

Emotional responses and perceptions of false alarms in flood warnings and their impact on evacuation action in the Kyushu Region, Japan

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Outline

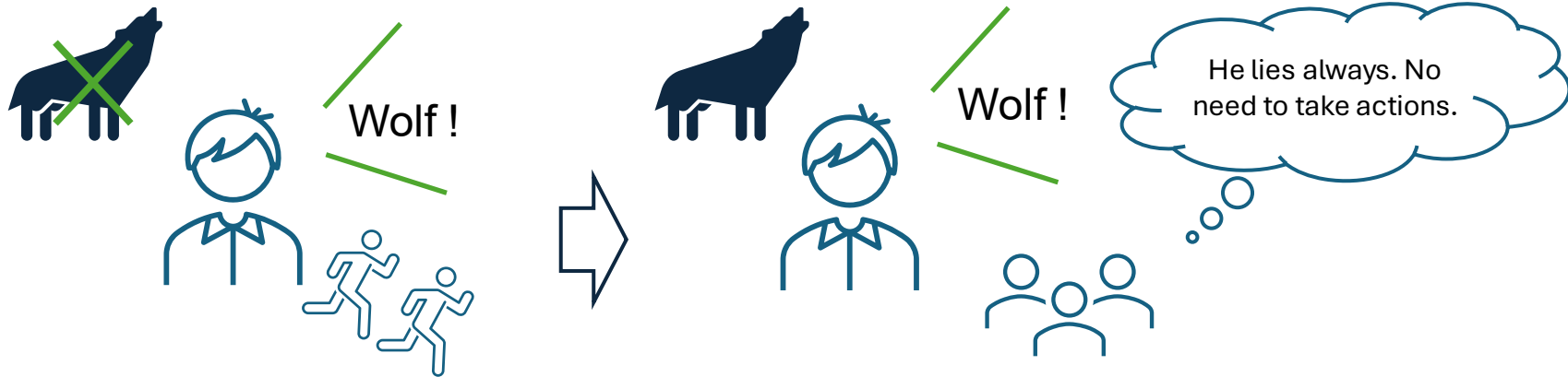
1. What is **false alarms**? (p.3)
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1. What is false alarms?

		Severe weather observed	
		Yes	No
Severe weather forecasted	Yes	Hit / true positive	False alarms / false positive
	No	Missed events / false negatives	All clear / true negative

2. What is Cry Wolf Effect ?

The boy who cried wolf (Aesop's Fable)



Inspired by this story, the word "**Cry wolf Effect**" refers to a situation where repeated false alarms of weather information cause people to lose trust in the information provider and stop taking action.

3. Why did we choose Kyushu ?

High-Risk Environment



Extreme Rainfall

It receives the highest annual rainfall in Japan.



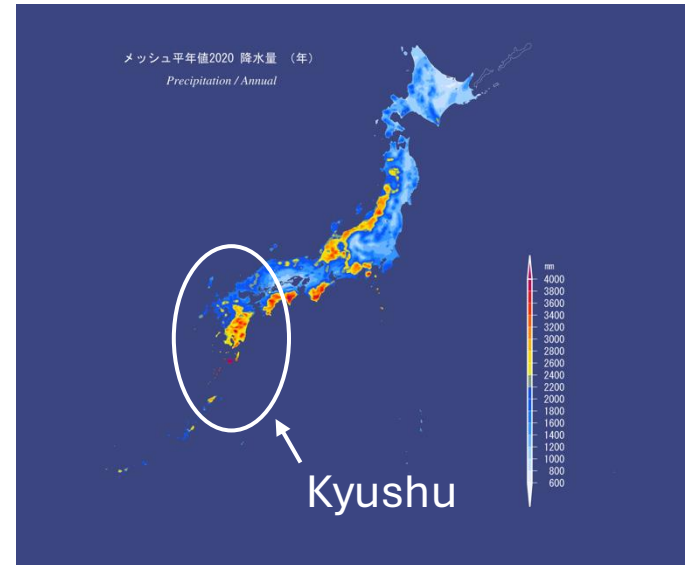
Weather Gateway

Prime path for typhoons and Linear Precipitation Zones (LPZs).



Frequent Warnings

Local governments issue flood warnings frequently.



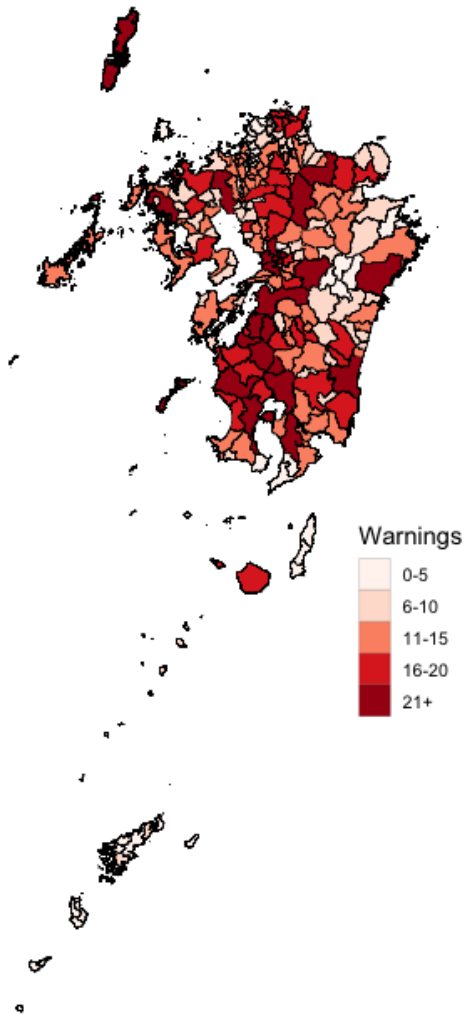
Precipitation 1 Annual (2020)[1]

These provides a unique environment to study the "Crying Wolf Effect" and how residents' evacuation behaviors evolve under repeated high-risk signaling.

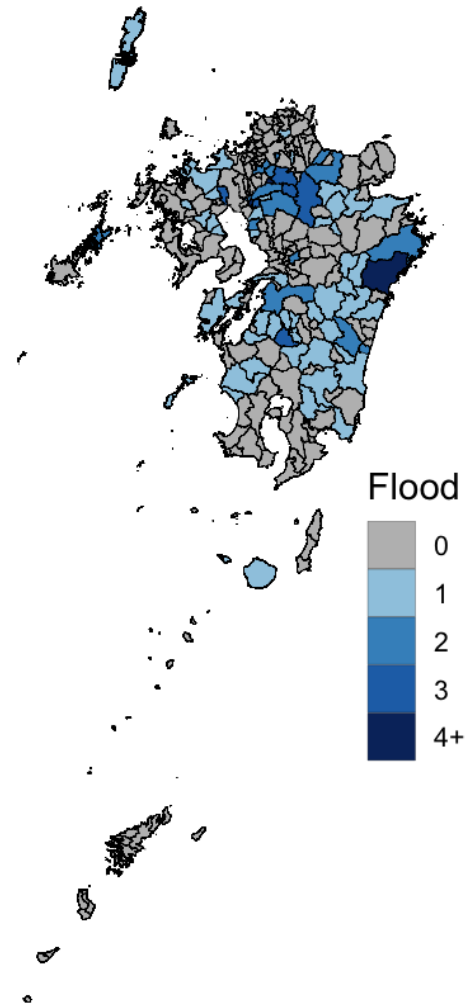
[1] Japan Meteorological Agency (2026) Mesh Normal Value Map [Mesh Heinentizu]<https://www.data.jma.go.jp/stats/etrn/view/atlas.html> Accessed 30 Apr 2026

3. Why did we choose Kyushu ?

Number of warnings issued



Number of flood occurred



4. What is Japan's warning system like?

- Japan uses a **five-level disaster warning system** to help residents understand risks and take timely protective actions.[2]

Level	Meaning	Typical Action
1	Early awareness	Check weather updates
2	Advisory	Confirm evacuation route
3	Warning	Prepare / Voluntary evacuation
4	Danger	Evacuate immediately
5	Emergency	Life-threatening situation

Flood
warning

- Flood warnings are mainly issued at the **municipal level** by the **Japan Meteorological Agency (JMA)**. [3]
- Issued when **severe flooding may occur** due to rising river levels, levee breach risk, heavy rainfall, snowmelt upstream [4]

[2] Japan Meteorological Agency (2026) Disaster prevention weather information and alert levels [Bosai kisho joho to keikai reberu tonu taiou nituite]. <https://www.jma.go.jp/jma/kishou/known/bosai/alertlevel.html>. Accessed 30 Apr 2026

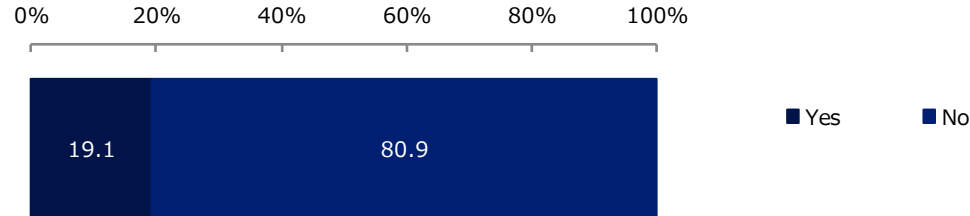
[3] Japan Meteorological Agency (2026) Areas covered by weather warnings, advisories, and forecasts [Kishokeiho chuiho ya tenkiyoho no happyokuiki]. <https://www.jma.go.jp/jma/kishou/known/saibun/> Accessed 30 Apr 2026

[4] Japan Meteorological Agency (2026) Types of weather warnings and advisories [Kishokeiho chuiho no shurui]. https://www.jma.go.jp/jma/kishou/known/bosai/warning_kind.html. Accessed 30 Apr 2026

5. What are the demographics of the survey respondents?

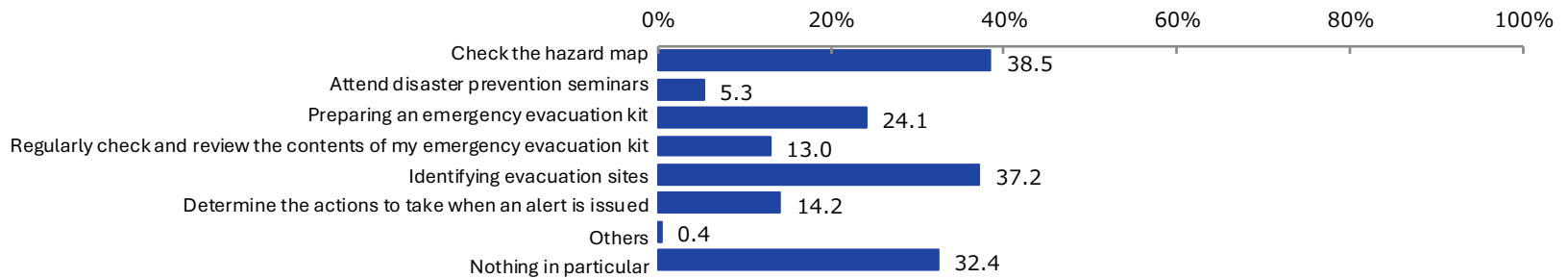
Experience

Have you ever experienced flood damage?



Daily disaster migration

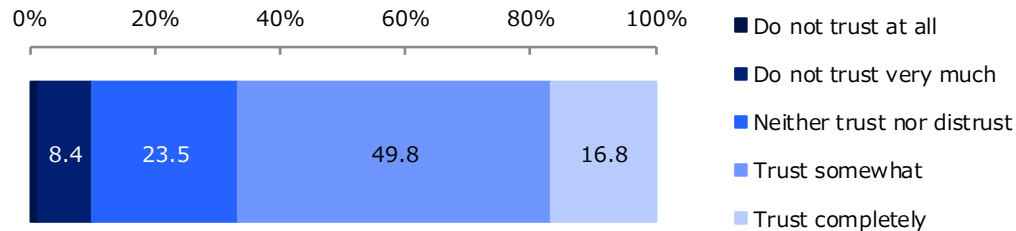
Are there any disaster preparedness measures you are mindful of in your daily life? (Select as many as apply)



5. What are the demographics of the survey respondents?

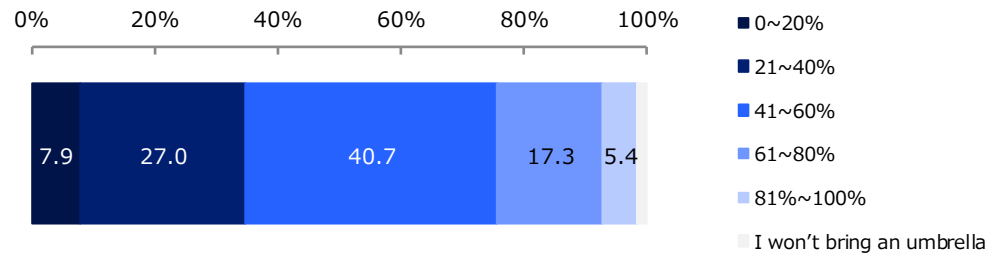
Trust

How much do you trust the Japan Meteorological Agency (JMA) as the issuer of weather warnings?



Risk preference

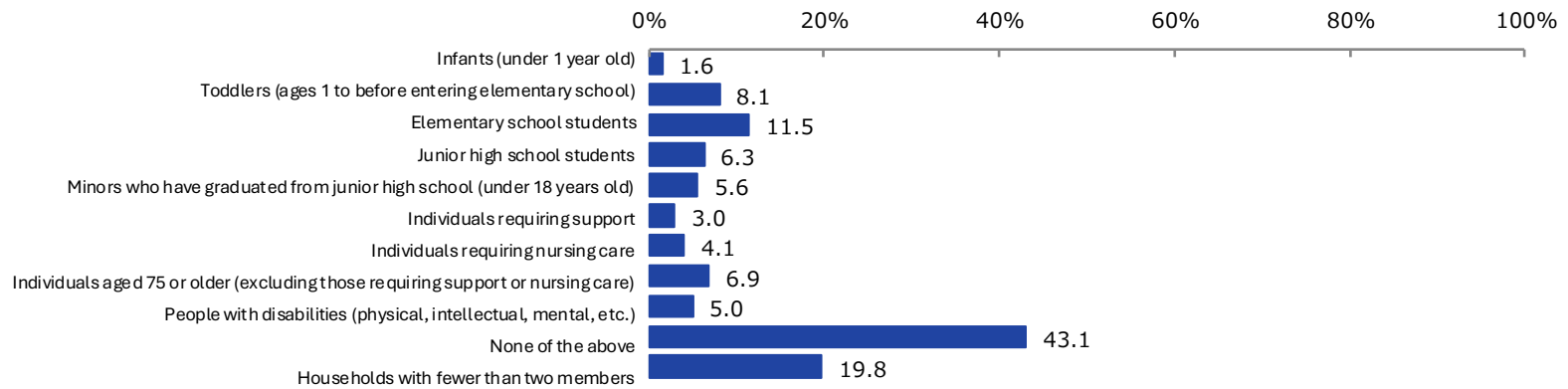
At what percentage of chance of rain do you decide to take an umbrella with you when you go out?



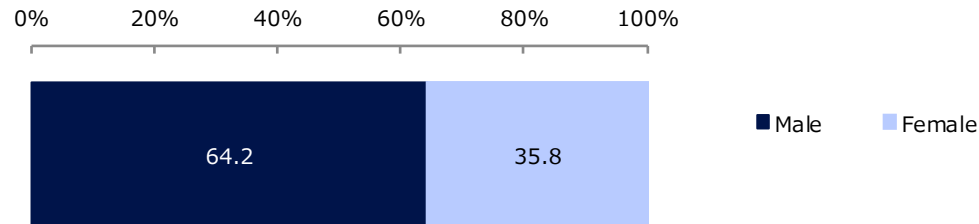
5. What are the demographics of the survey respondents?

Household composition

As of December 2024, does your household include any of the following people other than yourself? (Select all that apply)

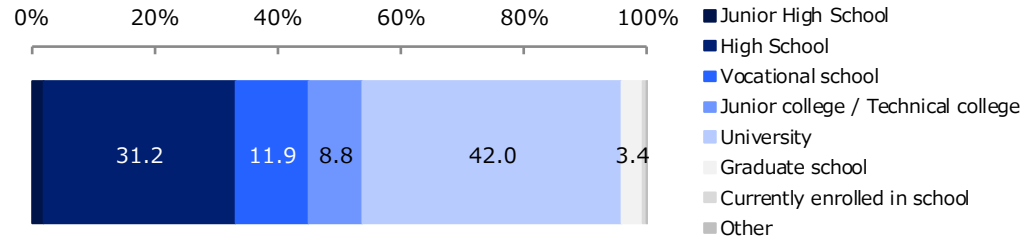


Gender

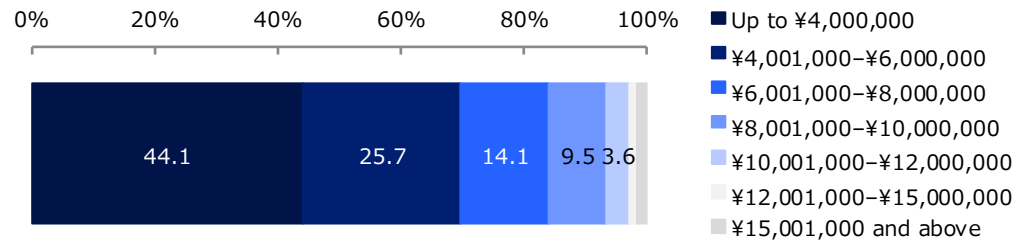


5. What are the demographics of the survey respondents?

Final Education



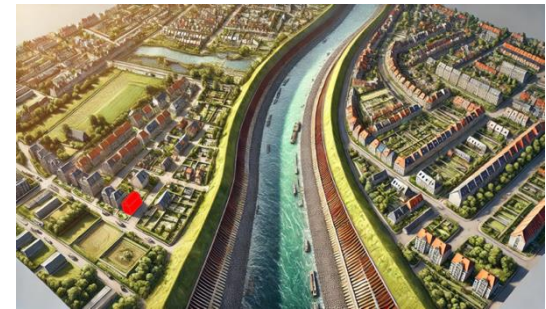
Household income



6. How did you ask about RQ1?

Present along with an illustrative diagram

When a flood warning is issued in your city, what situation do you think would constitute “the flood warning was hit” ?
Imagine that the **red part** is your house.



Usual



Level1: rising water levels



Level2: Flooding danger level reached



Level3: Overflowing



Level4: Flooding damage in other areas



Level5: Flooding damage in own areas

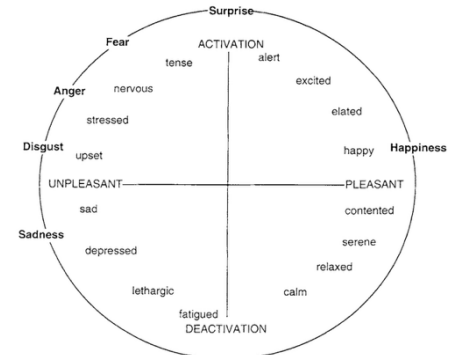


Level6: Flooding damage in own home

7. Why did you choose those four emotions?

Selected based on the Circumplex Model of Affect (Russell & Barrett, 1999), which conceptualizes emotions along two underlying dimensions:

- Valence: pleasant ↔ unpleasant
- Arousal: activated ↔ deactivated



A circumplex model [5]

Valence / Arousal	Selected Emotion	Operational Meaning in This Study
Unpleasant + Activated	Angry (怒り)	Feeling irritated, frustrated, or resentful about the warning
Unpleasant + Deactivated	Sad (悲しみ)	Feeling disappointed, discouraged, or emotionally let down
Pleasant + Deactivated	At ease (安心)	Feeling relieved, calm, or reassured after no damage occurred
Pleasant + Activated	Pleased (喜び)	Feeling glad, happy, or positively energized because no harm occurred

- These terms were chosen not as perfect one-to-one translations, but as **survey labels representing broader affective states** relevant to the context of false flood warnings.
- Because the original questionnaire was conducted in Japanese, slight differences in nuance may exist between Japanese labels and English expressions. Therefore, the definitions above are provided to clarify the intended meanings used in this study.

8. What kind of people feel what?

✓ multiple regression analysis

Women tend to feel more positive about false alarms, while men are more likely to have negative feelings.

People who trust the JMA tend to feel more positive about false alarms, while those who don't trust it are more likely to have negative feelings.

			Outcome variable			
			Joy	Relief	Anger	Sad
			after - before FA (Q2 - Q1)	after - before FA (Q2 - Q1)	after - before FA (Q2 - Q1)	after - before FA (Q2 - Q1)
Explanatory variable	Income	Annual income of 6 million yen or more: 1 Less than 6 million yen: 0	-0.00736	-0.0118	-0.0625	-0.183*
	Trust	1 (Very) - 5 (Not at all)	0.442***	0.396***	-0.185***	-0.296***
	Age	Age 60 or older: 1 Younger than 60: 0	-0.00523	-0.122	-0.123	0.0971
	Gender	Male: 1, Female: 0	-0.258**	-0.474***	0.0873	0.359***
	Experience	Experienced: 1 Inexperienced: 0	0.0790	0.0224	0.0384	-0.0319
	Children	With children: 1 Without children: 0	0.0434	-0.175	0.0364	0.0885
	Elderly	With elderly family members: 1, Without elderly family members: 0	0.383*	0.267	-0.150	-0.258
	Daily_disaster_preparedness	Disaster mitigation awareness: 1 (aware) 0 (not aware)	0.266**	0.298***	-0.129	-0.136
	Educational_background	University graduate: 1 Other: 0	-0.0528	0.108	0.108	0.0916
	Riskpreference	1 (Risk-averse) - 6 (Risk-loving)	-0.112**	-0.135***	0.00724	0.0887**

People with a higher daily awareness of disaster mitigation are more likely to feel positive about false alarms.

People who are risk-loving tend to feel more positive about false alarms, whereas those who are risk-averse are more likely to have negative feelings.

9. Where does pFAR come from?



Possible Origins of pFAR (previous studies^[6,7,8] & my opinion)

1. Trust in warning issuers

Lower trust in authorities may increase perceptions of false alarms

2. Spatial mismatch between warnings and perception

- Warnings are issued for municipalities, but residents may judge them based on conditions near their homes.
- This gap may increase perceived false alarms.

Perceived FAR is socially constructed, not purely meteorological.

[6] Lim JR, Liu BF, Egnoto M (2019) Cry Wolf Effect? Evaluating the Impact of False Alarms on Public Responses to Tornado Alerts in the Southeastern United States. *Weather Clim Soc* 11: 539-563. <https://doi.org/10.1175/WCAS-D-18-0080.1>

[7] Ripberger JT, Silva CL, Jenkins-Smith HC, et al (2015) False Alarms and Missed Events: The Impact and Origins of Perceived Inaccuracy in Tornado Warning Systems. *Risk Anal* 35:44-56. <https://doi.org/10.1111/risa.12262>

[8] Trainor JE, Nagele D, Philips B, Scott B (2015) Tornadoes, Social Science, and the False Alarm Effect. *Weather Clim Soc* 7:333-352. <https://doi.org/10.1175/WCAS-D-14-00052.1>

10. How can the results of this study be applied in practice?

Key Findings

- People who perceive warnings as frequent “false alarms” are less likely to evacuate. (RQ4-1)
- This negative effect is weakened when people hold **positive emotions** toward false alarms.(RQ4-2)

What This Means

- **Warning accuracy alone is not enough.** Even technically accurate warnings may fail if residents perceive them negatively.
- **Public perception matters.** How people interpret repeated warnings influences future evacuation behavior.

Practical Actions (Detailed on the next page)

- **Improve risk communication**
- **Build trust through transparency**

10. How can the results of this study be applied in practice?

Practical Actions

- **Improve risk communication**



False Alarms as "Karaburi" (空振り)
A "swing and a miss" in baseball.
Implies a wasted effort or a failure.



Update !

NOW

IDEA

Re-framing as "Suburi" (素振り)
A "practice swing."
Focuses on building skills and preparing for the real thing.

- **Build trust through transparency**

Explain:

uncertainty in
forecasts

why early alerts are
necessary

why warnings were
issued