

# AFTER THE FLOOD:

## THE IMPACT OF CLIMATE CHANGE ON MENTAL HEALTH AND LOST TIME FROM WORK



FLOOD VICTIM FROM AUGUST 2014 FLOOD IN BURLINGTON, ON  
(SOURCE: ROBERT DEEKS)

DANA DECENT AND DR. BLAIR FELTMATE | INTACT CENTRE ON CLIMATE ADAPTATION | JUNE 2018

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## EXECUTIVE SUMMARY

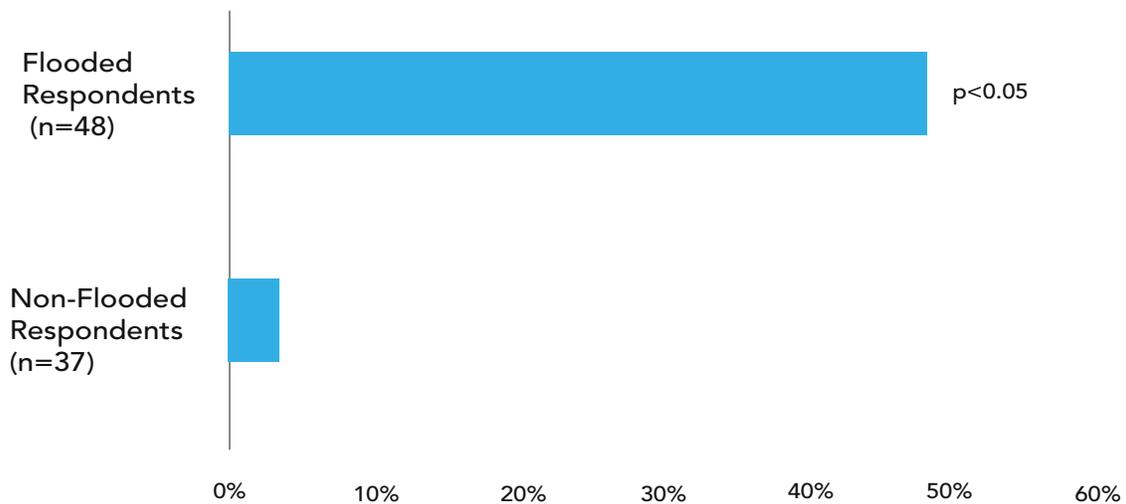
Climate change is one of the most pressing issues facing Canadians today, increasing the frequency and severity of extreme weather events across the country (Insurance Bureau of Canada, 2016). Flooding, exacerbated by built infrastructure failures and loss of natural infrastructure, is the costliest of these extreme weather events in terms of Property and Casualty insurable losses, and its impact has been well-documented from this perspective. Conversely, there has been no similar level of examination regarding how residential basement flooding might impact areas of interest to Life, Health and Disability insurers, such as mental and physical health impacts, and lost time from work. International studies have suggested there may be substantial impacts, but the full extent of these impacts and their financial costs in Canada has been subject to limited research to date.

The Intact Centre on Climate Adaptation (Intact Centre) sought to address this omission, based on 100 interviews with households that experienced basement flooding and non-flooded control households that were in close proximity to one another (i.e., less than one km separation). The geographic area of focus was Burlington, Ontario, which in August of 2014 experienced atypical and severe precipitation (196 mm over seven hours), that resulted in 3,500 homes flooded (Halton Conservation, 2015).

For households that experienced basement flooding, the study indicated the following statistically significant findings:

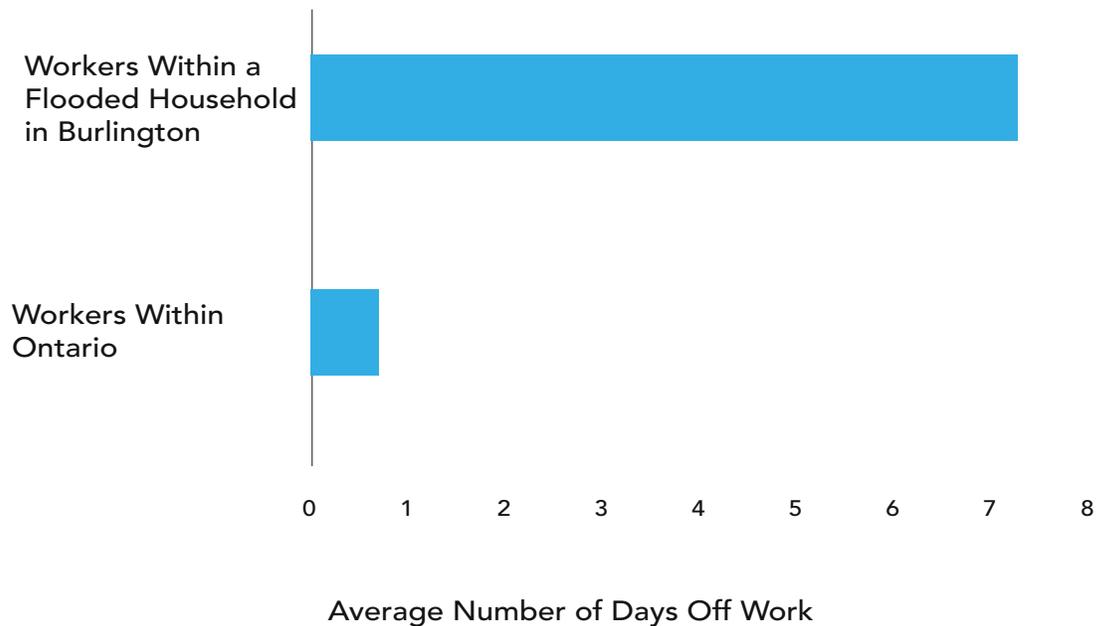
- **Flooded household members experienced significantly higher worry and stress.** Within the first 30 days of experiencing a flood, 47% of flooded household members were worried and stressed, compared to 11% of those who had never been flooded.
- **Flooded household members were still worried years after a flood event.** Three years after their home was flooded, almost half (48%) of respondents from flooded households were very worried when it rained, compared to 3% of respondents from non-flooded households (Figure 1).
- **Flooded household members were forced to take days off work due to flooding.** Over half (56%) of flooded households with at least one working member took time off work. The average was seven days per flooded household (which was 10X the Ontario average for non-flooded households) (Figure 2).

Figure 1: Responses from Flooded and Non-Flooded Households ~ Three Years After Flooding in Reference to *How Worried They Are When it Rains*



% of Household Respondents Who Gave a Four or Five on a Scale of One to Five (One= not worried, Five= very worried)

Figure 2: Average Number of Days Off Work Per Worker for One Month in 2014



Physical health impacts (e.g., exacerbated asthma rates) were not statistically different in homes that experienced flooding vs. those that were not flooded.

There are two critical implications from this study. First, the findings of significant worry and stress for flooded household members indicate that home flood risk bears relevance not only to Property and Casualty insurance, but also to Life, Health and Disability insurance. Additional research is needed in this area to further explore mental health needs associated with severe weather events in Canada (including lost productivity) and its impact on Canadian employers.

Second, without action to reduce this flood risk, the mental health impacts profiled above are likely to worsen as flooding increases in frequency and severity across the country. Action must be taken at both an individual level and a national level. At an individual level, homeowners can become prepared and avoid the worry and stress of residential basement flooding by:

- Talking to their insurance provider to understand their property and casualty insurance coverage,
- Ensuring they are financially prepared for emergencies, and
- Taking action to protect their home in the event of a flood (e.g. disconnecting downspouts, fixing cracks in the foundation, and installing window wells). For a complete list of actions to take, visit: [https://www.intactcentre-climateadaptation.ca/programs/home\\_flood\\_protect/resources/](https://www.intactcentre-climateadaptation.ca/programs/home_flood_protect/resources/).

At a national level, it is recommended that in order to avoid rising financial costs and significant worry and stress for homeowners, the following existing efforts must continue with haste:

- Developing and adopting national Standards to limit household and community flood risk,
- Updating flood risk maps for Canadian communities, and
- Training and certifying home inspectors across Canada on the subject of home flood risk assessments (i.e., currently, home inspectors in Canada receive virtually no home flood risk assessment training).

This study demonstrates that residential basement flooding has a significant impact on the mental health, and lost time from work, of impacted homeowners. Thus, the need to put measures in place to limit residential basement flood risk in Canada and address this 'adaptation gap' cannot be overstated. The challenge for Canadian communities and homeowners is not whether to limit basement flood risk, but rather how quickly.

## 1. INTRODUCTION

**“Canadians must become better prepared for severe weather conditions as our climate continues to change”**

– Government of Canada (2017)

The costs of residential basement flooding are increasing across Canada. To date, the financial implications have been considered primarily from the perspective of Property and Casualty insurable losses. This report considers the financial implications from a new perspective – mental and physical health impacts, and lost time from work.

More specifically, the purpose of this report is to:

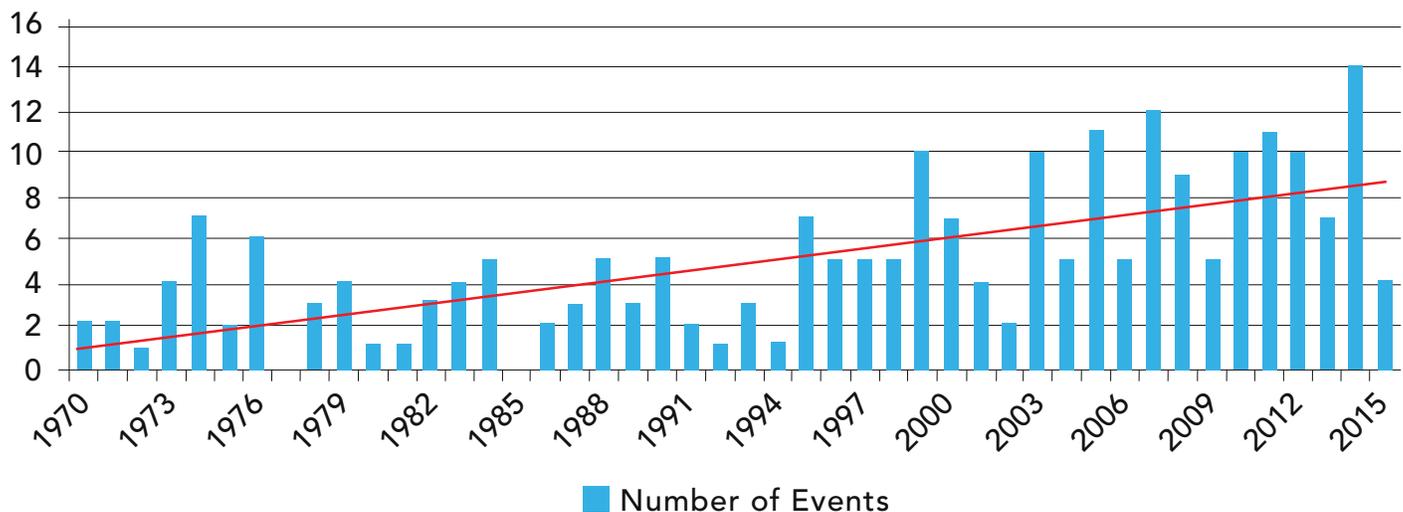
- Identify mental and physical health impacts from residential basement flooding in Canada,
- Identify associated financial costs of the above (i.e., days off work, visits to health services, and elevated use of medication), and
- Demonstrate the importance of reducing the risk of basement flooding to mitigate health impacts and their financial costs.

Section 1 describes the context for this research, including rising financial costs associated with extreme weather events (e.g. flooding), and the global health impacts that can arise from flooding. Section 2 profiles the study method, Section 3 presents results, and Section 4 discusses the results and next steps.

### 1.1. RISING COSTS OF EXTREME WEATHER

Extreme weather events in Canada are increasing in frequency and severity, and this trend is likely to continue with climate change (Insurance Bureau of Canada, 2016). These events are increasing costs for governments and, by extension, for all Canadians. From 2009 to 2015, federal expenditures on the Disaster Financial Assistance Arrangements (DFAA) program were more than in the previous 39 fiscal years combined (see Figure 3 below), with the majority spent on weather-related expenditures (Auditor General of Canada, 2016).

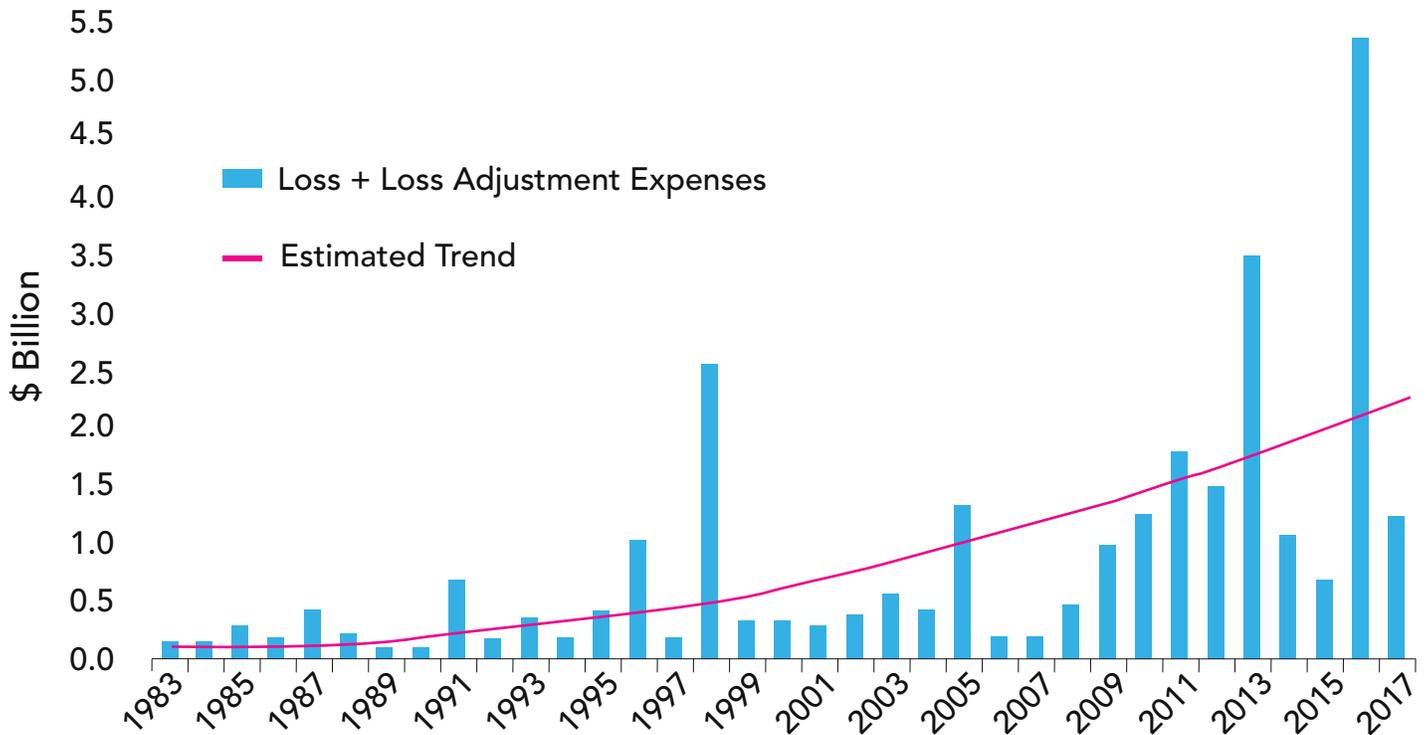
**Figure 3: Number of Natural Disasters in Canada Requiring Disaster Financial Assistance Arrangements for Provinces and Territories (1970 to 2015)**



Source: Public Safety Canada, 2016-2017 Evaluation of the Disaster Financial Assistance Arrangements.

This rising cost of extreme weather events – combined with factors such as failures in built infrastructure and loss of natural infrastructure – is reflected in rising property and casualty insurance costs in Canada. Data from the Insurance Bureau of Canada demonstrates that “property and casualty insurance payouts from extreme weather have more than doubled every five to 10 years since the 1980s” (Insurance Bureau of Canada, 2016). While insurable payouts averaged \$400 million per year over the period of 1980 to 2008, for the last eight out of nine years leading up to 2017, extreme insurance payouts exceeded \$1 billion in Canada (Figure 4).

Figure 4: Catastrophic Insured Losses\* from Natural Disasters in Canada (1983-2017) (Values in 2017 CAN\$)



\*Insured losses for a given disaster are deemed catastrophic when they total \$25 million or more. Catastrophic losses for a year are the sum total of insured losses from these natural disasters.

Source: Insurance Bureau of Canada (January 2018), PCS, CatIQ, Swiss Re, Munich Re & Deloitte

The financial costs of extreme weather events can also be measured by impact on hours worked. For example, the 2013 Alberta floods led to a net loss of 5.1 million hours worked (Statistics Canada, 2013).<sup>1</sup>

Of all extreme weather impacts, flooding in Canada has become one of the costliest, as measured by the following:

- Fifty-eight percent of catastrophic insurable loss claims between 2008 and 2015 were due to water damage (Insurance Bureau of Canada, 2017, personal communication),
- Between 2005 and 2014, 82% of DFAA payments went to Manitoba, Saskatchewan, and Alberta, mostly due to flood events (Office of the Parliamentary Budget Officer, 2016), and
- Seventy-five percent of estimated DFAA payments (\$673 million out of \$902 million) in the next several years will be due to flooding (ibid).

The rising cost of flooding poses significant financial challenges to homeowners. While the Insurance Bureau of Canada estimates that 1.7 million Canadian households (19% of Canada’s population) are at risk of riverine and overland flooding<sup>2</sup> (Canadian Underwriter, 2017), microbursts (a sudden localized rainstorm of extreme rainfall) can cause high amounts of rainfall to occur in areas not previously designated as at risk of flooding. The average cost of a flooded basement in Canada is approximately \$40,000 (Insurance Bureau of Canada, personal communication, 2017), and yet, almost half of Canadians live paycheck to paycheck unable to “scrape together \$2,000 if an emergency arose next month” (Canadian Payroll Association, 2016). Homeowners, if they are not insured due to high risk of flooding, may be unable to afford refurbishing their flooded basements, and in turn, may default on paying the mortgage on their largest asset – their home.

<sup>1</sup> 300,000 Albertans (13.5% of the working population) lost 7.5 million hours of work, and 134,000 people (6% of the working population) put in 2.4 million additional hours of work.

<sup>2</sup> Riverine flooding is an “excess of stream flow in a watercourse, such that land outside the normal banks is submerged or inundated” while overland flooding is “flooding that occurs when runoff water flows from the streets onto properties causing flood damages.”(Moudrak & Feltmate, 2017, p. vii).



## 1.2 RISING COSTS OF HEALTH IMPACTS

While these financial costs are substantial, there is an additional perspective for consideration – the financial implications of physical and mental health impacts associated with residential basement flooding. Global refereed literature has identified considerable physical and mental health impacts associated with all types of flooding.<sup>3</sup> These impacts range from physical health impacts (e.g. sleeping difficulties, breathing difficulties, and stomach cramps) to mental health impacts (e.g. general worry and stress, anxiety, depression and Post-Traumatic Stress Disorder). However, the full extent of these impacts and their financial costs in Canada has been subject to limited research.

This perspective on health may impact Life, Health and Disability insurance in Canada. In 2015, the industry paid over \$32.2 billion in health benefits, including benefits for medication(s) and visits to health services (doctors, hospitals, and therapists and counsellors) (Canadian Life and Health Insurance Association, 2016). If there are health impacts being realized in Canada associated with residential basement flooding, these costs could reasonably be expected to increase.

In addition, this new perspective has implications for employers whose employees directly experience a flood. Employees may take days off work and may still be worried and distracted when they return to work, due to lingering financial impacts and stress resulting from the flood event, or from the expectation that flooding may repeat itself.

In summary, there may be significant financial implications of health impacts resulting from residential basement flooding in Canada that, until this study, have been superficially explored. This study sets the foundation for more in-depth work in this area.

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<sup>3</sup> This includes fluvial, pluvial and coastal flooding.

## 2.0 METHODS

Researchers quantified the health impacts associated with residential basement flooding by conducting in-person, door-to-door interviews in Burlington, Ontario, in 2017. The City of Burlington was chosen due to the following reasons:

- Burlington experienced severe flooding when two months' worth of rain (196 mm) fell in seven hours on August 4th, 2014, when over 3,500 homes were flooded (Halton Conservation, 2015),
- Three years was sufficient time for some long-term mental health impacts to manifest themselves (Sahni *et al.*, 2016), and
- Three years was within a timeframe where respondents would be able to remember many immediate impacts (Tunstall *et al.*, 2006).

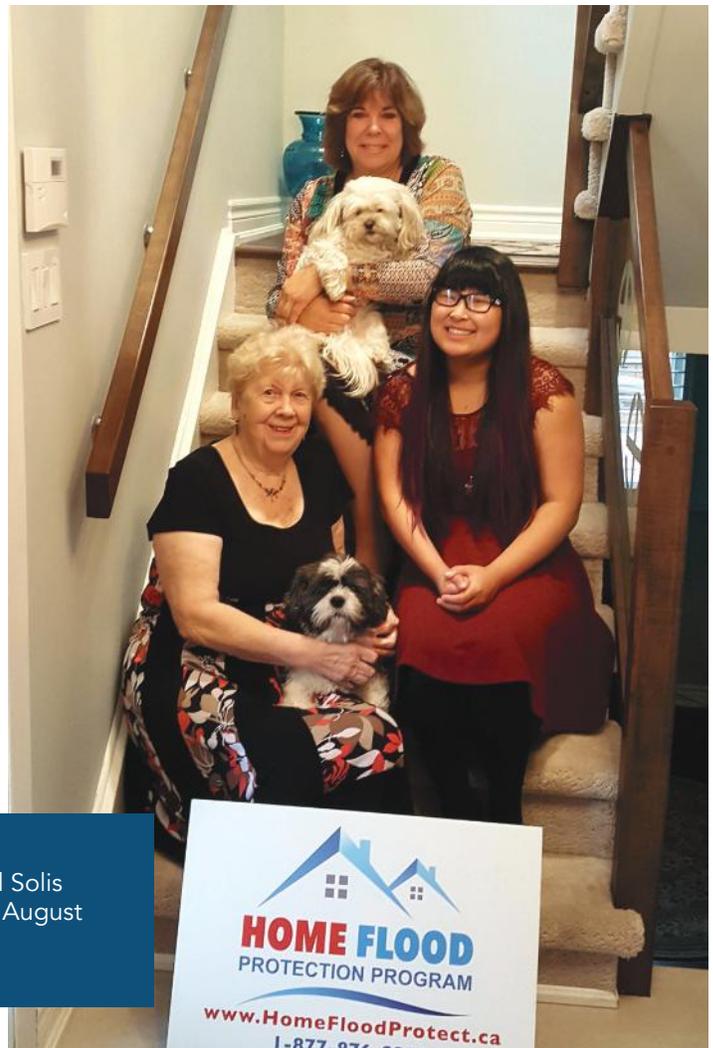
Researchers designed interview questions based on an examination of mental and physical health impacts from flooding identified in refereed and grey literature (see Appendix A for questions for flooded households, and Appendix B for questions for the non-flooded households). Researchers test-piloted the questions by interviewing flooded and non-flooded households in March 2017, and integrated households' feedback into the final interview design. To maximize response rates, researchers ensured the interviews could be completed in 10-15 minutes (i.e., a short time period for participants).

Researchers identified flood-impacted neighbourhoods from media articles, input from the City of Burlington, and from local residents who identified locations that experienced flooding. Both flooded households and non-flooded households were in close proximity to one another (i.e., less than one km separation). One person per household acted as the respondent<sup>4</sup> on behalf of the entire household - all respondents were at least 18 years of age. The number of households studied was capped at 100, as the responses of those interviewed showed limited variance beyond this sample size.

During each interview, respondents from flooded households were interviewed in reference to health impacts (sleeping difficulties, new breathing difficulties, stomach cramps, skin rashes, worsening of existing health issues, and worrying and stress) that occurred over two time periods: within the first 30 days of experiencing flooding, and anytime after those first 30 days. Respondents from non-flooded households were interviewed in reference to health impacts that occurred between August 2014 and Spring/Summer 2017, when the interviews were conducted.

Results were analyzed using the Chi-Square test and Fisher's Test to determine whether there were any statistically significant differences between the responses from flooded and non-flooded households. Chi-Square was used in all cases except where the expected value for a specific frequency was lower than five – in those cases, Fisher's Test was used. A two-sample t-test was used to test significance for the question "how worried do you get when it rains, on a scale of 1-5". Statistical significance was considered to occur where  $p < 0.05$  (95% confidence interval).

These results can be reasonably extrapolated to other communities in Canada – the only material difference between the households in this study, and households in the Province of Ontario or Canada (see Appendix C) is the average level of financial affluence (as measured by reported household income, education, and home ownership). Burlington tends to exhibit a higher level of affluence compared to the average Canadian city (Statistics Canada, 2017), thus, the results of this study may be conservative relative to other communities in Canada, where households may have reduced financial resources to cope with the ravages of residential basement flooding.



Residents of Burlington, Ontario (Carol Solis and her family), who lived through the August 2014 flood.

<sup>4</sup> Respondents would occasionally demand a nearby household member to corroborate answers (e.g. water height, or length of time to process a property and casualty insurance claim). However, researchers emphasized that only one household member was to respond directly to the interview.

### 3.0 RESULTS

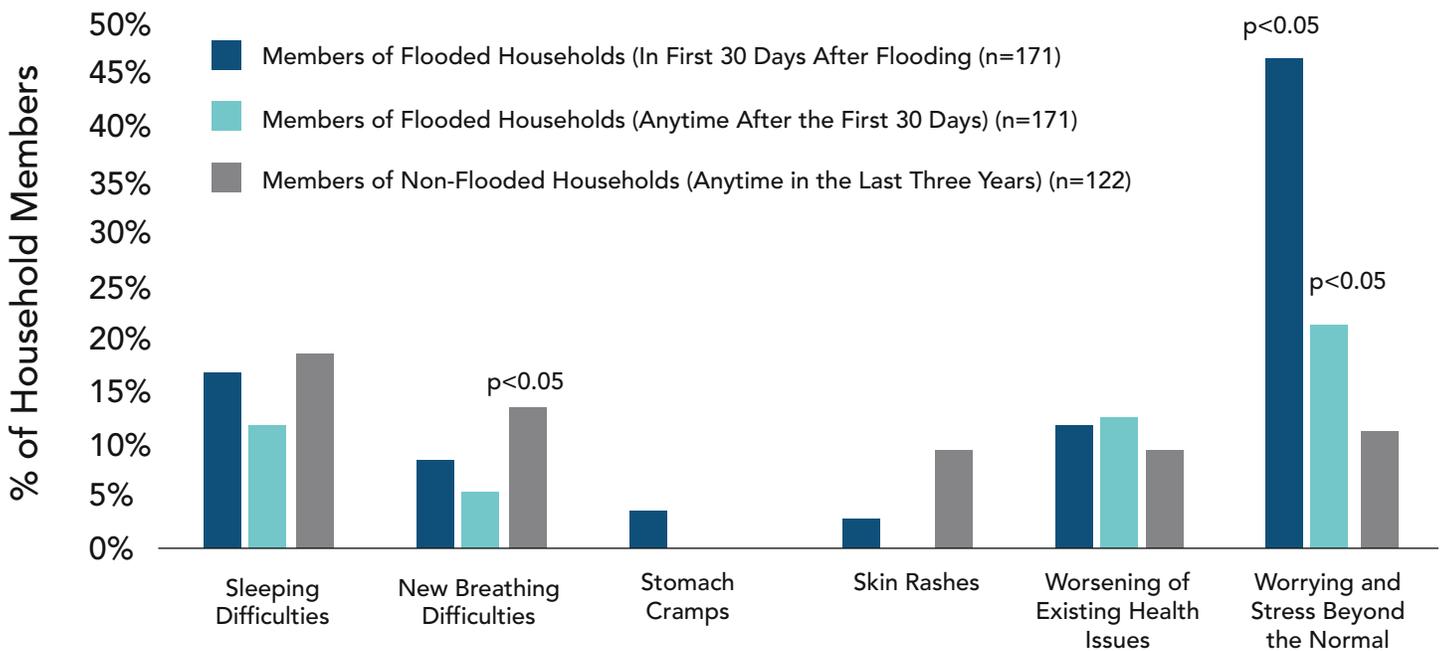
This section profiles findings on health impacts and financial costs among flooded households, as compared to a control group of non-flooded households within close geographic proximity (i.e., less than one km separation).

A total of 100 respondents agreed to participate in the interview, out of 233 potential respondents that were approached (a 43% response rate). Fifty-eight percent of respondents experienced flooding in their homes and 42% were from non-flooded households (the control group). Eighty-six percent of the flooded households had experienced the August 2014 flood – the rest experienced flooding since that event.

Figure 5 demonstrates that worry and stress and breathing difficulties were the only health impacts where there was a statistically significant difference between flooded households and the non-flooded households relative to the assessed measures. Specifically:

- All flooded household members experienced **significantly higher worry and stress in the first 30 days** compared to anytime after. Forty-seven percent of flooded household members experienced worry and stress in the first 30 days, compared to 21% of flooded households after the first 30 days of experiencing flooding.
- All flooded household members experienced **significantly higher worry and stress after the first 30 days compared to the non-flooded households**. Twenty-one percent of flooded households experienced worry and stress compared to 11% of the non-flooded households.
- Members of the non-flooded households experienced **significantly higher breathing difficulties** compared to members of flooded households. Sixteen percent of non-flooded household members had new breathing difficulties, compared to 5% of the flooded household members after the first 30 days of experiencing flooding.

Figure 5: Health Impacts in the First 30 Days After Flooding and Anytime Since (Members from Flooded vs. Non-Flooded Households)



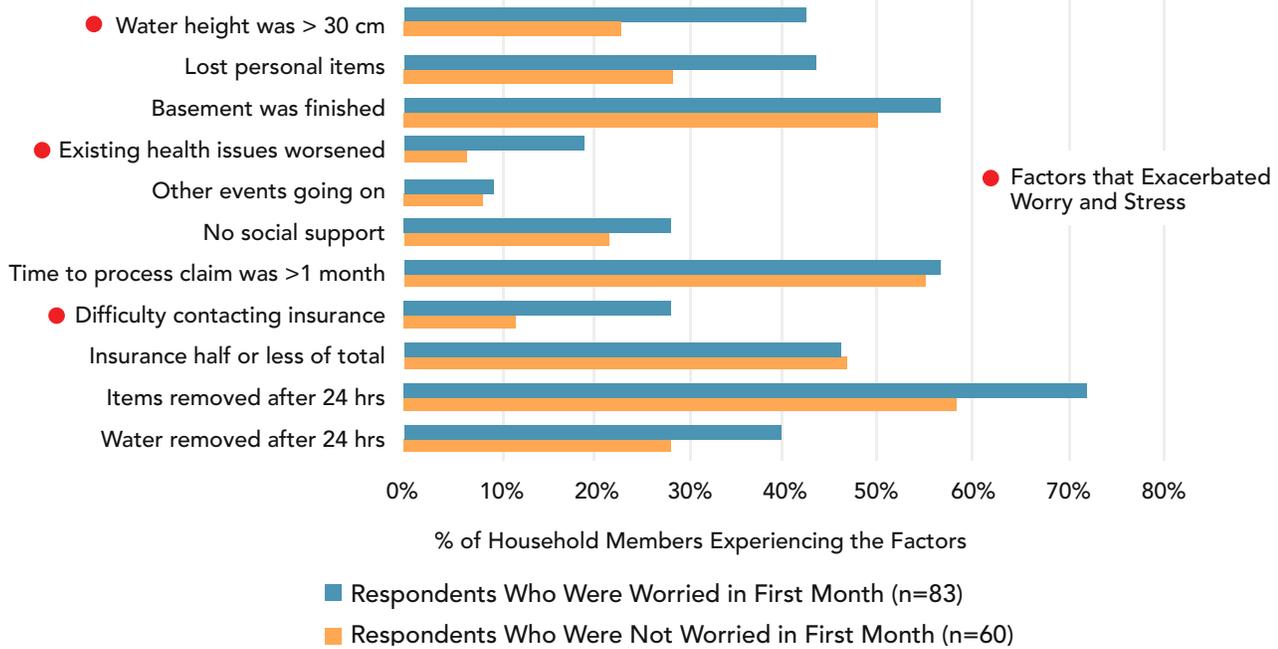
The following quotes from respondents illustrate 'typical' worry and stress expressed in reference to flooding.

- "Oh my God it was stressful" – man aged 25-64
- "Some days I just wanted to run away" – woman aged 25-64
- "It's something you never want to experience again in your life" – man aged 65 or older
- "It's just an awful, awful experience" – woman aged 25-64

Researchers analyzed differences in responses between two sub-groups – flooded household members who expressed worry and stress in the first 30 days after experiencing flooding compared to those that did not – to determine factors (Figure 6) that significantly correlated with worry and stress in the first 30 days.<sup>5</sup> This analysis demonstrated that there were three factors that significantly correlated with worry and stress in the first 30 days:

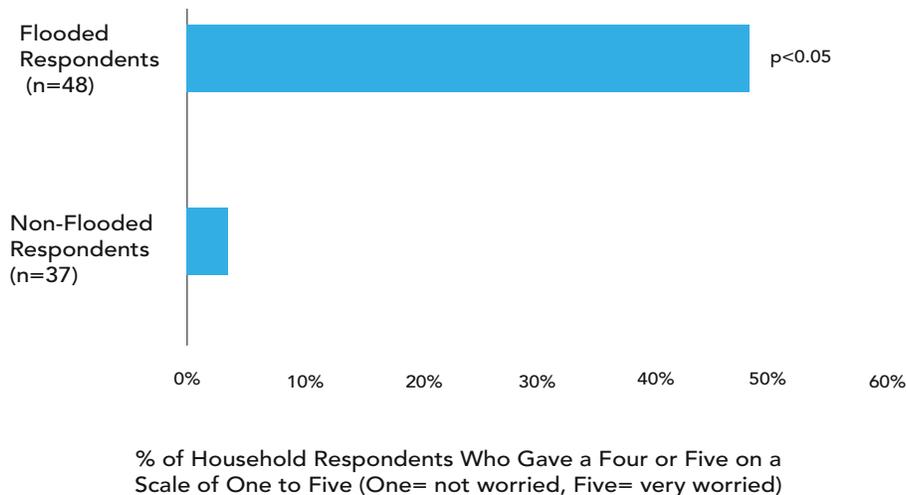
- Water height was 30 cm (one foot) or higher,
- Difficulty contacting an insurance provider, and
- Existing health issues worsened.

Figure 6: Factors Potentially Exacerbating Worry and Stress in the First 30 Days After a Flood in Burlington, ON



For many respondents from flooded households, their worry and stress lingered for a minimum of approximately three years after the floodwaters receded.<sup>6</sup> Researchers interviewed respondents from flooded households who had experienced the August 2014 flood and respondents from non-flooded households, eliciting responses to the question “how worried do you get when it rains, on a scale of one to five” – one was not worried, and five was very worried. Respondents from flooded households were significantly more worried when it rains compared to non-flooded households ( $t(83) = 4.65, p < 0.05$ ) (Figure 7). Forty-eight percent of these respondents from flooded households gave a four or a five, compared to only 3% (one respondent) from a non-flooded household. Significantly more women exhibited worry approximately three years later – 60% of women compared to 39% of men from flooded households. “You have a fear of more rain”, said one woman, “before, I used to like a good thunderstorm, [now] when it rains it makes you more anxious”.

Figure 7: Responses from Flooded and Non-Flooded Households ~ Three Years After Flooding in Reference to How Worried They Are When it Rains

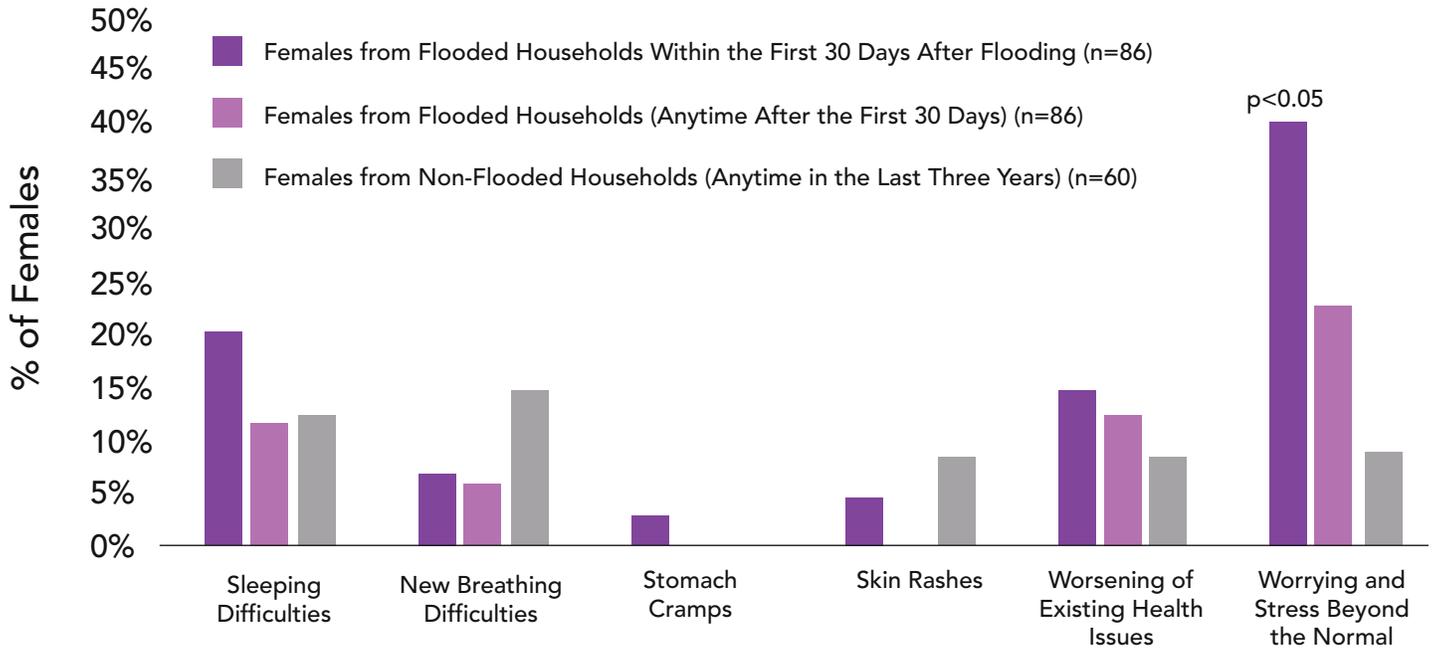


<sup>5</sup> See Appendix D for the list of factors and the rationale behind their inclusion.

<sup>6</sup> As interviews occurred between April and July 2017, the respondents from flooded households would have experienced the August 2014 flood between 2.75 and three years before the interview.

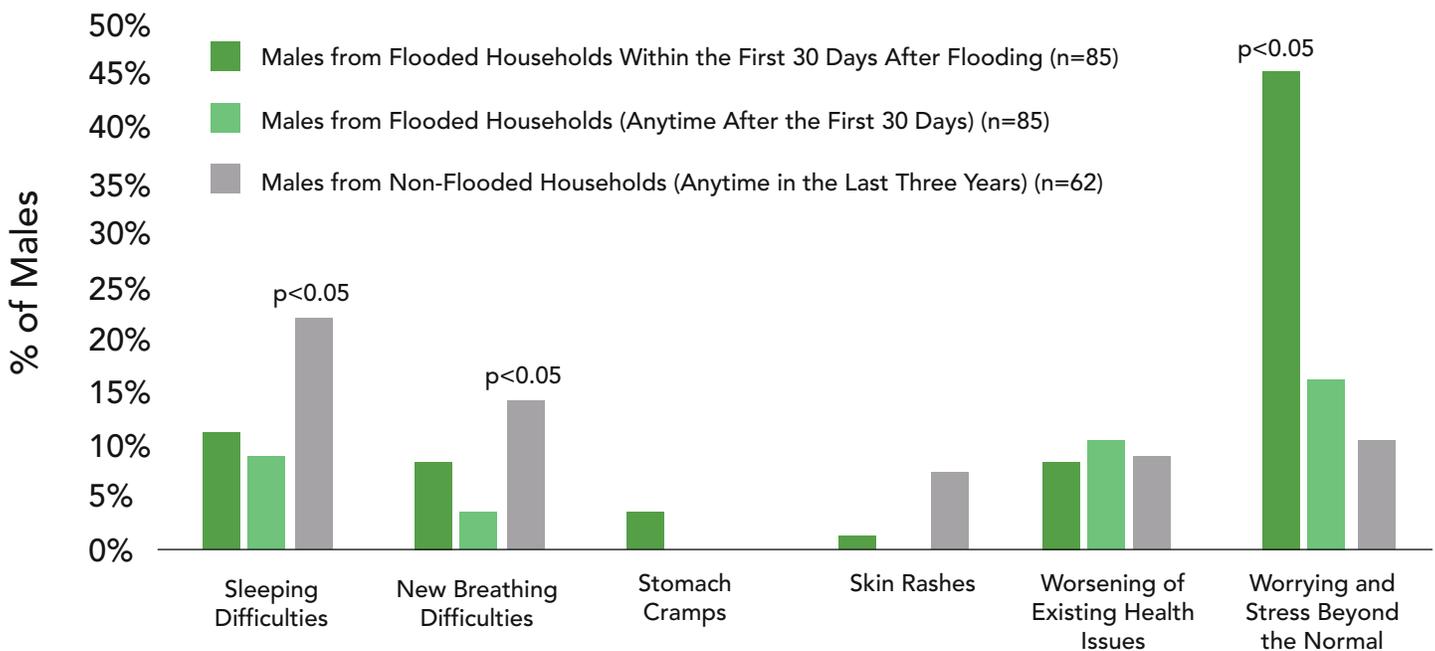
This exhibition of worry and stress is also captured in Figure 8 below. A total of 47% of female flooded household members experienced significantly more worry and stress in the first 30 days of flooding compared to 26% after the first 30 days and compared to 10% of females who had never experienced flooding.

Figure 8: Health Impacts for Females (Flooded and Non-Flooded Households)



As illustrated in Figure 9, males in flooded households exhibited significantly higher worry and stress in the first 30 days after flooding compared to anytime afterwards. Specifically, 47% of males from flooded households in the first 30 days exhibited worry and stress compared to 16% anytime after and compared to 11% from non-flooded households. Males from non-flooded households exhibited greater sleeping difficulties and breathing difficulties.

Figure 9: Health Impacts for Males (Flooded and Non-Flooded Households)



The main difference between age groups is that seniors ( $\geq 65$  years) and adults (25-64 years) who were flooded exhibited significantly higher worry and stress compared to other age groups:

- Seniors ( $\geq 65$  years) who experienced flooding were significantly more worried compared to seniors in the non-flooded households, both in the first 30 days and anytime thereafter. Fifty percent of seniors from flooded households experienced worry and stress in the first 30 days, compared to 31% anytime after. Zero seniors in the non-flooded households exhibited worry and stress.
- Adults (25-64 years) who experienced flooding in the first 30 days were significantly more worried compared to adults in the non-flooded households. Sixty-four percent of adults who experienced flooding were worried in the first 30 days, compared to 30% of adults anytime after and 20% of adults in the non-flooded households.



City of Burlington Mayor Rick Goldring shows Anna Maria Tremonti (Host, CBC The Current) how high the water was in his basement when it flooded in August 2014

Source: City of Burlington

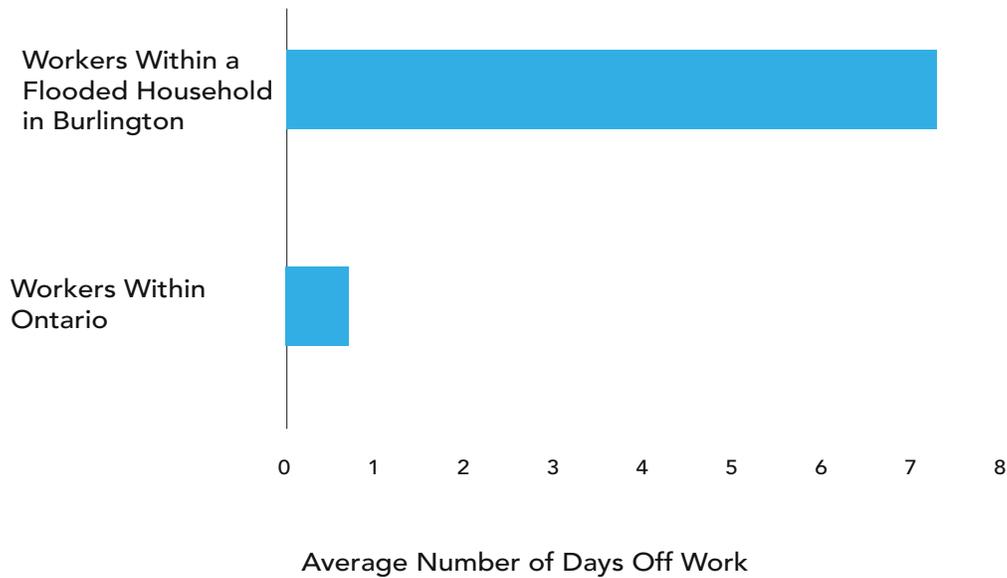


Source: Robert Deeks

## Financial Costs

Out of the flooded households that had at least one working member, **56% took time off work** to clean their basement and/or address health issues immediately following the flood event. On average, the time off work was **seven days**. This is 10 times higher than the average for Ontario in 2014 (Figure 10).

Figure 10: Average Number of Days Off Work Per Worker for One Month in 2014



Purchase of sleeping aids, medication for Post-Traumatic Stress Disorder, as well as payment for visits to a naturopath, a counsellor/therapist, family doctor and a hospital are all financial costs due to health impacts that households attributed to a flood event. Although in most cases, the differences between flooded and non-flooded households for health service visits and medication(s) used were not significant, there were extreme cases from flooded households where these were required.

Out of the flooded households that disclosed to researchers the range of property and casualty insurance coverage they received, almost half (49%) did not have full property and casualty insurance coverage for flood damage<sup>7</sup>. Many respondents shared how this lack of coverage was a source of worry and stress due to financial hardship.

## Community Resilience

Concurrent to the significant worry and stress exhibited by flooded households, researchers also encountered stories of resilience that highlight a community coming together and respondents recognizing their own coping capabilities. For many respondents, social support helped them in a very difficult period. Many residents shared how in response to the flooding, "the support was phenomenal" and "it really was a community that came together". Strangers supported flooded residents by offering to do laundry and by providing meals, and one flooded household organized a community barbeque to raise funds for flood survivors. Respondents also shared how they were glad they "all got to know our neighbours better", and that the flood was a "leveling experience" as neighbours "were all in the same boat". Respondents shared how they have increased empathy with other disaster survivors, and how "we've learned to give back".



Source: Robert Deeks

<sup>7</sup> The rest received full coverage (25%), did not submit claims (14%), were denied coverage (11%), or they did not know the range of coverage received (2%). One household explained they did not submit claims because their damage was small, but other households may simply have not had any insurance as these households did experience property damage.

## 4.0 DISCUSSION

### Mental Health Impacts Due to Residential Basement Flooding

As outlined in Section 3, flooded household members experienced significantly higher worry and stress compared to non-flooded households, both in the first 30 days of experiencing a flood and up to three years afterwards. There were three significant factors that contributed to these elevated levels of worry and stress in the first 30 days: water height in the basement, difficulty liaising with insurance providers, and worsening of existing health issues (Figure 6). Based on in-depth face-to-face interviews with flood survivors, the researchers heard firsthand how losing personal items and a sense of insecurity compounded the stress and worry experienced by flooded households, both in the short-term and long-term.

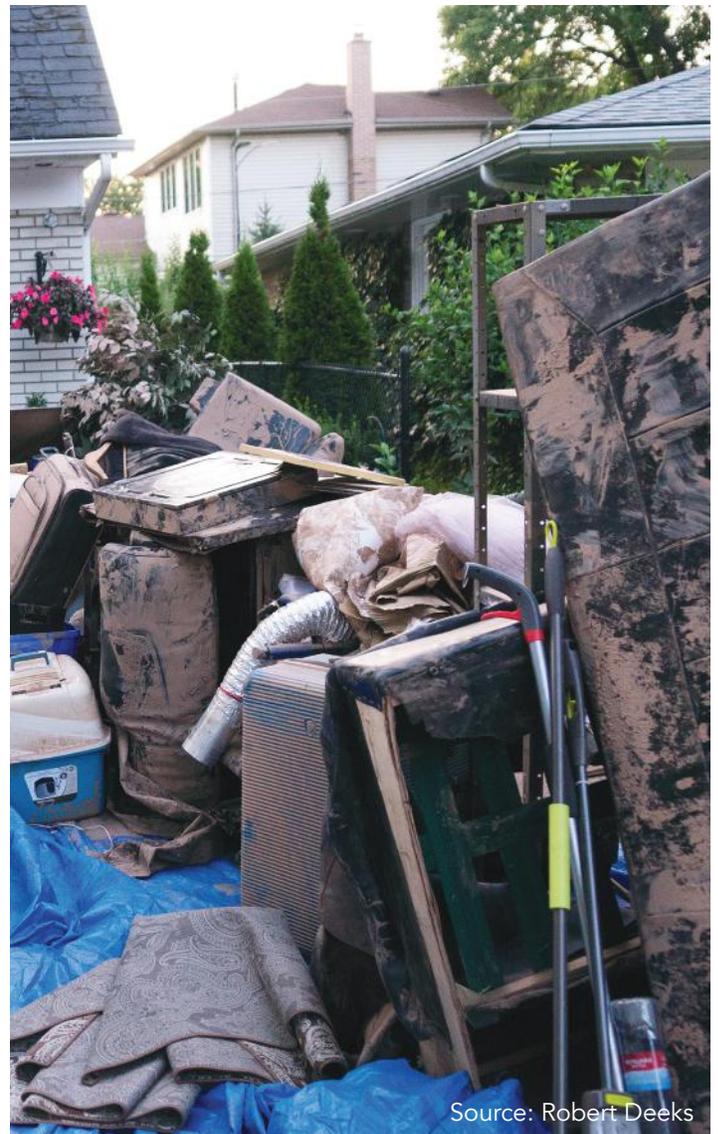
**Water Height in Basements:** In the days and weeks following a flood, the greater the water height, the greater the potential for physical damage and resulting financial cost, which contributed to the worry and stress of homeowners. Respondents shared how water came to the main level of their home, destroying items they had brought up from the basement and thought safe, and how the sheer amount of water (e.g. metres) diminished their sense of control.



**Difficulty with Insurance Providers:** Many homeowners in this study also experienced difficulty navigating their property and casualty insurance coverage. Homeowners referenced uncertainty surrounding the amount of insurance coverage to be received and frustration surrounding delays in compensation. One respondent, who “lost everything”, waited four days for an adjuster to visit her house in the aftermath of a flood, during which time food rotted in her basement from a capsized refrigerator.

**Worsening of Existing Health Issues:** This factor was repeatedly a ‘tipping point’ that led to elevated levels of worry and stress. The change in routine brought about by basement flooding exacerbated conditions such as Alzheimer’s, increasing worry and stress for those living with the condition and for the caregivers. Respondents shared how they felt they were coping well until their sore back worsened from lifting destroyed furniture, or until someone in their household went to the hospital with health complications. Said one respondent about an already ill family member who survived the flood - “I believe that the stress of the whole situation deteriorated her condition...she went into the hospital and never came home”.

**Loss of Personal Items:** In the months following a flood, many shared how the loss of personal items was “the hardest part of it all”. Researchers heard repeatedly how households “lost quite a bit of irreplaceable stuff” and “lost so much that was important to us, such as irreplaceable photographs and high school yearbooks”. “I think of something I want and it’s gone” said a respondent who lost their whole garden as well as family heirlooms. Many households expressed that this sense of loss will always stay with them and “I just hope nobody else goes through it, that’s for sure”.



Source: Robert Deeks

## Lost Time from Work Due to Residential Basement Flooding

Flooded household members were forced to take days off work due to flooding, with the average of seven days per working flooded household. The lost time from work and the elevated worry and stress experienced by flooded households are both likely conservative estimates, for this study, when compared to impacts from other flood events in Canada. This view is supported by the following:

- As the 2014 flood occurred in August, various Burlington respondents had already secured time off work or were not working (e.g. they were teachers). If the flood had occurred at a different time of year, the average of seven days off work may have been higher.
- Respondents may have under-reported mental health impacts if they perceived stigma around disclosing impacts. Health claims for flood-impacted communities would determine whether self-reported impacts align with claims.
- With significantly higher worry and stress materializing in the relatively affluent households in this study (see Appendix C), it is likely that even greater worry and stress would materialize in less affluent communities due to reduced financial means to redress a flood event.

### Implications of Findings

The findings of elevated worry and stress in the short and long term among flooded households indicate that action must be taken to protect homeowners and communities.

At an individual level, homeowners can become prepared and avoid the worry and stress of residential basement flooding by:

- Talking to their insurance provider to understand their property and casualty insurance coverage,
- Ensuring they are financially prepared for emergencies, and
- Taking action to protect their home in the event of a flood (e.g. disconnecting downspouts, fixing cracks in the foundation, and installing window wells. For a complete list of actions to take, visit: [https://www.intactcentreclimateadaptation.ca/programs/home\\_flood\\_protect/resources/](https://www.intactcentreclimateadaptation.ca/programs/home_flood_protect/resources/)).



At a national level, existing flood mitigation efforts must proceed with haste. This is not only to reduce costs for Property and Casualty insurance, but to reduce costs for Life, Health and Disability insurance and avoid significant worry and stress for homeowners who experience basement flooding. Several means to limit flood risk in the immediate term include the following:

- **Developing National Standards to Limit Household and Community-Level Flood Risk:** The Intact Centre is collaborating (2018) with the Standards Council of Canada, Canadian Standards Association, and National Research Council of Canada to create and implement flood mitigation Standards. The Basement Flood Protection Guideline outlines best practices to prevent flooding for homeowners at the lot level and will be completed in Fall 2018. The Residential New Community Flood Risk Standard profiles best practices for developing any new community to become flood-resilient, and will be completed in Fall 2018. The Residential Existing Community Flood Risk Standard profiles best practices for existing communities in Canada to reduce their flood risk, and will be completed in Fall 2019.
- **Updating Flood Risk Maps for Canadian Communities:** It is essential to ensure that all homeowners are aware of the flood risk, if any, to which their property may be subject. Flood risk maps can help owners to identify their risk of flooding, and to subsequently take action to limit water entry into their basement.
- **Certifying Home Inspectors in Home Flood Risk Assessment:** The Intact Centre is collaborating with Ontario colleges to help develop training and certification in basement flood risk assessment, and is set to be released Fall 2018. This assessment can then be applied to homes, generally when they transfer ownership, to both identify flood vulnerabilities and to correct any deficiencies. Home inspectors currently receive limited training on identifying and mitigating flood risk and this certification will address that omission.

As this report illustrates, residential basement flooding has a significant impact on the mental health, and lost time from work, of impacted homeowners. Accordingly, the need to put measures in place to limit residential basement flood risk in Canada cannot be overstated.

The challenge for Canadian communities and homeowners is not whether to limit basement flood risk, but rather how rapidly mitigation measures can be implemented to limit otherwise debilitating worry and stress.



## APPENDIX A

1. At the time you had water in your basement, who made up the members of your household? You can circle these age ranges and the sex of the different members. If you prefer not to list the sex and age range of members of your household you do not have to answer these questions.

HOUSEHOLD MEMBER 1	HOUSEHOLD MEMBER 2	HOUSEHOLD MEMBER 3	HOUSEHOLD MEMBER 4	HOUSEHOLD MEMBER 5
Male / Female				
<5 years old				
6-14 years old				
15-24 years old				
25-64 years old				
65 years old+				

- Prefer Not to Answer
- Don't Know

2. Did you or any members of your household receive any guidance on how to clean up your basement?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] What guidance was it, and was it useful?

3. Who was physically present to help clean up your basement?

- Yourself
- A member of your household
- A friend
- A contractor
- Don't know
- Prefer Not to Answer

4. (If answered "Yourself" or "A member of your household"): Did you or any members of your household take any precautions during clean-up of your basement? [if person needs clarification, say "This may include, but is not limited to: wearing rubber boots when walking in the water, or wearing goggles, or a breathing mask. Things like that.]

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] What was this?

5. How long did it take to have all the water and all the items that got wet removed from your basement?

	Don't Know	Prefer Not to Say
--	------------	-------------------

6. Was your basement finished when it had water in it?

YES	SOMEWHAT	NO	Don't Know	Prefer Not to Say
-----	----------	----	------------	-------------------

Now I have a couple of questions about insurance.

7. How much of the water damage was covered by your insurance?

None	Less than half	More than half	Don't Know	Prefer Not to Say
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8. [If covered at least partly] How long did it take to process your claim?

- Within 3 months
- Within 6 months
- Within a year
- Over a year
- Still ongoing
- Don't Know
- Not applicable
- Prefer Not to Answer

9. Did you have any difficulty contacting your insurance company?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] What was the difficulty that you had?

10. What social support did you receive?

11. Within the first month of experiencing water in your basement, did you or any members of your household experience difficulties sleeping? If so, why?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

12. Anytime since, have you or any members of your household experienced difficulties sleeping?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] What caused the difficulty sleeping?

[IF YES] Which household member was affected?

13. Within the first month of experiencing water in your basement, did you or any members of your household experience breathing issues you had not experienced before having the water in the basement?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

14. Anytime since, have you or members of your household experienced breathing issues that you had not experienced before the water in the basement?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

15. Within the first month of experiencing water in your basement, did you or any members of your household experience stomach cramps?

YES	NO	Don't Know	Prefer Not to Say
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[IF YES] Which household member was affected?

16. Within the first month of experiencing water in your basement, did you or any members of your household experience skin rashes?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

17. Within the first month of experiencing water in your basement, did you or any members of your household experience worsening of health issues that had already existed at the time your basement had water in it?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

18. Anytime since, have you or any members of your household experienced worsening of health issues that had already existed at the time your basement had water in it?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] What was it?

[IF YES] Which household member was affected?

19. Within the first month of experiencing water in your basement, did you or any members of your household experience worrying and stress beyond the normal and everyday? (If the participant asks for a definition then can clarify: "worrying and stress beyond the normal and everyday is worrying and stress that interferes with your regular day to day activities")

YES	NO	Don't Know	Prefer Not to Say
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[IF YES] Which household member was affected?

20. Anytime since, have you or members of your household experienced worrying and stress beyond the normal and everyday?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

21. On a scale of 1-5, how worried do you get when it rains? 1 is not worried at all, and 5 is very worried.

	Don't Know	Prefer Not to Say
--	------------	-------------------

[IF YES] Which household member was affected?

22. Did you or any members of your household take time off work to deal with any of these health issues, or to deal with the health issues of other members of your household, or to clean up the basement? (If participant asks for clarification: "this could involve taking time to go to a medical appointment, or taking time to bring a child to a medical appointment")

YES	NO	Don't Know	Prefer Not to Say
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23. [If "Yes" to above] Did this cause any difficulties for you?

YES	SOMEWHAT	NO	Don't Know	Prefer Not to Say
-----	----------	----	------------	-------------------

[IF YES] Which household member was affected?

[IF YES] 24. How many approximate days did you or members of your household take off?

(skip to PAGE 12 (question 34) if there were no health impacts identified)

25. During and since your basement had water in it: Did you or any members of your household begin taking medication or increase your medication to deal with any of these health issues?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

26. During and since your basement had water in it: Did you or any members of your household begin or increase visits to the following to deal with any of these health issues?

- 27. A therapist or counsellor?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

- 28. A family doctor?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

- 29. A hospital?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

- 30. A walk-in clinic?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

32. Are there any other ways your health or the health of a member of your household might have been impacted by the water in your basement that you'd like to mention?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

33. Were there any other situations or events going on around the same time as the water in your basement you feel could explain some of the health impacts?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

34. Have you or any members of your household noticed visible mould or mildew in your basement or other parts of your home?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

35. Have you or any members of your household detected the smell of mould or mildew in your basement or other parts of your home?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

Almost done! Now I have several brief demographic questions purely for statistical purposes.

36. At the time of the water in your basement, did you own or rent?

OWN	RENT	Don't Know	Prefer Not to Say
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37. How long have you lived in this house?

38. We would like to know your combined household income level, for statistical purposes only. Please select your income range.

- Within 3 months
- Under \$49, 999
- \$50,000 - \$59, 999
- \$60,000 - \$69, 999
- \$70,000 - \$79, 999
- \$80,000 - \$89, 999
- \$90,000 - \$99, 999
- \$100,000 - \$124,999
- \$125,000 or more
- I don't want to share
- Don't know

39. What is the highest level of education you have obtained?

- No certificate, diploma or degree
- High school diploma or certificate
- Apprenticeship or trades certificate or diploma
- College, CEGEP or other non-university certificate or diploma
- University certificate or diploma below bachelor level
- Bachelor's degree
- University certificate, diploma or degree above bachelor level
- Prefer Not to Answer
- Don't Know

40. (If applicable) And the highest level of education your partner/spouse has obtained?

- No certificate, diploma or degree
- High school diploma or certificate
- Apprenticeship or trades certificate or diploma
- College, CEGEP or other non-university certificate or diploma
- University certificate or diploma below bachelor level
- Bachelor's degree
- University certificate, diploma or degree above bachelor level
- Prefer Not to Answer
- Don't Know



## APPENDIX B

1. Who currently makes up the members of your household? You can circle these age ranges and the sex of the different members. If you prefer not to list the sex and age range of members of your household you are free not to answer these questions.

HOUSEHOLD MEMBER 1	HOUSEHOLD MEMBER 2	HOUSEHOLD MEMBER 3	HOUSEHOLD MEMBER 4	HOUSEHOLD MEMBER 5
Male / Female				
<5 years old				
6-14 years old				
15-24 years old				
25-64 years old				
65 years old+				

- Prefer Not to Answer
- Don't Know

2. Have you or any member of your household received any guidance on how to clean up your basement after a flood? If so, please specify what this guidance is.

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] What guidance was it, and was it useful?

In the last three years, have you or any member of your household ever experienced:

3. Skin rashes?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

4. Difficulties sleeping at night?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

5. Worsening of existing health issues?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

6. New breathing issues?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

7. Worrying and stress beyond the normal and everyday?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

In the last three years:

8. On a scale of 1-5, how worried do you get when it rains?

1 is not worried at all, and 5 is very worried:

	Don't Know	Prefer Not to Say
--	------------	-------------------

[IF YES] Which household member was affected?

9. Did you or any members of your household begin taking medication or increase your medication?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

10. Did you or any members of your household begin or increase visits to a therapist or counsellor?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

11. Did you or any members of your household begin or increase visits to a family doctor?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

12. Did you or any members of your household begin or increase visits to a walk-in clinic?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

13. Did you or any members of your household begin or increase visits to a hospital?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

14. Did you or any members of your household begin or increase visits to other health services not mentioned above?

If yes, please specify what services you went to.

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

15. Are there any other ways your health or the health of a member of your household has been impacted in the last three years? If yes, please specify in what ways:

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

[IF YES] Which household member was affected?

16. Were there any situations or events going on in the last three years that you feel could explain some of the health impacts?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

17. Have you or any members of your household noticed visible mould or mildew in your basement or other parts of your home?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

18. Did you or any members of your household detect the smell of mould or mildew in your basement or other parts of your home?

YES	NO	Don't Know	Prefer Not to Say
-----	----	------------	-------------------

Script: Now I have several brief demographic questions purely for statistical purposes.

19. Do you own or rent?

OWN	RENT	I don't want to share	Don't Know
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20. How long have you lived in this house?

21. We would like to know your combined household income level, for statistical purposes only. Please select your income range.

- Within 3 months
- Under \$49, 999
- \$50,000 - \$59, 999
- \$60,000 - \$69, 999
- \$70,000 - \$79, 999
- \$80,000 - \$89, 999
- \$90,000 - \$99, 999
- \$100,000 - \$124,999
- \$125,000 or more
- I don't want to share
- Don't know

22. What is the highest level of education you have obtained?

- No certificate, diploma or degree
- High school diploma or certificate
- Apprenticeship or trades certificate or diploma
- College, CEGEP or other non-university certificate or diploma
- University certificate or diploma below bachelor level
- Bachelor's degree
- University certificate, diploma or degree above bachelor level
- Prefer Not to Answer
- Don't Know

23. (If applicable) And the highest level of education your partner/spouse has obtained?

- No certificate, diploma or degree
- High school diploma or certificate
- Apprenticeship or trades certificate or diploma
- College, CEGEP or other non-university certificate or diploma
- University certificate or diploma below bachelor level
- Bachelor's degree
- University certificate, diploma or degree above bachelor level
- Prefer Not to Answer
- Don't Know

## APPENDIX C

Below is a table outlining the demographics of the flooded and non-flooded households interviewed in this study, compared to the demographics of the City of Burlington, Province of Ontario, and Canada. Data for the City of Burlington, Province of Ontario and Canada originate from the 2016 Census (Statistics Canada, 2017).

Table 1: Demographics of Flooded and Non-Flooded Households Interviewed Compared to Burlington, Ontario, and Canada

	Study (Flooded Households) (n=58 households)	Study (Non-Flooded Households) (n=42 households)	City of Burlington	Province of Ontario	Canada
Average House- hold Income	\$100,000 or above	\$100,000 or above	\$93,588	\$ 74,287	\$70,336
% Who Own Their Home	97%	97%	76%	70%	68%
Average Size of Families	3.04	3.17	2.9	2.9	2.9
0-5 years	6%	12%	17% for total under 14 years	16% for total under 14 years	17% for total under 14 years
6-14 years	9%	12%	17% for total under 14 years	16% for total under 14 years	17% for total under 14 years
15-24 years	16%	12%	11%	13%	12%
25-64 years	50%	54%	53%	54%	54%
≥65 years	15%	11%	19%	17%	17%
High school diploma or certificate	9%	9%	26%	27%	26%
Apprenticeship or trades certificate or diploma	3%	5%	5%	6%	10%
College, CEGEP or other non-university certificate or diploma	16%	21%	24%	21%	19%
University certificate or diploma below bachelor level	12%	7%	2%	2%	3%
Bachelor's degree	22%	30%	21%	17%	15%
University certificate, diploma or degree above bachelor level	28%	26%	10%	9%	8%



## APPENDIX D

Table 3 is a list of factors that researchers hypothesized would positively correlate with worry and stress in the first 30 days after experiencing flooding. These factors were identified in the referred literature.

Table 2: Factors Hypothesized to Positively Correlate with Worry and Stress among Flooded Households in Burlington, Ontario

FACTOR	METRIC	EXPLANATION
Water height	Water height was >1 foot (30 cm) high	The higher the water level, the greater the potential for physical damage and resulting financial cost.
Time for water to be removed	Removed after 24 hours	The greater the amount of time it took to remove items, the greater the amount of time for mould growth and the longer the respondent could be worried or stressed.
Time for items that got wet to be removed	Removed after 24 hours	Same as above.
Insurance coverage (Property and Casualty)	Insurance covered half or less than half of total damages	Households where property and casualty insurance covered half or less than half of all damages would pay for the rest themselves or find alternative sources, potentially resulting in financial hardship.
Difficulty contacting the insurance provider	Yes	If households experienced difficulty contacting insurance providers, this may have created additional stress due to uncertainty surrounding coverage and waiting for an adjustor.
Time to process claim	More than 30 days	The longer it took to process a claim, the greater the uncertainty for the respondents, and the greater the amount the respondent would have paid upfront. This could have potentially resulted in financial hardship and worry and stress.
No social support	Yes	Social support can act as a buffer against stress. No social support can be a risk factor for negative health outcomes (Bei <i>et al.</i> , 2013, Gordon <i>et al.</i> , 2011; Tunstall <i>et al.</i> , 2006).
Other events at same time as flood	Yes	If there were other events (e.g. addressing health issues) occurring at the same time, this could exacerbate stress. For instance, some respondents shared that they dealt with the flood at the same time that they were looking after aging parents who were also flooded.
Existing health issues worsened	Yes	Existing health issues can complicate recovery and increase the risk of mental health challenges (Fernandez <i>et al.</i> , 2015).
Basement was finished	Yes	Finished basements would require greater financial resources to refurbish.
Lost personal items	Yes	If there were personal items lost, then the respondent could have experienced a greater sense of loss than if no personal items were lost. The greater the loss, potentially the greater the emotional toll on the respondent and worry and stress.

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