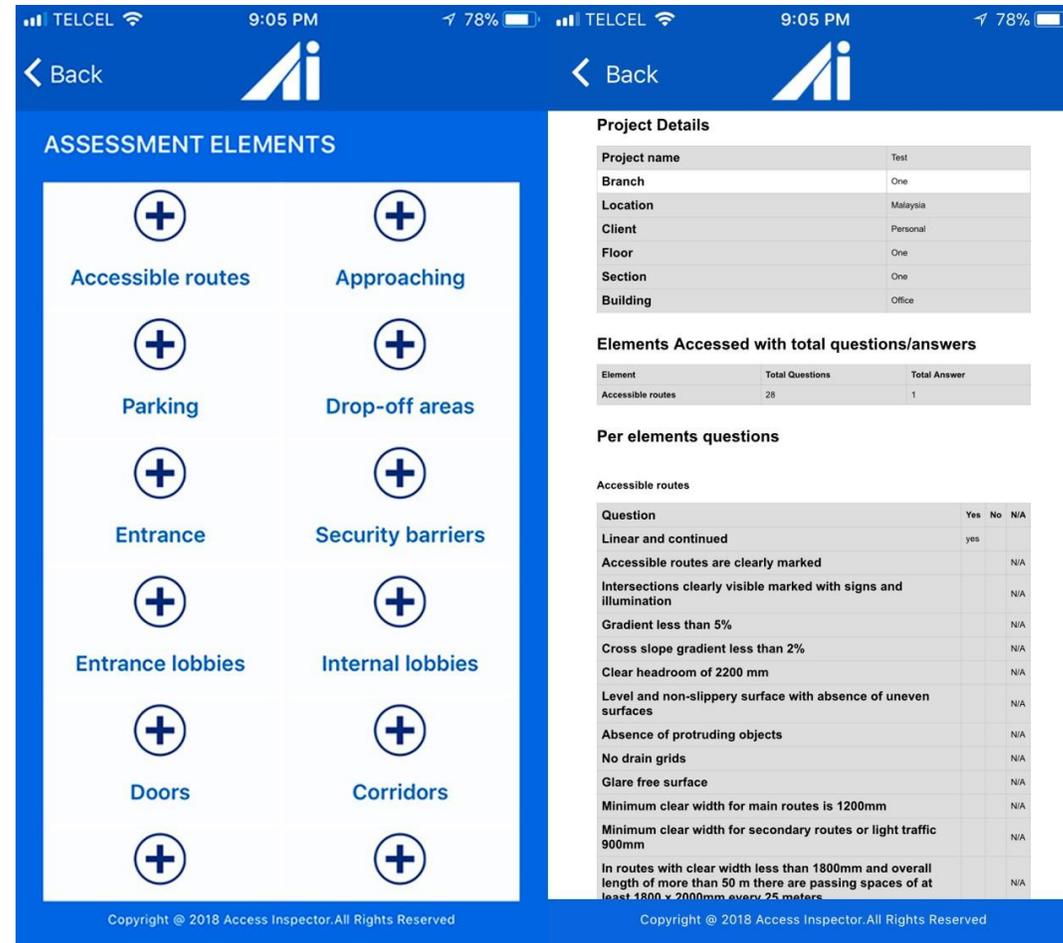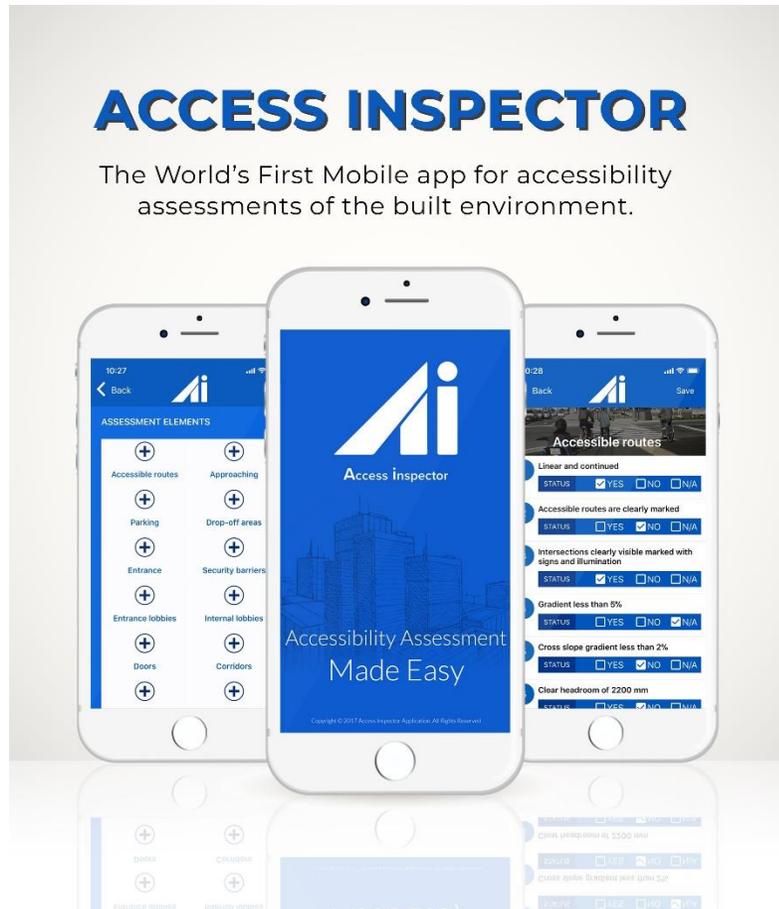10. Munoz, J. P., Boger, R., Dexter, S., Low, R., & Li, J. (2018). Image Recognition of Disease-Carrying Insects: A System for Combating Infectious Diseases Using Image Classification Techniques and Citizen Science.
11. Zych, A. (2018) Help SciFri track the 'flu' near you. https://www.sciencefriday.com/articles/help-scifri-track-the-flu-near-you/

A Citizen Science Approach to Stair Falls

Objectives:

- Link falls and injuries to building characteristics

- Increase consumer awareness about scale and importance of residential-based falls-related injuries, prevention strategies

- Promote consumer demand for safer stairs

- Create/support citizen-driven advocacy to builders and building product manufacturers to offer safe stair options in new residential units (houses, condos, apartments, seniors' residences)

Safer House / Maison sécuritaire

Features of App (under development)

- Demographics of user
- Fall events and injuries
- Characteristics of stairs
  - # of steps and their shape + dimensions (top-of-flight flaw)
  - Handrails: present/absent, graspability, diameter/shape, continuity
- Psychosocial measures e.g. confidence in using stairs, fear of falling
- GIS-linked (location, age of house, stair characteristics, etc.)
- Checklist for consumers to assess safety of indoor and outdoor stairs
- Interactive website interface will show assessment results for indoor and outdoor stairs as data are entered
- Tips to improve stair safety (e.g., top-of-flight fault, handrails) – based on responses to checklist
- Bilingual

Additional Information

- Target users: all age groups
- Target locations: indoor & outdoor stairs and steps in both private homes as well as in public buildings
- Users will have option to create an account using an e-mail or receive immediate feedback based on the images or information they entered about stairs
  - No other personally identifiable information will be collected or linked to user e-mails
- Data to be housed at CPHA

Next steps

- App development (October 2019)
- Translation into French (October 2019)
- Pilot testing (November/December 2019)
- Evaluate results (January/February 2020)
- Explore potential utility to other code-related issues (continuous)
- Re-engineering, scale-up and roll-out (Spring 2020)

Discussion Questions

- What do you think of this idea?

- Is there anything missing from the app?

- Would you like to be involved?

- Do you have any suggestions for other potential organizations we could partner with?

THANK YOU

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