

# WHAT'S THAT SOUND?

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## How Residents Responded During a Tsunami Evacuation on Vancouver Island and How Similar Evacuations Might be Improved

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# Who Are We?

**Ryan P. Reynolds, MGIS, PhD**  
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Ryan's research aims to assist Canadian communities and households to prepare for and respond to local hazard threats.

His work explores hazard risk mapping, risk communication, and how online and mobile tools assist vulnerable households to learn about, prepare for, and respond to hazards-related emergencies.

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Alexa's research focuses on understanding how people perceive risks and make risk management decisions associated with natural hazards.

This interest has been applied to the maritime transportation system and risk management in multi-hazard environments to understand how geographic, spatial, and temporal distance influence risk perceptions and risk management preferences.

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Bâtir des communautés résilientes

# Quick Outline

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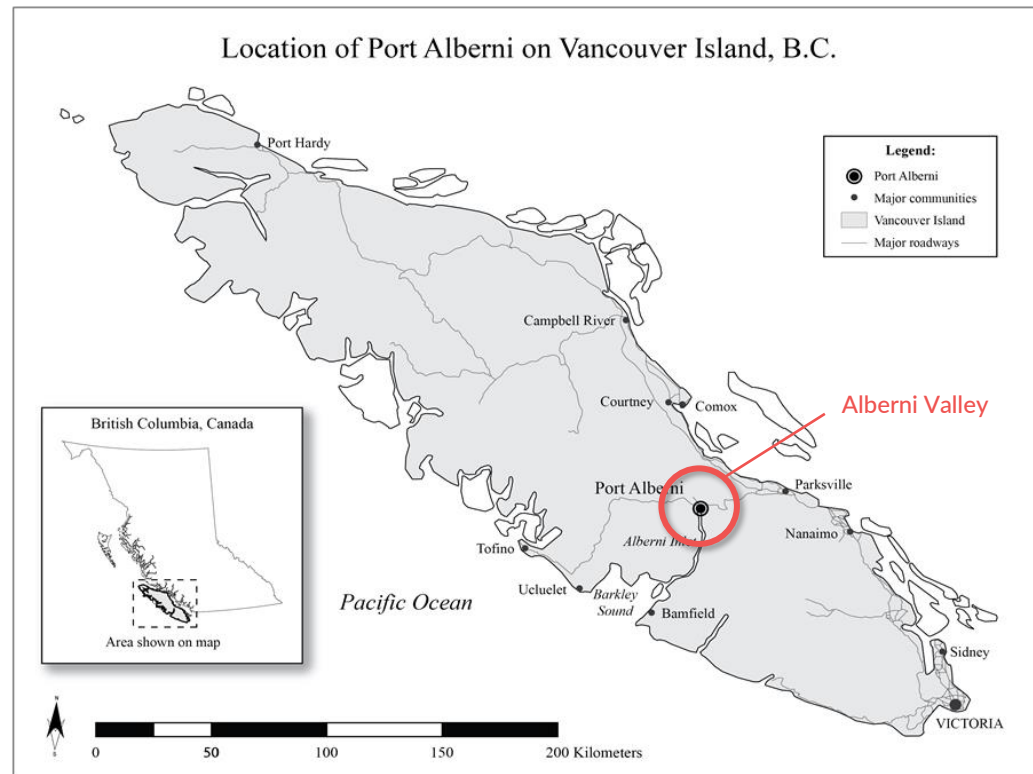


# Introduction

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January 23<sup>rd</sup>, 2018

# Port Alberni & The Alberni Valley



Port Alberni and the Alberni Valley are **located on Vancouver Island** west of Nanaimo along the highway to Ucluelet and Tofino

Image Credit: Ryan Reynolds (2017)



# 1964 Good Friday Tsunami



Photo Credit: Alberni Valley Museum, PN09510; Photographer: Pat Power



Photo Credit: Alberni Valley Museum, PN15406

The **tsunami inundation zone** is shown here along with the locations of the six warning towers and the official reception centre

**Legend**

-  Official Reception Centre
-  Tsunami Warning Towers
-  Boundaries for City of Port Alberni
-  Tsunami Inundation Zone
-  Waterbodies





# Earthquake Near Alaska

A **magnitude 7.9** earthquake was detected by the **National Tsunami Warning Centre** (NTWC) in Palmer Alaska at 01:31 PDT

## M 7.9 - 280km SE of Kodiak, Alaska

2018-01-23 09:31:40 (UTC) | 56.004°N 149.166°W | 14.1 km depth

[Back to Overview](#)

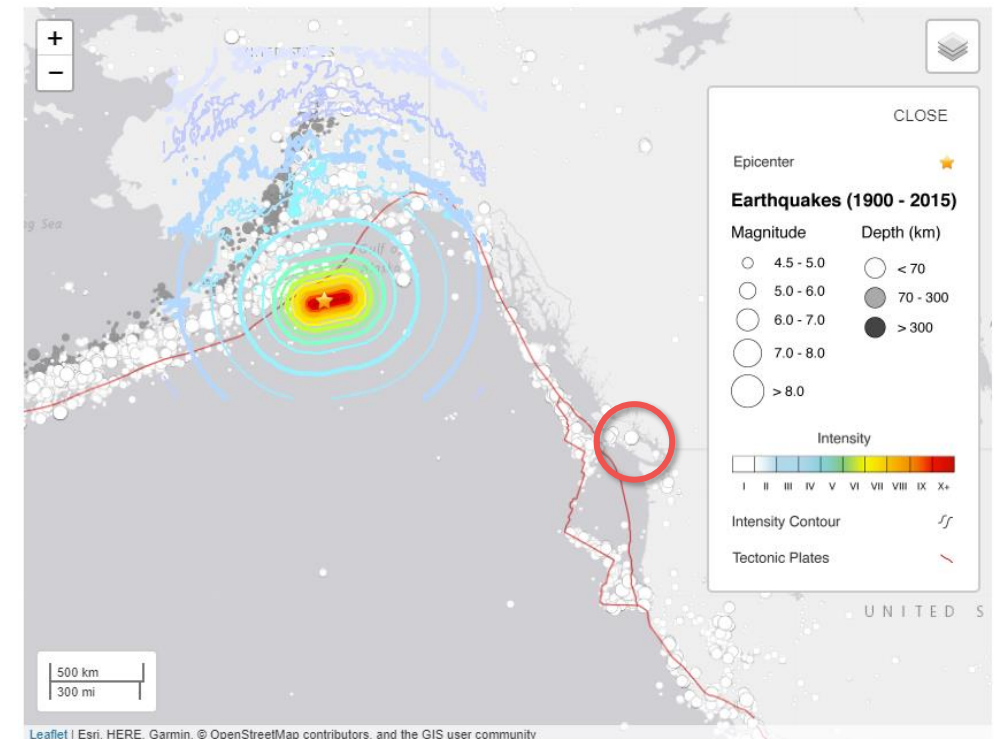
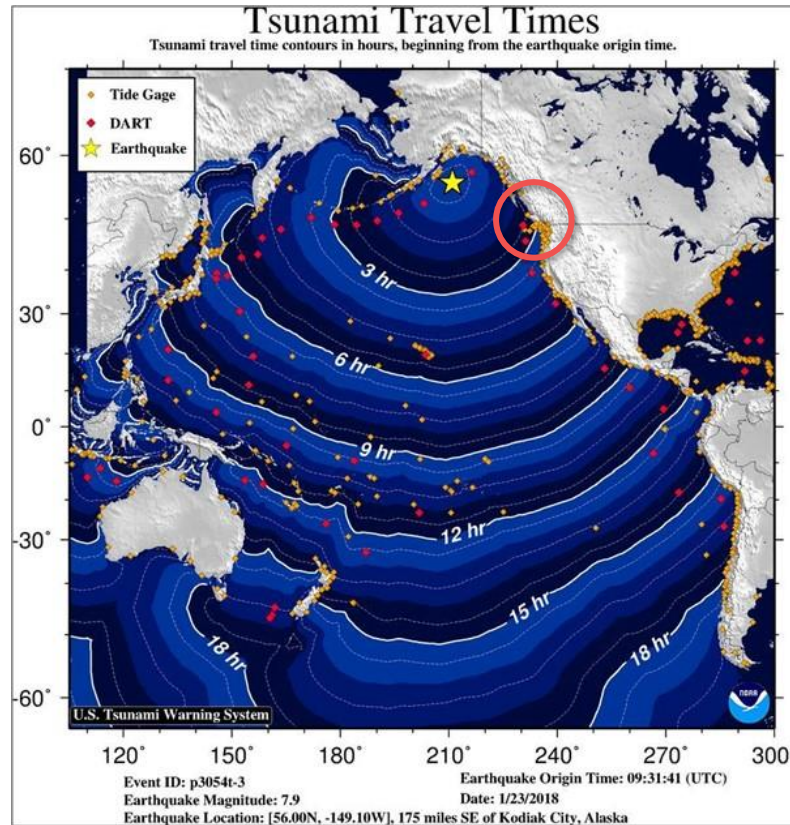


Image Credit: [USGS \(2018\)](#)

# Initial Tsunami Warning



The NTWC issued its **first tsunami warning** five minutes after event detected at 01:36 <sub>PDT</sub>

Image Credit: [NTWC \(2018\)](#)



# EMBC Notifications

Emergency Management BC (EMBC) provided the **first notification** of the tsunami warning to **Alberni officials** at 01:50 <sub>PDT</sub>



Image Credit: [CBC News \(2018\)](#)

# Alberni Valley EOC Opened

## TSUNAMI WATCH, ADVISORY & WARNING?

Tsunami Notification	Meaning	How does local government respond?	How will I know?
<b>WATCH</b> Wait for more information	Watches are issued when early seismic information indicates that an area <b>could be</b> impacted <b>if</b> a tsunami has been generated	The Alberni Valley Emergency program monitors the situation and waits for further information	Personal investigation through news and internet
<b>ADVISORY</b> Stay above high tide line	Advisories are issued due to the threat of a tsunami that has the potential to produce strong currents dangerous to those in or near the water (EMBC website)" <i>"The second highest level of tsunami alert."</i>	Course of action may include one or all of the following: <ul style="list-style-type: none"> <li>• Closure of public waterfront including beaches and marinas</li> <li>• Notification of the Port Authority and local industries on the water</li> <li>• Community safety announcements</li> </ul>	Personal investigation through news and internet.  Lowest lying properties, depending on the tsunami activity predicted, may receive notification from municipal officials – e.g. fire department, RCMP, public works
<b>WARNING</b> Move to higher ground and stay there	<i>"This is the highest and most serious level of tsunami notification."</i>  Warnings are issued when there is imminent threat of a tsunami or confirmation of a tsunami wave (EMBC website)"	Immediate activation of the Tsunami Warning System  Full activation of the Emergency Operations Centre (EOC) and implementation of the emergency evacuation plan	<b>Large local earthquake – the earthquake will be your notice.</b>  For off shore generated tsunami warnings, notification will be the warning siren, and may include media and door to door announcements

The Alberni Valley **Emergency Operations Centre** (EOC) opened at 02:15 <sup>PDT</sup>

- Pre-arranged protocols enacted
- Notifications to staff & elected officials sent by pager and phone

Image Credit: [Alberni-Clayoquot Regional District \(2018\)](#)



# Warning System Activated

The EOC activated the  
Alberni Valley **tsunami**  
**warning system** at 03:00 PDT

- Warning siren coupled with public address system
- Six warning towers throughout the inundation zone
- Local radio begin broadcasting warning



Photo Credit: [Teresa Bird/Peninsula News Review \(2018\)](#)

# Evacuation Centre Opens



Photo Credit: The authors

The **Echo Aquatic and Fitness Centre** opens doors as local evacuation centre at 04:00 PDT

- Registration services
- First aid
- Refreshments



# All Clear Issued

At 04:30 <sup>PDT</sup> **EMBC** contacted the EOC to inform them the **tsunami warning had been lifted** and they could stand down



Photo Credit: [Cariboo Regional District](#)

# Criticism of Official Response

**Criticism of the official response** was quick to follow with a focus on:

- Lack of response on social media and the web
- Confusion about siren sound
- Confusion about household response
- Delay between the NTCWC warning at 1:36 and the start of the evacuation at 3:00

The image displays two overlapping screenshots of news content. The background screenshot is from CBC News, featuring the headline "Tsunami scare exposes communication breakdown in vulnerable B.C. city" under the "British Columbia" section. The foreground screenshot is from Alberni Valley News, with the headline "City of Port Alberni 'dropped the ball' in communicating tsunami warning on social media". This article includes a sub-headline "Officials will look at how to better communicate emergencies to the public online" and a byline "KARLY BLATS / Jan. 24, 2018 1:44 p.m. / LOCAL NEWS / NEWS". Below the text is a Facebook post from the "City of Port Alberni Local Government" dated "Thursday at 4:39 a.m.", which states: "The 'all clear' warning has been given. Echo Centre is now closed and will be open for business as usual at 8:30 a.m." The article also includes a photo of Port Alberni and a caption: "Port Alberni lies at the end of the 40 km long Alberni Inlet, tsunamis. (Alberni Valley Chamber of Commerce)".



# Our Approach

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Our methodology and research tools



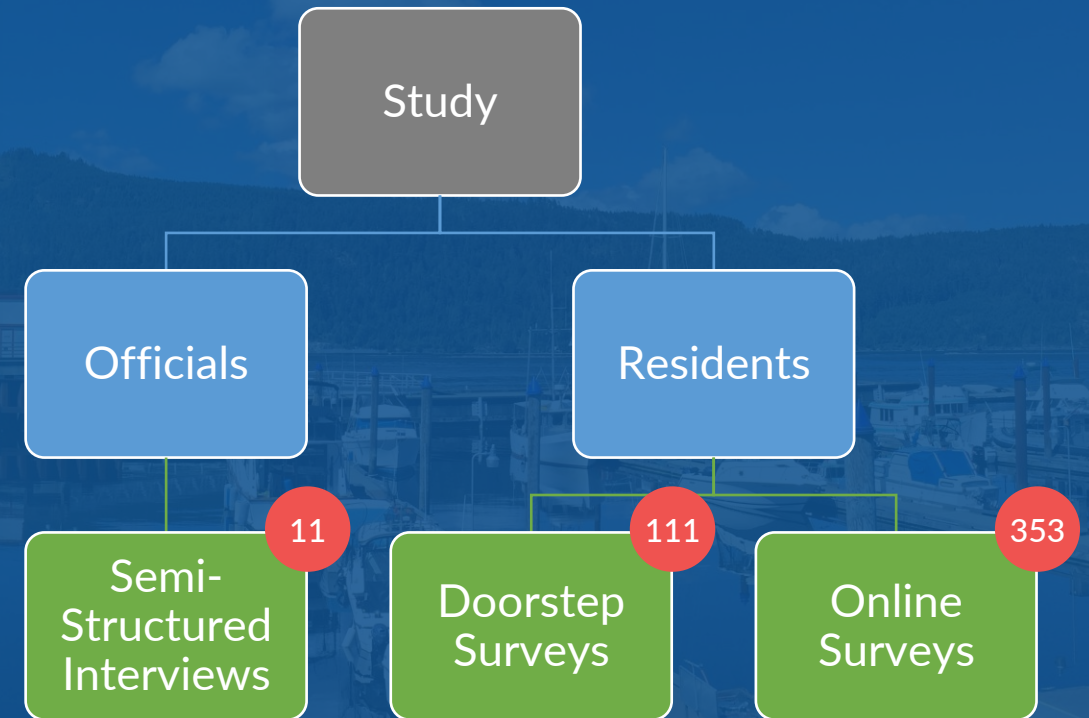
# Timing of Our Study

We travelled to Port Alberni in **April**, roughly 3 months following the evacuation, and stayed in the community for a period of **7 days**



# Our Research Tools

We spoke with **local officials** and **community residents** seeking to understand how this evacuation played out and how it was perceived by these two groups







# Our Findings

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Residents' response and changing perceptions of tsunamis



# Themes

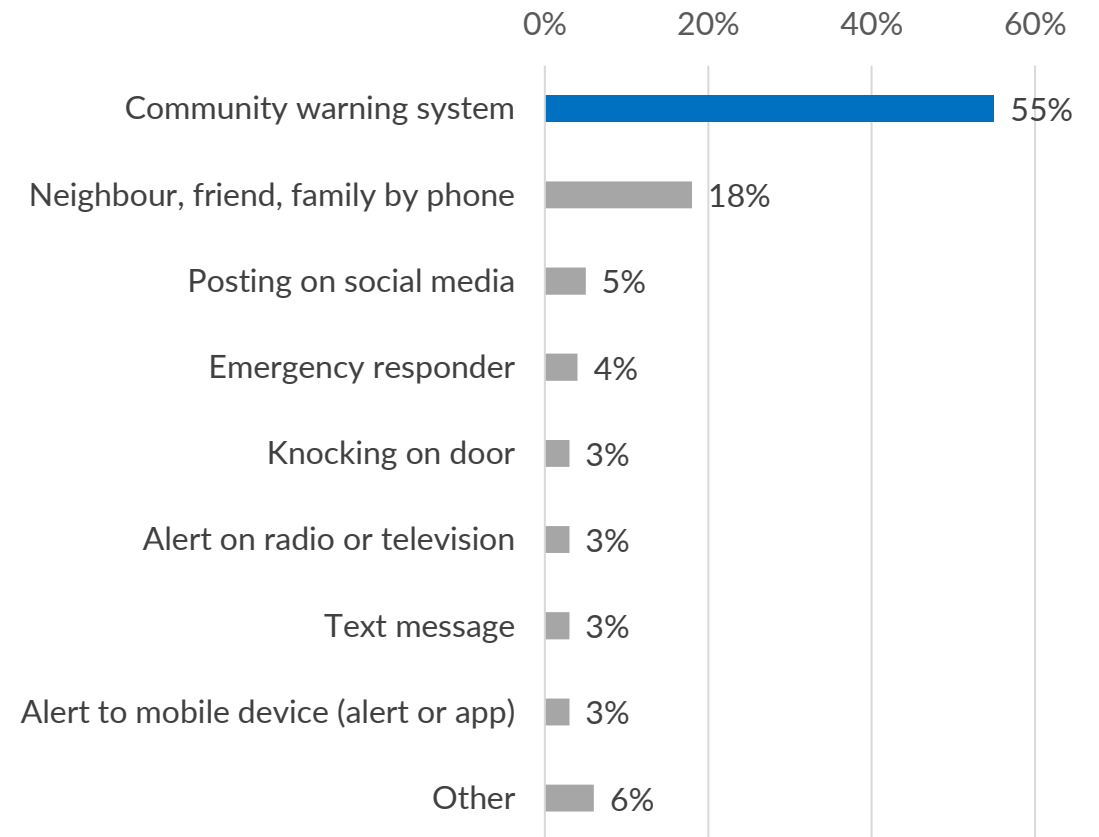
- Q1:** Resident response
- Q2:** Evacuation difficulties
- Q3:** Perceptions of the event
- Q4:** Changing risk perceptions

# Research Question

**Q1:** *“How did residents living in the inundation zone respond to the warning and evacuation?”*

# Method of First Notification

**55%** of participants indicated the official community **tsunami warning system** was their first warning of the tsunami and evacuation



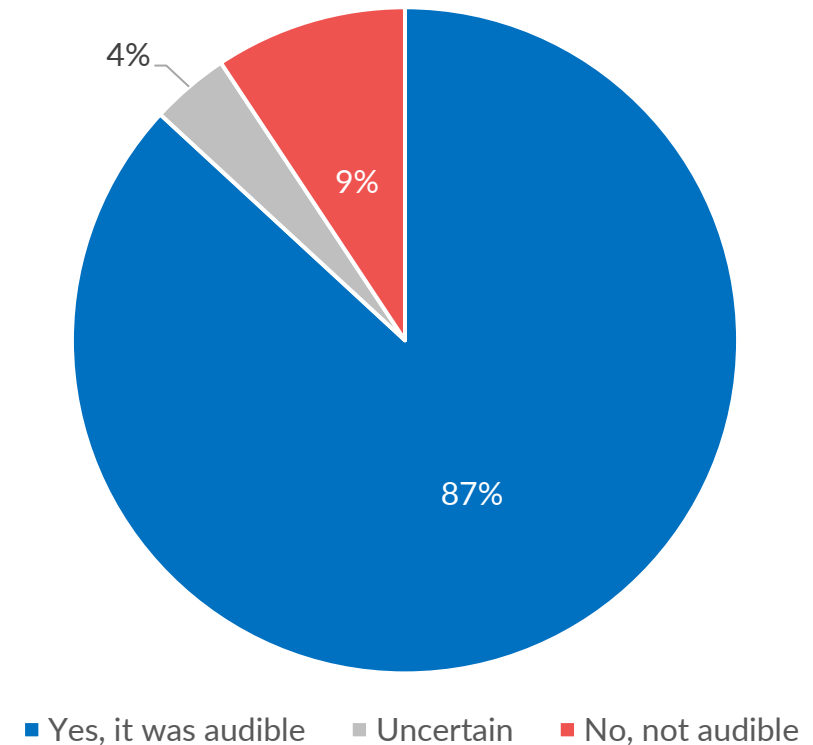


# Reach of Warning System

Of those confirmed to be living within the inundation zone, **87%** indicated the tsunami warning **was audible** at their home

- Not always sufficient to wake from sleep
- Verbal instructions often too quiet or difficult to understand

Living Within the Inundation Zone

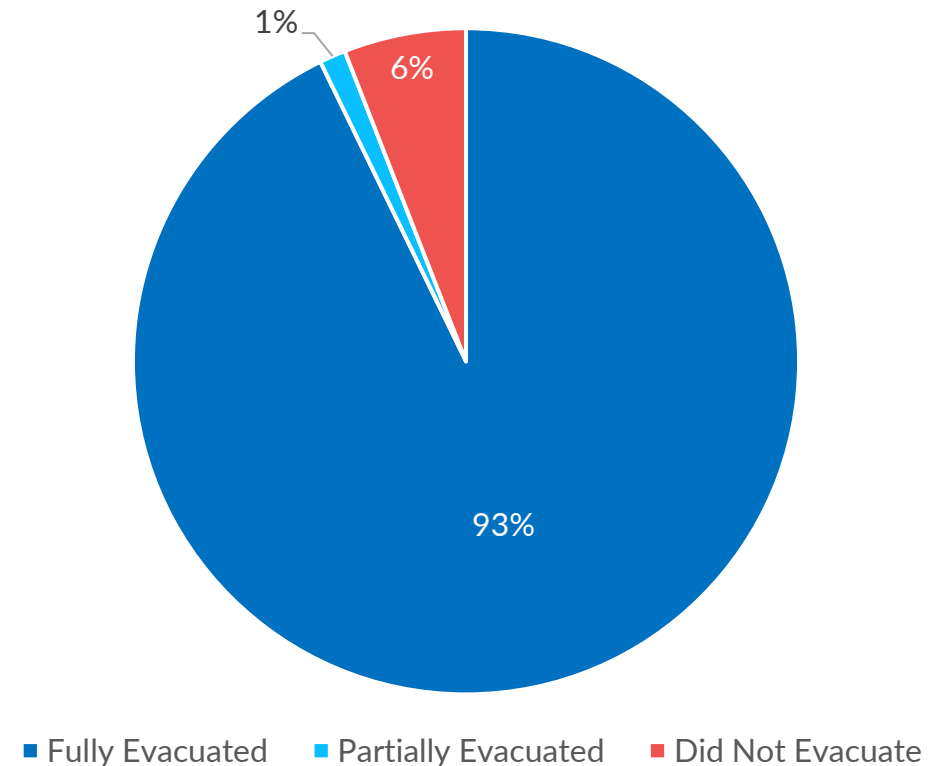


# Choice to Evacuate – Within Zone

Of those confirmed to be living within the inundation zone, **94%** indicated they **opted to fully or partially evacuate**

- Only **6%** indicated they chose to remain or were unable to evacuate

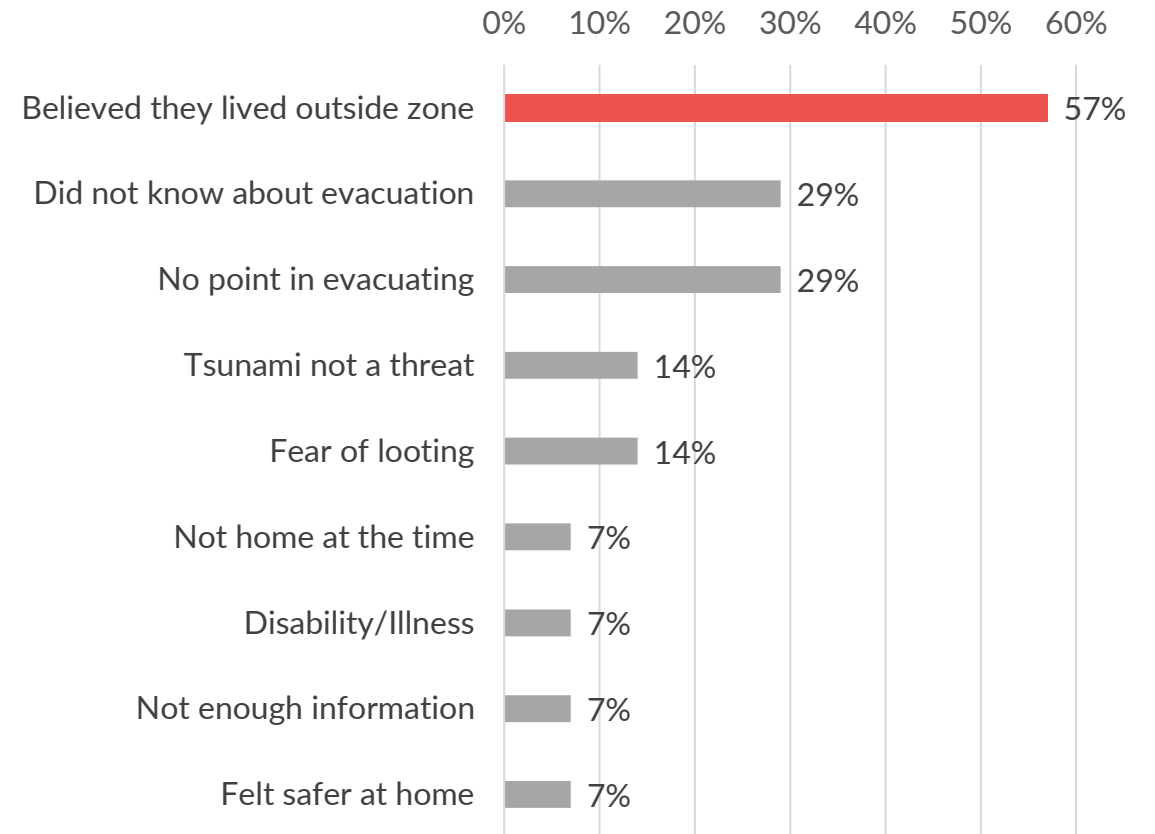
Living Within the Inundation Zone



# Reasons for Not Evacuating

**57%** of participants living within the inundation zone **who did not evacuate** indicated they did not believe they lived within the zone

- Multiple reasons could be selected
- $N=14$



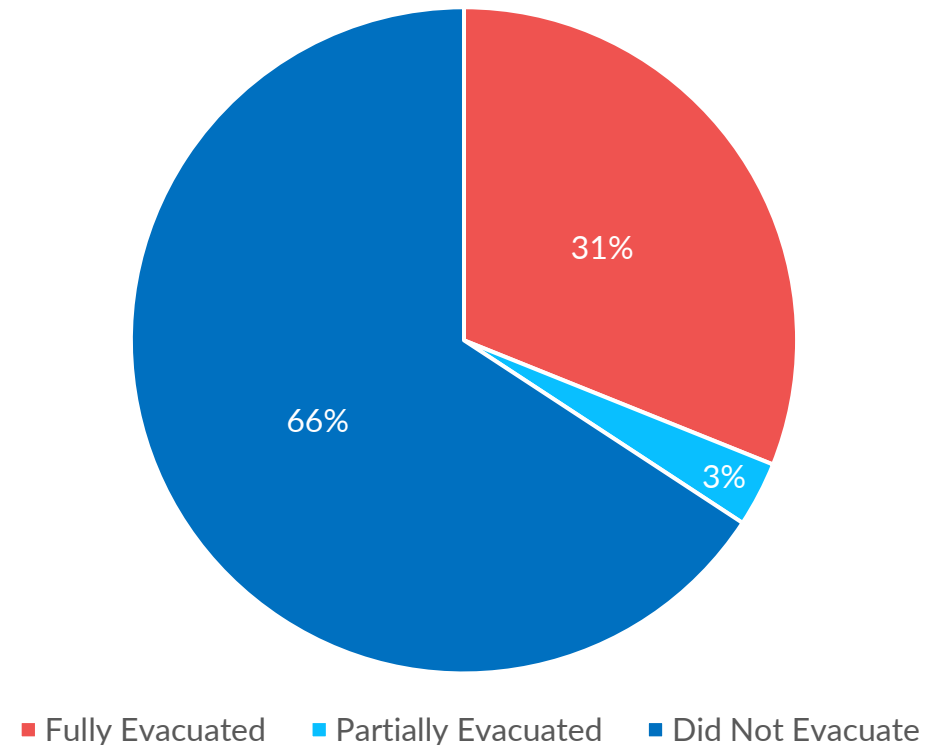


# Choice to Evacuate – Outside Zone

Of those confirmed to be living outside the inundation zone, **34%** indicated they **opted to fully or partially evacuate**

- Unnecessary evacuees place additional pressures on the system, including increasing traffic congestion

Living Outside the Inundation Zone



# Hazard Zone Proximity Awareness

Approximately **18%** of participants were unsure or mistaken about whether their homes were located within the official inundation zone:

- **5%** believed they lived inside the zone when they did not
- **3%** believed they lived outside the zone when they did not
- **10%** were unsure

Reported Location of Participant Home	Verified Location of Participant Home		Both Studies Combined
	Within Zone	Outside Zone	Total
Within Zone	49%	5%	54%
Outside Zone	3%	33%	36%
Uncertain	2%	8%	10%
Total	53%	47%	N=464

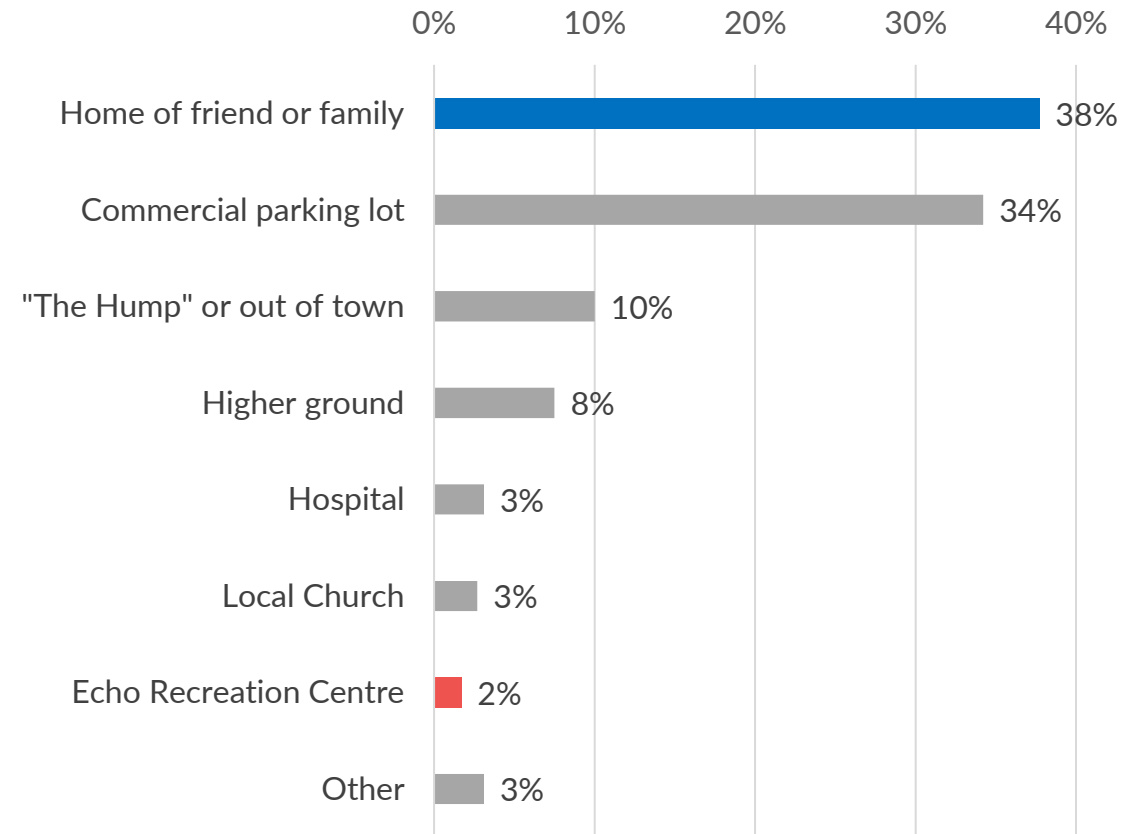
# Evacuation Destinations

**38%** reported traveling to the home of friends or family

- This was the desired outcome, where possible

**2%** reported traveling to the official reception centre at the Echo Centre

- Centre was not opened until 1 hour after evacuation initiated
- $N=292$





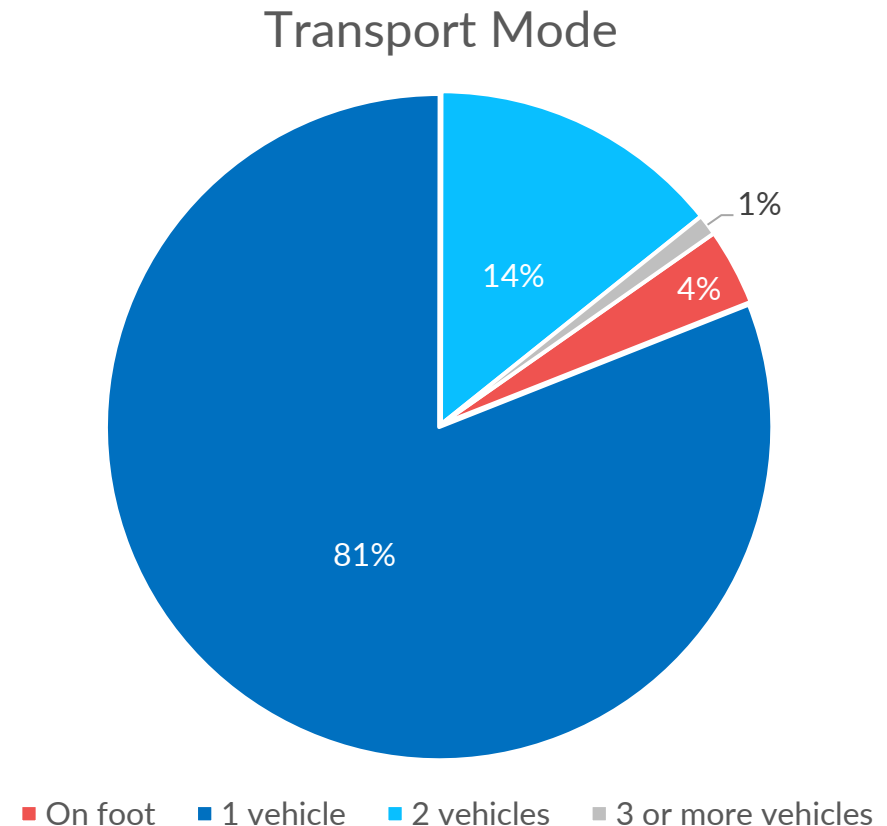
# Method of Evacuation

About **4%** of households started their evacuation on foot

- Some reported receiving rides partway through evacuation

About **5%** of households reported using 2 or more vehicles to evacuate

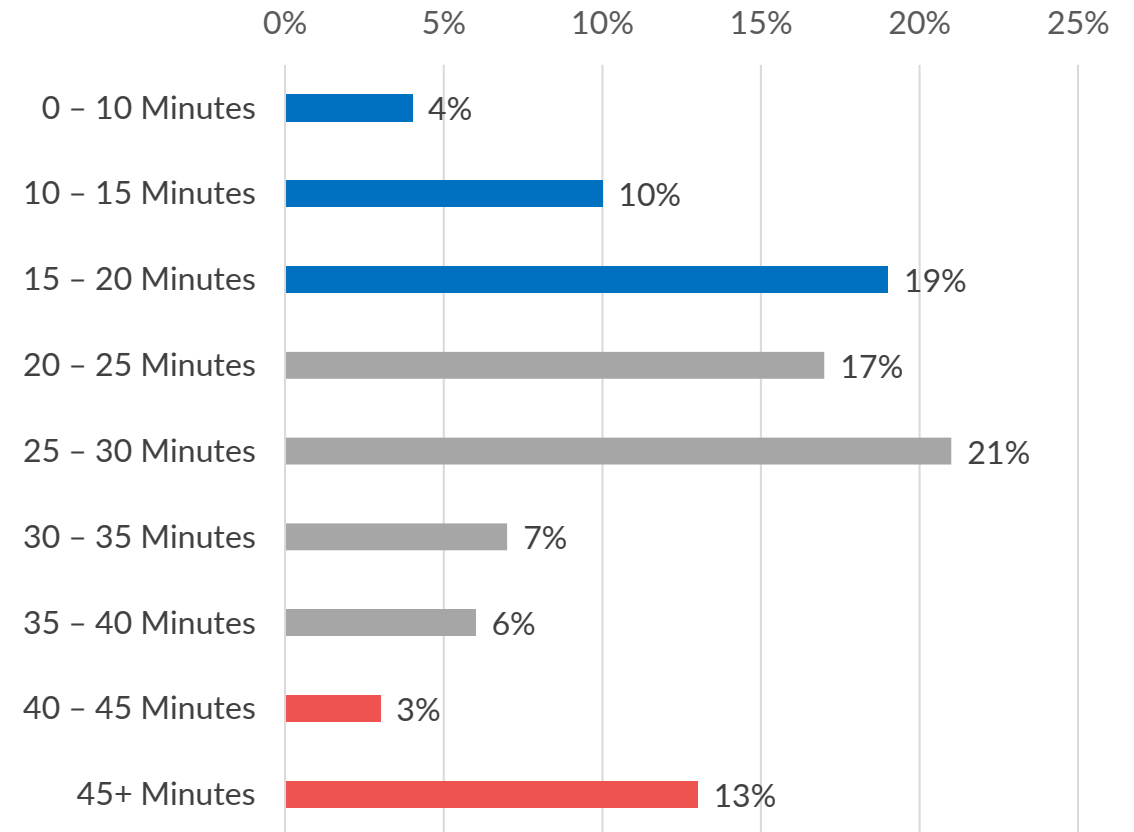
- $N=297$



# Total Time to Evacuate

Time from first learning about the evacuation to first arriving at safe destination:

- **32%** reported taking **20 minutes or less**
- **16%** reported taking **45 minutes or more**
- $N=108$



# Research Question

**Q2:** *“What difficulties did residents experience while evacuating?”*



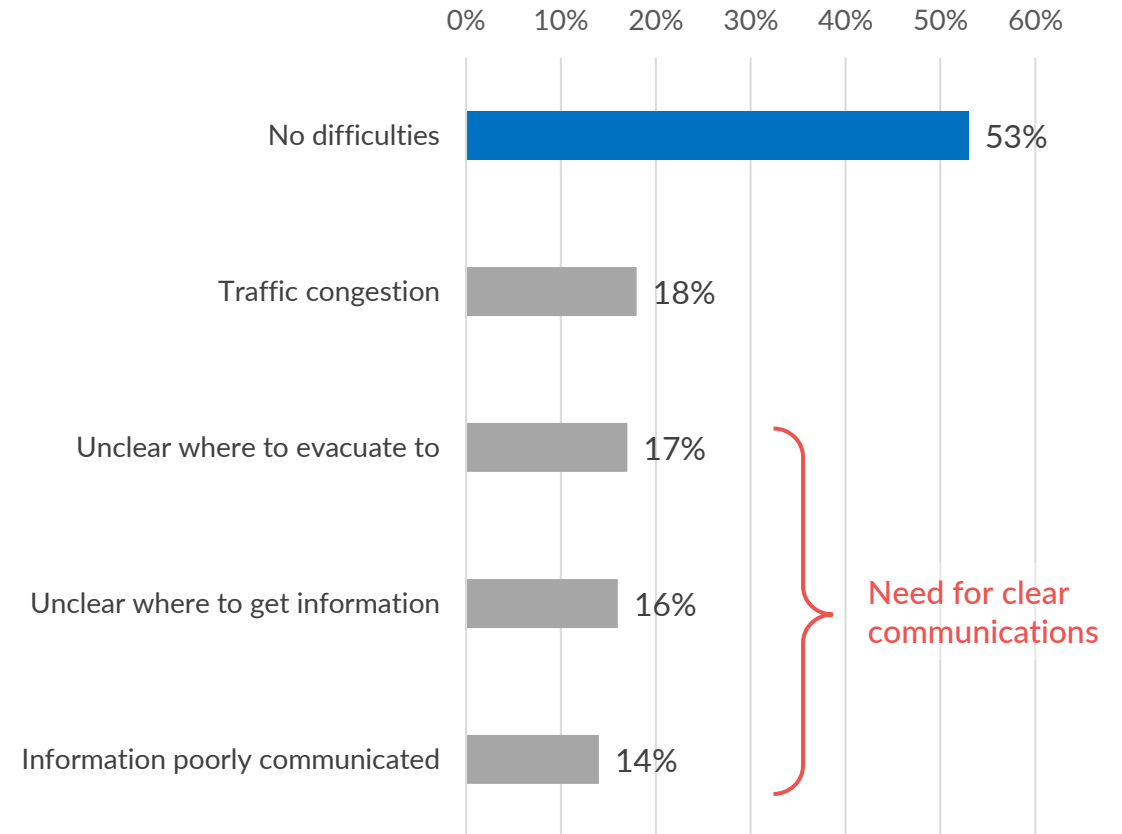
# Difficulties Experienced During Evacuation

**53%** reported no difficulties

**18%** reported experiencing traffic congestion

**3 of top 5** difficulties were related to communications to residents

- Multiple responses could be given
- $N=292$

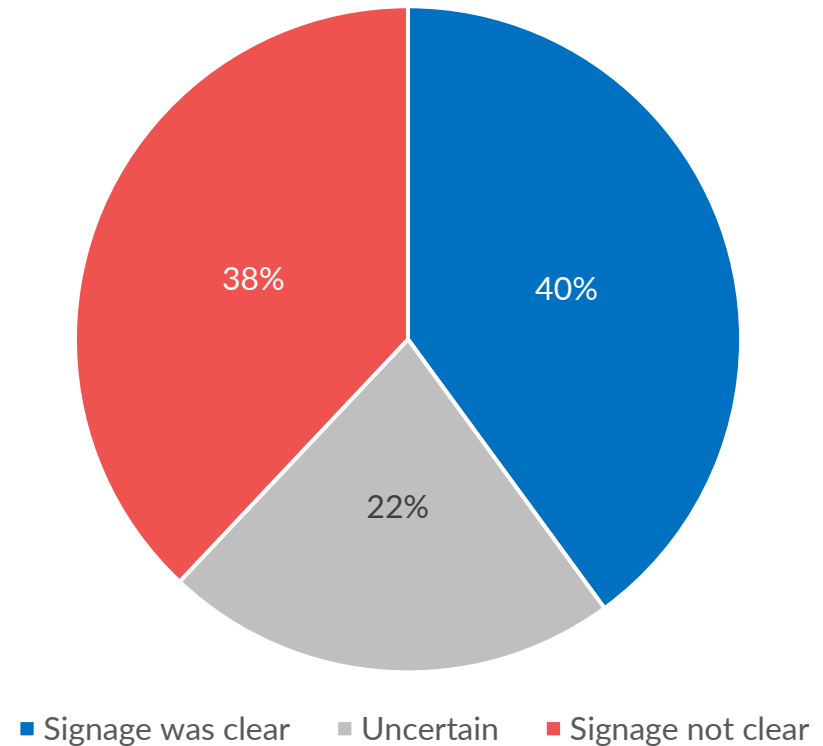


# Clarity of Evacuation Signage

*“Are the signs marking the emergency evacuation routes clear enough?”*

- It is possible some residents have become “blind” to the signs due to familiarity
- Some residents do not frequently travel routes where signs are posted
- May be too few signs, they may be too small, or are not readily visible

Clarity of Evacuation Signage



# Research Question

**Q3:** *“How was the tsunami warning and evacuation perceived by emergency officials and community residents?”*



# Official Perceptions of the Event

Official perceptions of the event were **largely positive**:

- Open and frank about issues related to communication, especially on social media
- Otherwise, all aspects of the evacuation were executed as planned and seen as effective
- Identified areas for improvements

# Public Perceptions of the Event

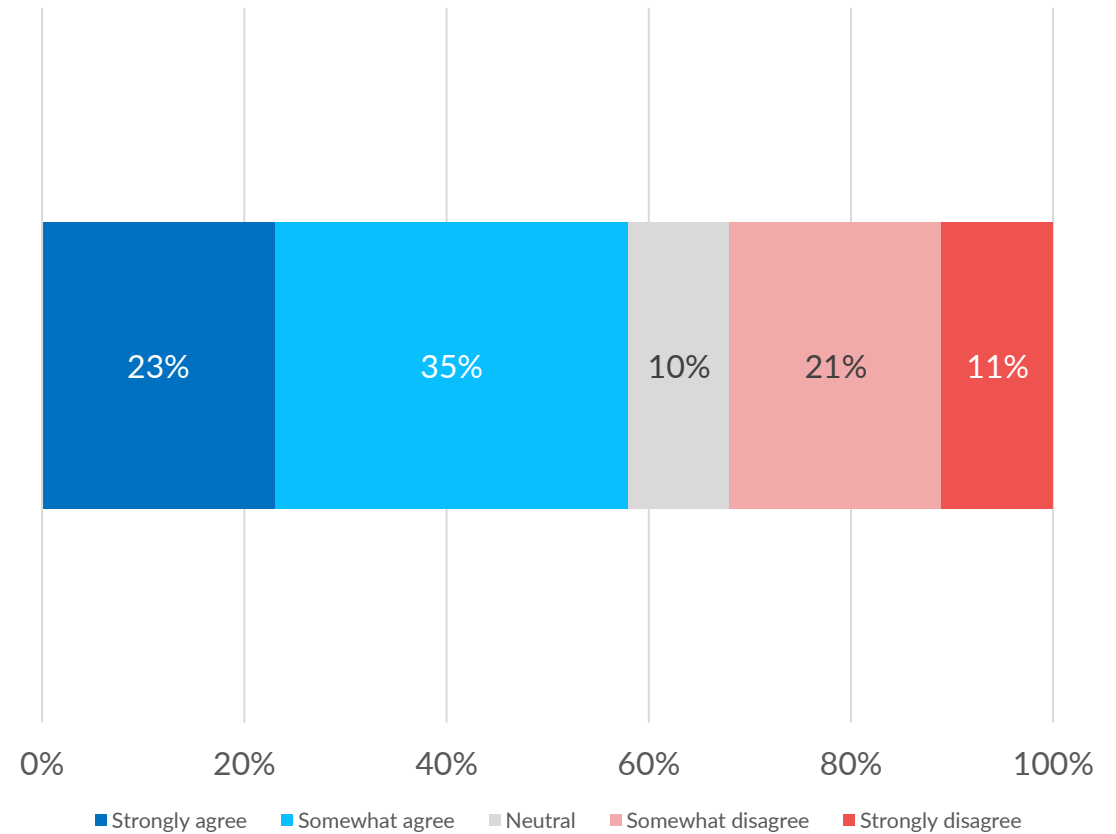
Public perceptions of this event were **generally positive**:

- Confusion about how to respond
- Issues of unclear verbal instructions over PA system
- Concerns around traffic congestion
- Concern around “lag” between NTWC warning and start of evacuation
- Difficulties experienced by older residents and those with disabilities

# Public Perceptions of the Event

*“I believe the City and Regional District were **reasonably prepared**”*

- **58%** indicated they felt officials were reasonably prepared

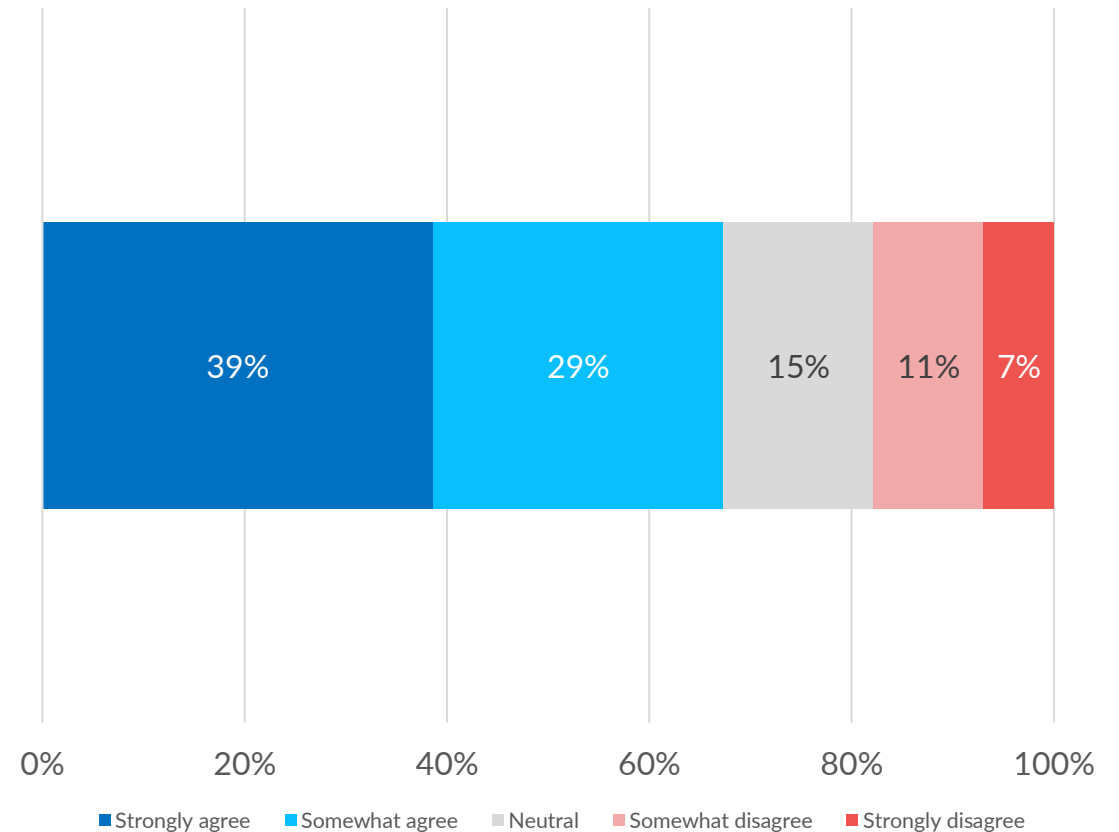




# Public Perceptions of the Event

*“I believe the officials conducted the evacuation in an **appropriate manner**”*

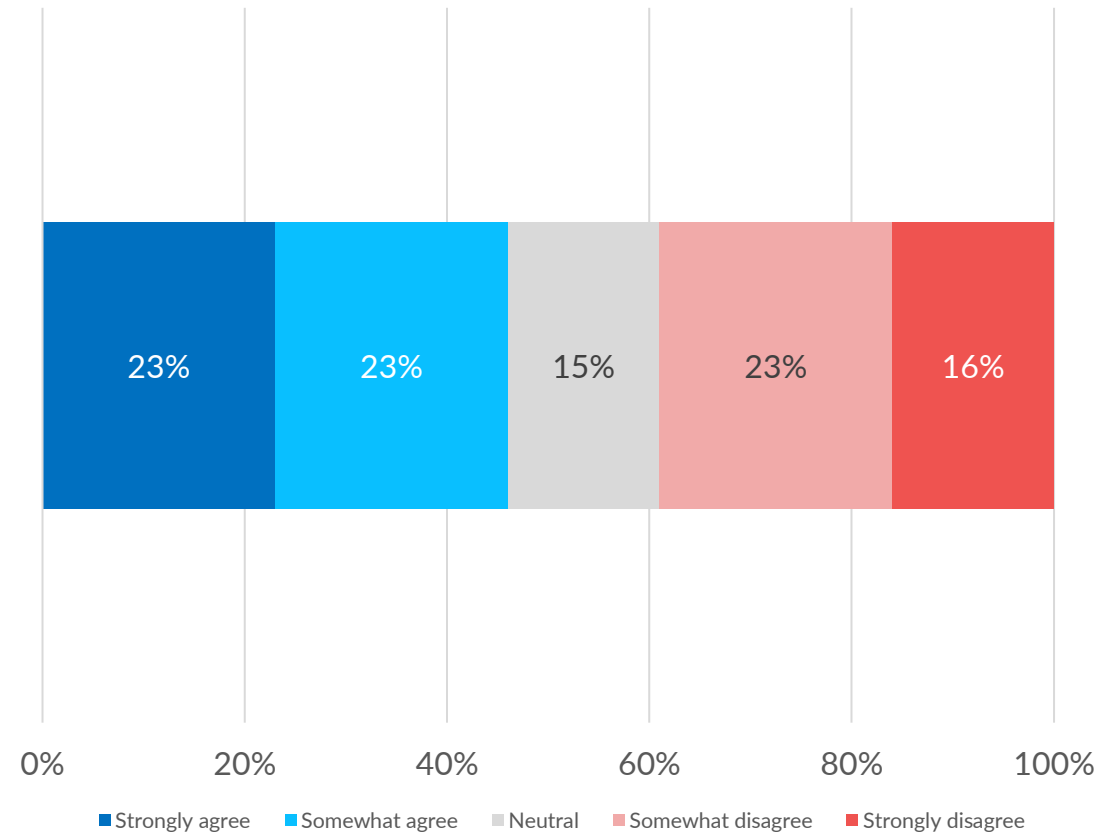
- **68%** indicated they felt the evacuation was conducted appropriately



# Public Perceptions of the Event

*“I believe that evacuation instructions were **clearly communicated** during the evacuation”*

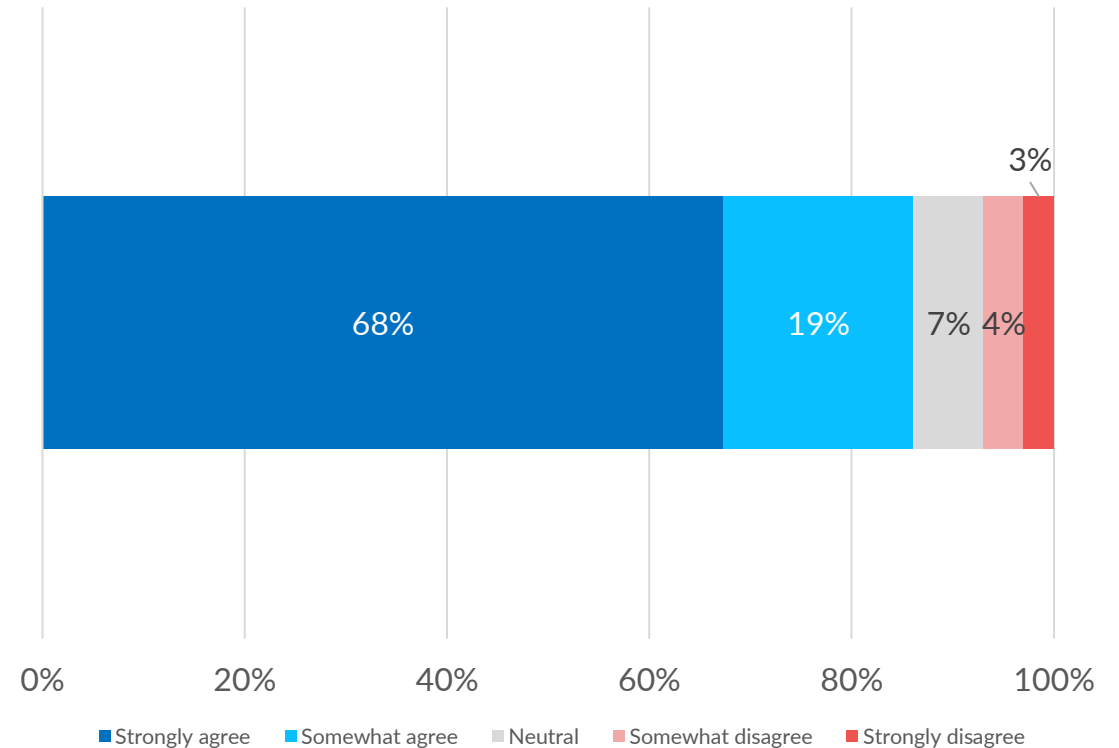
- **46%** indicated they felt evacuation instructions were clearly communicated



# Official Decision to Evacuate

*“I believe that given the information that was available at the time, the decision by emergency managers to evacuate ... was **the correct choice**”*

Evacuation Was Correct Response





# Research Question

**Q4:** *“What impacts has this event had on community perceptions of tsunami risk, their trust in emergency officials, and their participation in future evacuations?”*

# Changing Perception of Tsunami Risk

*Did the evacuation event change public perceptions of tsunami risk?*

- Participants were asked to rate their perceived tsunami risk prior to and following the event\*
- The relative change is shown here broken down by whether participants *believed* they lived in the inundation zone

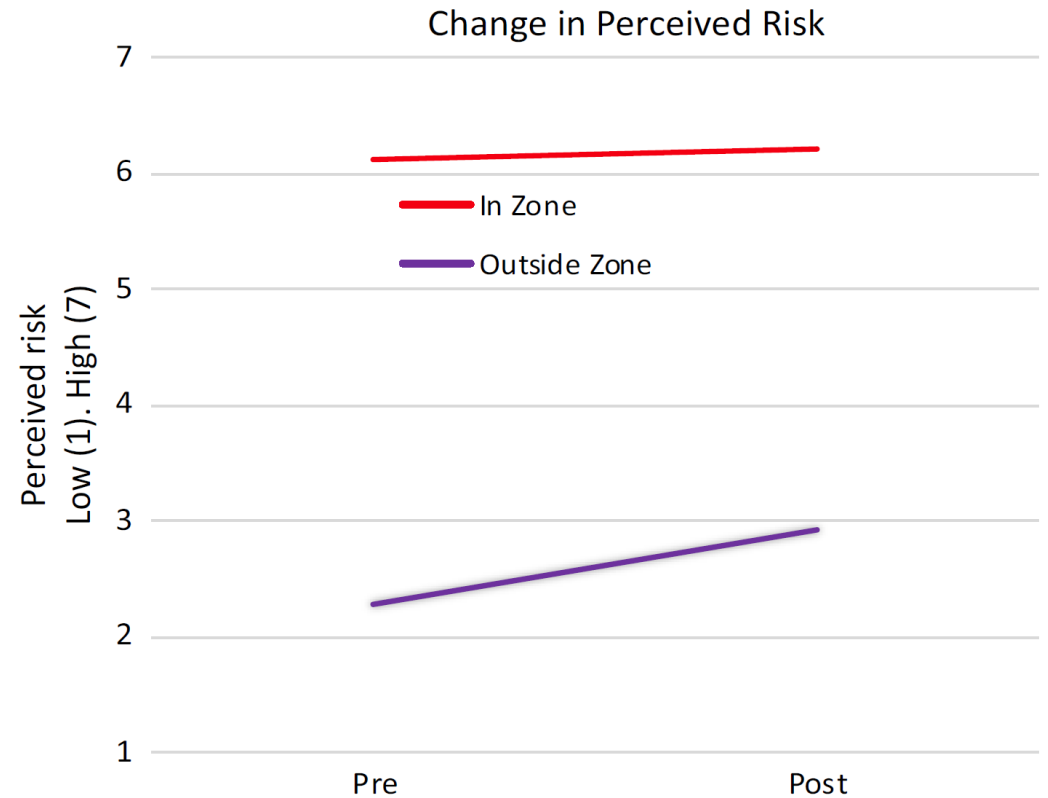
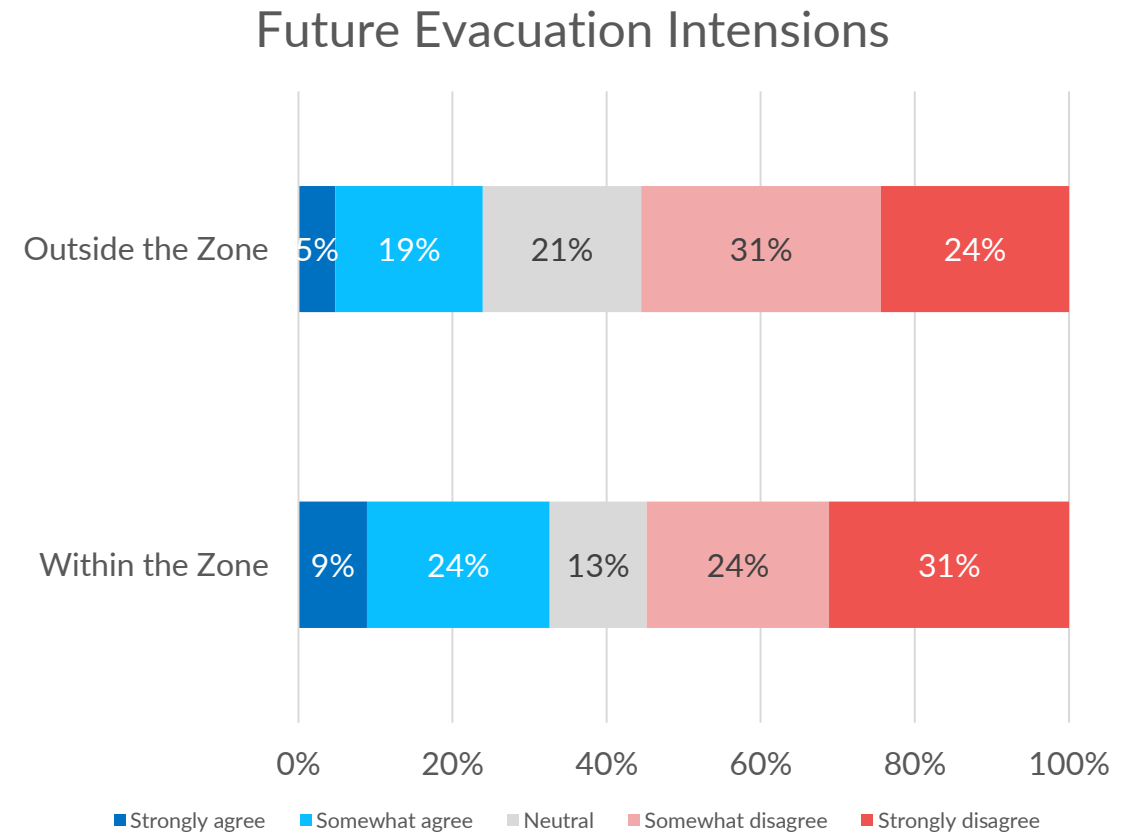


Image Credit: Tanner & Reynolds (2020)

# Sense of Worry or Fear about the Future

*“I feel worry or fear about my household’s ability to respond during a future emergency or evacuation”*

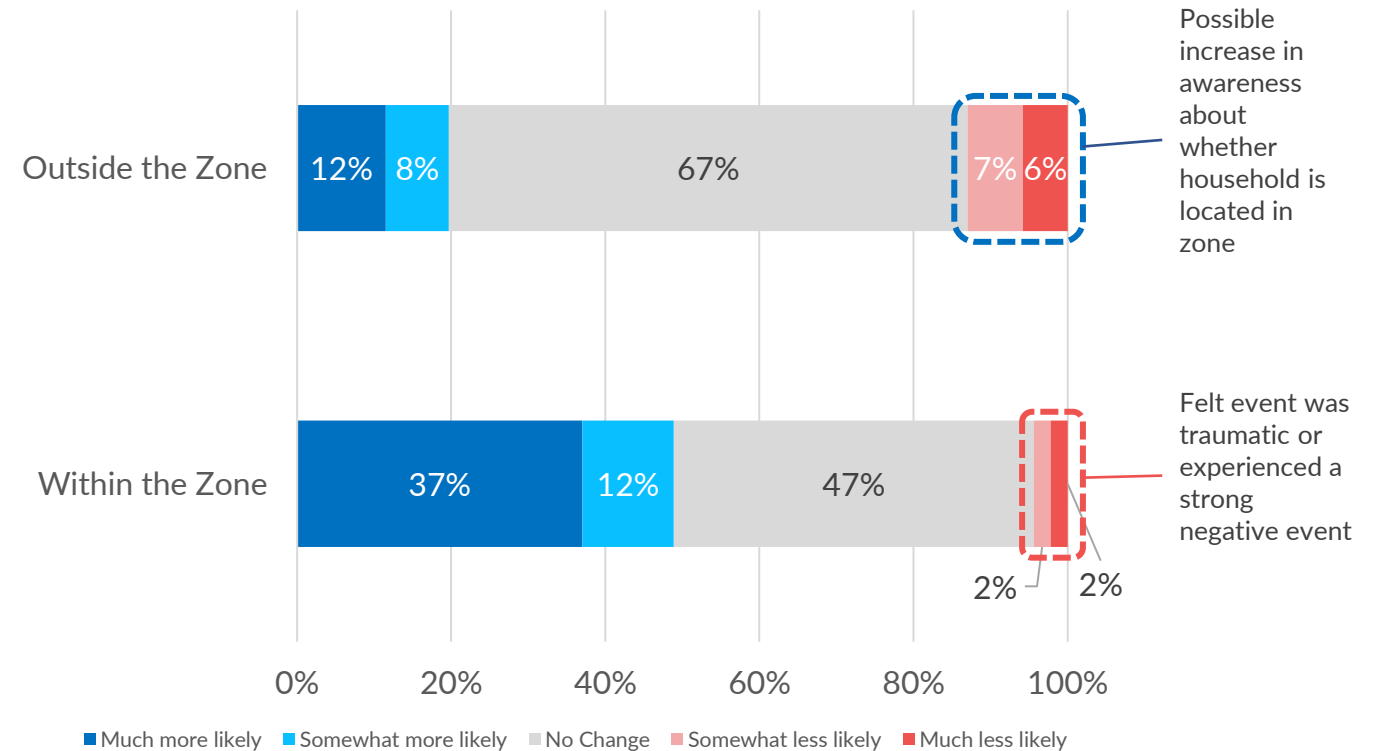
- Similar negative results between groups
- More uncertainty in those outside the zone
- More worry/fear within the zone



# Impacts on Future Evacuation

*“If a future tsunami warning were to occur, what impact would [the 2018] event have on your decision to evacuate?”*

### Future Evacuation Intensions






# Journal Article

More information on risk perceptions:


<https://link.springer.com/article/10.1007/s11069-020-04239-7>

Natural Hazards  
<https://doi.org/10.1007/s11069-020-04239-7>

ORIGINAL PAPER



**The near-miss of a tsunami and an emergency evacuation: the post-exposure effects on future emergency preparedness and evacuation intentions**

Alexa Tanner<sup>1</sup>  · Ryan Reynolds<sup>2</sup>

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**Abstract**  
In the early hours of January 23, 2018, residents of Port Alberni, British Columbia, Canada, awoke to the sounds of the community's tsunami warning system, alerting them of the need to evacuate. While the emergency evacuation successfully occurred, the tsunami, fortunately, did not. This event has provided an exceptional opportunity to understand how residents perceive near-miss events and how an evacuation experience due to a tsunami threat influenced residents' views towards emergency preparedness and future evacuation intentions. The results of our survey, completed by four-hundred fifty-seven households, reveal a partial let-down effect for those living within the tsunami inundation zone and a partial wake-up for those living outside the zone. For those within the risk region, no change in perceived risk was found post-event; however, households in the high-risk region indicated greater levels of worry or fear towards future evacuations compared to those outside the risk region. No differences were found in the number of households who had preparedness plans in place when compared by risk zones; however, those living within the tsunami inundation zone indicated higher levels of intention for creating an emergency plan post-event. Of importance, those who experienced difficulties in evacuating reported significantly lower intentions for future evacuation, higher levels of worry, and a stronger sense of disapproval towards the evacuation as compared to those who did not experience difficulties. Additional contributions of this paper include recommendations for officials responsible for initiating and managing an emergency evacuation.


**Keywords** Near-miss · Post-exposure · Tsunami · Emergency evacuation · Emergency preparedness

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# Our Recommendations

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Risk communication and evacuation recommendations

# Make Communications Part of the Front Line

## Pre-planning:

- Communications team should know exactly how they will integrate into the EOC and be **active participants** in all scenario planning and exercises
- Communications team should be aware of planned evacuation scenarios and **have messaging prepared** for each scenario
- Key scripts, websites, social media passwords, and contact information **should be prepared** and ready to be picked up immediately

## During Evacuation:

- Ensure communications representatives are part of the “**first notifications**” team
- Ensure communicators are given as much **notice** about a likely evacuation as possible to be ready to respond at  $T_0$
- Have at least one **backup communicator** who is aware of plans to cover when primary is away, unreachable, or directly impacted by the event

# Come to the People, Don't Make Them Find You

## Pre-planning:

- Identify **where** community members are likely to look for information during an emergency:
  - Official websites
  - Social media
  - Traditional media (and *their* websites)
  - Whiteboard outside City Hall
- Ask the community **what information** they are likely to need in an emergency:
  - Who is at risk, where to go, how to get there, what to bring, what to leave behind

## During Evacuation:

- Cast a **wide net** and ensure all official media has links to critical information
- Provide **regular updates**, even if there is nothing new to report – stale information dissolves trust!
- Use prepared materials where appropriate, but **be prepared to go “off script”** to adapt to changing situations



# Integrate Communications into Warning System Tests

## During Tests/Exercises:

- **Test as it will happen** “for real”
  - Confusion if things aren’t as expected
- Ensure communications representatives are included **at the table**
- Test all **communication protocols** along with the other systems – they need to work too!
- Ensure **prepared materials** are ready, up to date, and appropriate – identify gaps and areas that need to be updated following the exercise

## During Public Tests:

- Include clearly marked **test communications** where they will appear
  - Delete these messages after the test if appropriate
- Seeing such messages will help **train the public** where they will find this information when needed
- Helps build **good habits** for both the team and the public

# Risk Zone Mapping: Clear is Better than Perfect

When creating risk maps for the public, ensure zone boundaries are clear and easy to understand:

- **Easy to identify boundaries**, such as street centerlines, rail lines, or major landmarks
- Consider use of “**priority**” and “**secondary**” zones
- Being clear about who needs to evacuate reduces the number of **unnecessary evacuations** and ensures those who need to evacuate can do so



Precise risk zones are difficult to internalize, prone to error



Providing clear, easily understood boundaries helps reduce confusion

# Clear, Visible Signage

Signs are a simple method to communicate spatial risk information, particularly to tourists:

- Signage should be **immediately recognizable** and follow national/international standards
- Ensure **signs are visible** by keeping nearby trees well trimmed or relocating obscured signs
- Signs to identify when **entering and exiting** hazard zones
- Signs to identify official **evacuation routes**, showing direction to safety
- Signs to locate official **evacuation centres** or muster points



Photo Credit: [Times Colonist](#)



# Road Markings: Eliminate Ambiguity



Example of Tsunami Safe Zone Highway Road Marking from New Zealand

Source: [Waikawa Beach Ratepayers Association](#)



Example of Smaller Tsunami Safe Zone In-Town Road Marking from New Zealand

Source: [Newswire.co.nz](#)



# Make it Easy to Prepare & Avoid Where's Waldo

- **Make learning about local hazards easy**
  - Clearly describe local hazards
  - Clearly identify hazard risk zones
  - Provide information about household preparedness or link to relevant authoritative sources
  - Ensure this information is easy to find from your home page, don't burry it three steps down on your website's menu
- Include the information residents need to know about local hazards and household preparedness as part of **regular postings** to social media
- Adjust messaging to occasionally **focus on specific groups** to assist them to develop personalized preparedness and response plans:
  - Older adults
  - Very young children
  - Disabilities
  - Pets
  - No vehicle
  - Low income
  - High risk locations

# Additional Concerns in a Pandemic?

- **Life safety** will usually supersede pandemic response during a potential disaster
- Increased **hesitancy** to evacuate
- Increased **vulnerable populations**
- Additional households may be **unable to evacuate**
- Issues related to **social gatherings**:
  - Adjust plans that call for seeking shelter in homes of friends/family, may prefer to remain in vehicles
  - Capacity issues in evacuation or reception centres due to social distancing
  - Increased difficulty finding temporary shelter for displaced households

# The Final Findings Report

Our final findings report was published in March 2019, and is available from:

<http://bit.ly/WhatsThatSound2019>

