Storm Emma (2018): A Protection Motivation Perspective

An Analysis of Household Preparedness for Storm Emma and the cold spell which struck Ireland between the 28th of February and the 4th of March 2018

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1.0 Introduction

Modern emergency management theory recognises that it is often the public, not the emergency services, who will execute the first response during many national emergencies. "Adequate household emergency preparedness could significantly reduce the negative consequences from disasters and ensure that people can care for themselves and their families during the first 72 hours following a disaster" (Levac et al. 2012 p.725).

This report presents a case study of Storm Emma and the cold spell which struck Ireland between the 28th of February and the 4th of March 2018 from a Protection Motivation Theory perspective. The report covers:

- Respondents perception of weather and climate-related risk perception before Storm Emma;
- An assessment of the cause, level and pattern of worry – before and during Storm Emma;
- Household preparedness actions before and post Storm Emma;
- Respondents reflections on their household preparedness and actions that should have been taken to prepare;
- The extent to which respondents perceived they coped during Storm Emma;
- Evidence of community and individuals providing support and assistance;
- Respondents satisfaction with the Met Éireann weather warning system and the link between preparedness action and the Met Éireann weather warnings
- Satisfaction with the national response to Storm Emma;
- Respondents' socio-demographic characteristics, with an emphasis on gender, settlement (urbanicity) and county;
- An assessment of whether elements of protection motivation theory, worry and post-event coping appraisal, influenced household preparedness before and following Storm Emma.

The outline of the report is as follows:

Section 2.0 Storm Emma & The Beast from the East: presents an overview of The Storm and a timeline of the events.

Section 3.0 Background Literature: Protection Motivation Theory: provides an overview of Protection Motivation Theory and its key elements.

Section 4.0 Methodology: details the methodological choices adopted in this case study, including the quantitative and qualitative data analysis used.

Section 5.0 Weather Risk Perception: examines public perception of the impact, likelihood and overall risk rating for weather-related events. The weather-related risks considered were

drawn from the National Risk Register (2017): Flooding, Snow, Low Temperatures, High Temperatures, Storm, and Drought.

Section 6.0 Profile of Respondents: describes the sample of respondents in terms of their socio-demographic characteristics.

Section 7.0 The Public Response to the Storm: presents the findings from the case study of Storm Emma. Which includes:

- Worry about the Storm – cause, level and pattern of worry – before and during Storm Emma;
- Household Preparedness – actions taken before The Storm and household preparedness items present within the home;
- Actions which should have been taken to prepare for the Storm – respondents reflections of other actions they should have taken with the benefit of hindsight;
- Actions taken following the Storm to protect themselves or home against future severe weather events;
- Community Response - examines the role played by the community during and immediately after The Storm;
- Weather Warnings – respondents' opinions of the current Met Éireann weather warning system and the alerts they received about The Storm;
- Satisfaction with the National Response to Storm Emma.

Section 8.0 Regression Analysis: Protection Motivation Theory: presents regression analysis results that investigate whether elements of protection motivation theory influenced household preparedness actions before and following The Storm.

Section 9.0 Conclusion: Through a PMT Lens – which includes a final PMT model based on Storm Emma.

2.0 Storm Emma & The Beast from the East

Storm Emma was a severe weather event during the winter of 2018, causing record low temperatures, life-threatening blizzard conditions, massive countrywide disruption and the issuance of a nationwide red level alert and curfew (Met Éireann, 2019; NDFEM, 2019). This weather event resulted from the convergence of two discrete systems Storm Emma and the so-called Beast from the East (henceforth referred to as The Storm) over Ireland from the 28th February to the 4th March 2018 (Met Éireann, 2019; NDFEM, 2019).

Extremely cold air usually situated above the North Pole during wintertime is typically confined by a protective stratospheric jet stream propagating around the Pole known as the Polar Vortex (Met Éireann, 2019). A meteorological phenomenon called Sudden Stratospheric Warming (SSW) can cause this jet stream to destabilize, releasing a cold air mass (Met Éireann, 2019). This phenomenon occurred during the winter of 2018, liberating the very cold air mass, The Beast from the East, which was carried by the Easterly wind currents of a high-pressure system towards Ireland from Siberia (Met Éireann, 2019; NDFEM, 2019). The Beast from the East established itself over the country bringing with it unrelenting daytime temperatures of one to two degrees Celsius and sub-zero overnight lows (Met Éireann, 2019; NDFEM, 2019).

Simultaneously, a low-pressure system, named Storm Emma by the Portuguese Meteorological Service, developed in the North Atlantic (Met Éireann, 2019). Another result of SSW is that high-pressure systems are pushed South and blocking low-pressure systems are pushed North. Where they collide, they create a weather front that typically occurs at global latitudes between 50-66 degrees North and results in very wet and unsettled weather upon the landmass beneath (Met Éireann, 2019; Ryan, 2020). Ireland is situated at these latitudes in the North-Western Hemisphere, which explains the country's unsettled, wet, variable and difficult to predict weather (Ryan, 2020). This front brought together bitterly cold dry air and a warm moisture-rich system resulting in large amounts of snowfalls, arctic temperatures and, because of the converging systems, high winds. This combination resulted in blizzard conditions on the night of 1 March (Met Éireann, 2019; Ryan, 2020). The weather conditions Ireland experienced during The Storm had not been endured for almost 36 years -

since "The Big Snow" of January 1982 (DHPLG, 2018; NDFEM, 2019; Met Éireann, 2019; RTE, 2020).

2.1 Timeline

11th of February 2018: there was a split in the stratospheric polar vortex over the North Pole just before the SSW occurred (Met Éireann, 2019a).

16th of February 2018: the European Centre for Medium-Range Weather Forecasts (ECMWF) began deterministic modelling (with low certainty) of the potential path of the high-pressure system carrying the polar air mass.

20th of February 2018: it was confirmed, with high probability, that the anticyclone emanating from Siberia would establish itself over Ireland around the 27th/28th February (Met Éireann, 2019a; ECMWF, 2020).

22nd of February 2018: Met Éireann informed the Severe Weather Team in the National Directorate for Fire and Emergency Management (NDFEM), Department of Housing, Planning and Local Government, of the system's arrival over Ireland and confirmed it would bring unseasonal low temperatures and significant snowfalls.

23rd of February 2018: Met Éireann issued the first weather advisory (WA) for the event - that disruptive snow and exceptionally cold weather was expected from the 27th onwards (Met Éireann, 2019a). The NDFEM severe weather team decided to convene a meeting of the National Emergency Coordination Group (NECG) for Monday 26 February (Met Éireann, 2019a; NDFEM, 2019).

24th of February 2018: An update to the WA was issued. This WA warned of disruptive snow showers, particularly in the East and South East, perhaps merging into more persistent bands of snow. Met Éireann also began to monitor the development of a low-pressure system in the Mid Atlantic over the Bay of Biscay which was named 'Emma' by the Portuguese Meteorological Service. Met Éireann informed the NDFEM of the potential for mid-week blizzard conditions should the systems merge (Met Éireann, 2019a; NDFEM, 2019).

25th of February 2018: Storm Emma is tracked moving towards the Azores and Portugal bringing heavy rain and predicted to move northwards pushing up against the established anticyclone air mass. Update on WA confirmed that ground temperatures would be 5 to 10 degrees below normal, with significant wind chill and penetrating severe frosts. Snow

showers would become more widespread with significant and disruptive accumulations (Met Éireann, 2019a; NDFEM, 2019). "The Irish Times" began coverage of the event and used the name "the Beast from The East" (McGreevy, 2018).

26th of February 2018: The first meeting of the NECG took place. All Local Authorities were contacted and requested to activate their crisis management teams, local co-ordination centres, and any other arrangements they deemed necessary. The objective was to keep the country running, with an emphasis on public safety preparation (Clancy, 2019; NDFEM, 2019). Update to WA: sustained night-time sub-zero temperatures with day-time lows of -1 to 2°C (Met Éireann, 2019a).

27th of February 2018: Night-time snow showers fuelled by moisture picked up from the Irish Sea began to affect the South and East, eventually moving West and bringing accumulation of 5-10cms of snow in places. NECG advised that school closures are a matter for each School Board of Management, food supplies, supply chains and other essential services are to remain open (Clancy, 2019 DHPLG, 2018c). NECG urged the public to take preparatory mitigation measures. Employers were asked to spend the day planning and making the necessary arrangements for their employees, taking into account the forecasted weather and anticipated travel conditions on Thursday evening into Friday (DHPLG, 2018c). The first mention of Storm Emma by the NECG was printed by "The Irish Times" (Burns, 2018; DHPLG, 2018c).

28th of February 2018: Storm Emma began to move northwards and Met Éireann issued the first red warning for Dublin, Kildare, Louth, Wicklow and Meath from 0500 28 February until 1200 on the 1 March (Met Éireann, 2019a NDFEM, 2019). NECG closed all state schools in areas covered by the red alert on Thursday 1 and Friday 2 March. Bus Éireann services provided under the Dept. of Education and Skills School Transport Schemes were cancelled once a red status warning was announced. Schools in other areas not affected by red level warning decided on a case-by-case basis (DHPLG, 2018d). 2300 Met Éireann issued a red warning for the entire country (Met Éireann, 2019a).

1st of March 2018: NEGC issued a stay-at-home advisory stating that everyone must be indoors by 1600 until 1500 on the 2 March. Instructions were issued that motorways should remain open, and emergency services would respond as required. Dublin Bus and Bus Éireann services were suspended, Irish Rail was operating with significant delays and cancellations,

and Dart services were suspended. Dublin Airport operated with significant delays and cancellations, and ferry services were cancelled (DHPLG, 2018e; Met Éireann, 2019a). By 1800 Storm Emma moved northwards bringing persistent snow, sub-zero temperatures and strong easterly winds to the South and South-East and, finally, to the rest of the country overnight and into Friday 2 March.

2nd of March 2018: The shelter in place advisory was withdrawn at 0745. NECG urged no unnecessary travel. Met Éireann red level snow warning remained in place on Friday morning for Munster, Leinster and County Galway. An orange level warning was in place in the rest of the country (NDFEM, 2019).

3rd of March 2018: Dublin Port reopens to tankers for oil distribution.

5th of March 2018: All major transport routes were open. There was a risk of flooding due to thawing snow, and the NECG continued to issue community resilience and safety messages.

7th of March 2018: Final meeting of the NECG. Most Local Authorities stood down, some backlog with oil deliveries, warning of possible flooding, and water shortages remained. No press conference on this date, but a press release was issued. The NECG stood down (Clancy, 2019).

2.2 Timeline of Weather Warnings (Met Éireann, 2019a)

- Friday 23rd of February: Yellow warning, very cold weather forecast, severe wind chill, frosts and snow.
- Saturday 24th of February: Yellow warning for snow showers merging into more persistent bands of snow from midweek, particularly in the East and Southeast.
- Sunday 25th of February: Yellow warning for air and low ground temperatures, 5-10 degrees below normal, wind chill, and snow showers which will become heavier through midweek, disruptive accumulations of snow.
- Monday 26th of February: Orange warning for Dublin, Carlow, Kildare, Laois, Louth, Wicklow and Meath. 4-6cms of snow expected. A yellow warning for the rest of Ireland.
- Tuesday 27th of February: Orange and Yellow warnings remain in place.

- Wednesday 28th of February: Red warning for Munster and Leinster @1100, orange warning Connaught, Monaghan and Cavan. 2300 Red Warning covering all of Ireland, snow showers, significant accumulations, blizzard conditions will develop.
- Thursday 1st of March: Red warning for Munster, Leinster, Connacht, Cavan, Monaghan and Donegal. Sub-zero temp and icy conditions, strong Easterly winds, and blizzard conditions with exceptionally high accumulations of snow.
- Friday 2nd of March: Red warning for Munster, Leinster, and Galway. Snow accumulations continuing. End of Red warning.
- Saturday 3rd of March: Orange warning for Munster, Leinster Monaghan. Some snow widespread, treacherous surfaces, and rain spreading from the South with the potential for flooding.
- Sunday 4th of March: Orange warning for warning Munster, Leinster, Cavan and Monaghan. Widespread snow (lying) and ice will continue to lead to hazardous conditions. Risk of localized flooding.
- Monday 5th of March: Orange warning for Leinster. Deep snow remaining in places, localized flooding risk.
- Tuesday 6th of March: Warnings lifted.

2.3 Impacts of Storm Emma (Met Éireann, 2019a)

2.3.1 Travel

Storm Emma caused severe disruption to the transport network with many cars abandoned in many places. Air transport experienced many flight cancellations and airport closures with over 70,000 passengers stranded. Many rural locations cut off for several days. Public transport nationwide including bus, rail and Luas came to a standstill. Many ferry services were cancelled.

2.3.2 Power and Water Outages

The ESB reported over 100,000 homes and businesses lost power. Eir reported more than 10,000 were without telephone or broadband and Irish water confirmed that 18,000 people were without water across the country.

2.3.3 Disruption to Other Services

Critical HSE staff stayed overnight in hotels, in temporary accommodation in hospitals, or were transported to work by the fire services, the defence forces, and civil defence. Colleges, schools, businesses, leisure centres, public libraries, public offices and community centres were shut down. Some coastal flooding was reported during high tides in towns along the East and South coasts.

2.3.4 Farming

Some farmers, especially in the Southeast and East, suffered significant loss of crops, machinery and livestock due to the cold and as a result of shed collapse. There were fodder shortages and food shortages. Growers in the soft fruit and nursery stock sectors were also badly hit by the heavy snowfall with tunnels and glasshouses collapsing.

3.0 Background Literature: Protection Motivation Theory

Protection Motivation Theory (PMT) originates from research into health psychology that focused on explaining the impact fear can have on health-related behaviours (Rogers, 1975; Floyd et al., 2000). Higbee (1969) explains that the basis of fear or threat appeals in health risk communication is to associate an undesirable or unsafe practice (e.g., smoking) with negative consequences (e.g., cancer). The fear appeal for the cessation of smoking relates the negative consequences, the self-efficacy of the response (i.e., quitting smoking), and the lessening the risk of the consequence becoming an actuality.

The motivation behind both health protection and disaster preparedness are encouraged by the same principles; recognition and assessment of the danger and efficacious mitigation options (Westcott et al., 2017). The core elements of Protection Motivation are outlined in Figure 1 below.
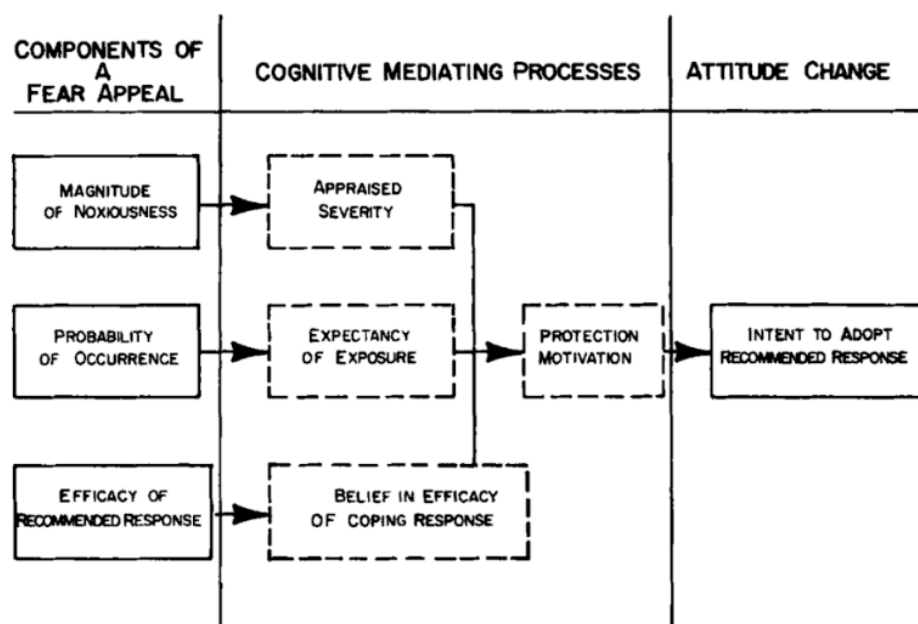
Figure 1: Schema of The Protection Motivation Theory (Rogers, 1975, p. 99)

Figure 2 sets out the two key cognitive processes, threat appraisal and coping appraisal, that together influence the decision to take protective action, or not (Rogers and Prentice-Dunn 1997; Floyd et al., 2000).

Figure 2: Model of Protection Motivation Theory (Reproduced from Floyd et al., 2000, p.410)

The first process, threat appraisal, is used to weigh risk (Rogers and Prentice-Dunn, 1997). The threat appraisal process is understood to commence first, as identification of the threat must exist before a protective response can be evaluated (Floyd et al., 2000). It considers the severity of the outcome and the probability of occurrence (vulnerability or expectancy of exposure). These are often "subjective judgment[s] that people make about the characteristics and severity of a risk." (Darker 2013).

- Severity is defined as "The magnitude of the damage …" in other words the impact that an event may have: "The effects that the consequences have on specified values (such as human life and health, environment and economic assets)" (SRA 2018, p.6).
- Vulnerability is defined as "a measure of the propensity of an object, area, individual, group, community, country or other entity to incur the consequences of a hazard' (Coppola, 2015, p.193). In other words, "Vulnerability is the likelihood that an individual or group will be exposed to and adversely affected by a hazard" (Cutter 1993).

Fear is associated with the threat appraisal in effecting protection motivation (Rogers and Prentice-Dunn 1997). Fear is defined as "an affective state protecting one against danger or a motivational state leading one away from something" (Rogers 1975, p.95). Described as a sub-component, it "plays an indirect role in threat appraisal by affecting the estimate of the severity of the danger" (Grothmann and Reusswig 2006, p.105). Rogers and Prentice-Dunn (1997) emphasise that factors other than fear and threat have shown to play motivating roles in assessing risks and protective actions.

The second key factor is coping appraisal, which occurs when "individuals perceive that the available protective measures are effective, easy and not too costly" (Poussin et al., 2014, p. 70). Coping appraisal incorporates three components: response efficacy, self-efficacy and response costs. Together, this "process evaluates the ability to cope with and avert the threatened danger." (Floyd et al., 2000, p.411).

- Response efficacy is "the belief that the adaptive response will work, that taking the protective action will be effective in protecting the self or others." (Floyd et al., 2000, p.411).

- Self-efficacy "the person's belief that he or she is or is not capable of performing the requisite behavior" (Maddux and Rogers 1983, p.470).
- Response costs account for a person's estimation of how costly it would be to implement the protective response (Floyd et al., 2000). These costs can include financial, personal, time and general effort (Floyd et al., 2000).

The PMT appraisal outcome can be categorised into three states: the decision (or intention) to take protective action, continue taking action, or inhibit commencing an action.Rogers (1975) and Maddux and Rogers (1983) emphasised that this decision-making process focuses on adverse events and understanding the effect of fear. While PMT has been applied extensively across the health sphere, it has also been applied to areas where risk messaging is involved (Olson and Zanna, 1993, p. 139). For example, Grothmann and Patt (2005) suggested that PMT can explore individuals' behaviour regarding emergency preparedness. Given that the motivation behind both health protection and emergency preparedness are encouraged by the same principles, it recognises the threat and evaluates the mitigation options (Westcott et al., 2017).

4.0 Methodology

4.1 Data Collection

A questionnaire was administered online (anonymously using Qualtrics) through May and June 2018—approximately two months after The Storm—with participants voluntarily opting-in on behalf of their household across the entire island of Ireland. Social networking sites (Twitter; Facebook; LinkedIn) were used to promote the questionnaire—which included the use of paid promoted links— and it was also promoted using official social media accounts, such as the Met Éireann (the national meteorological service), County Councils (Local Government), the Office of Emergency Planning, and Dublin Fire Brigade.

Data was collected from 4451 households. The household socio-demographic characteristics of those surveyed (64.9% of households earned less than €70,000, and 70.1% owned their home) matched closely the latest Irish census data from 2016: 62.6% had a gross income of less than €60,000 (CSO, 2016); 67.6% homeownership (CSO, 2016). Furthermore, the CSO reported 31.4% of people in Ireland lived in a rural area which also closely matched the survey data (30%) (CSO, Urban and Rural Life in Ireland, 2019). However, the individual socio-demographic characteristics of those who completed the survey did not perfectly align with the population in the case of both gender (with an over-representation of females) and respondent's age (with an underrepresentation of older people within the age range 65+) (CSO, 2016).

4.2 Quantitative Data Analysis

Before analyzing, the data was checked and cleaned to prevent errors in the dataset impacting results (Van den Broeck et al., 2005). The data were screened to identify anomalies such as missing values, outliers determined to be impossible values, and inconsistencies in data. In the case of missing values, imputation for variables was carried out where possible, based on the individuals' responses to other questions. This imputation was only completed when inferences could be made with certainty. Impossible, obviously erroneous values for variables were recoded as missing values.

The quantitative analysis was carried out using the statistical software package STATA (StataCorp Release 16.1/SE). Descriptive statistics (frequencies and measures of central tendency) were presented to provide an overview of all responses. Breakdowns of responses by respondents' gender, county, and settlement type (urbanicity), were provided for items of interest. Basic statistical tests were performed to check whether observed differences in results are statistically significant. These included t-tests for differences in mean, Kruskal Wallis tests which checked whether responses for different groups are drawn from the same distribution, and Chi-square tests of independence between variables. The final section was

then assessed using various regression analysis techniques (see 8.0 Regression Analysis: Protection Motivation Theory).

4.3 Analysis of Qualitative Data

The methodology adopted by this study is based on content analysis as defined by Krippendorff (2004, 2013) who drew on the work of Lasswell (1946) in his development of this methodological framework. Maykut and Morehouse (1994) point out: "words are the way that most people come to understand their situations, we create our world with words, we explain ourselves with words, we defend and hide ourselves with words", thus, in qualitative data analysis and presentation: "the task of the researcher is to find patterns within those words and to present those patterns for others to inspect (p18).

Framed by a focus-of-inquiry, data were collected using an online questionnaire that included open-ended questions designed to allowed respondents to articulate their perceptions and experiences freely. In analyzing data generated in this format, responses were not grouped according to pre-defined categories, rather salient categories of meaning and relationships between categories were derived from the data itself through a process of inductive reasoning known as coding units (Stemler, 2001). This process involved breaking down the data into discrete 'incidents' (Glaser and Strauss, 1967) or 'units' (Lincoln and Guba, 1985) and coding them into categories.

NVivo software was used to organize and interpret the data. It must be stressed that in using qualitative data analysis software, the researcher does not capitulate the hermeneutic task to the logic of the computer; rather the computer is used as a tool for efficiency and not as a tool which in and of itself conducts analysis and draws conclusions. As Fielding and Lee (1998) explain, qualitative researchers "want tools which support analysis, but leave the analyst firmly in charge" (p167). Importantly such software serves as a tool for transparency; logging data movements and coding patterns, and mapping conceptual categories and thought progression.

There were eight discrete cycles of analysis (see below and in Appendix One).

Phase 1 – Downloading qualitative comments and demographic and other profiling information into a table for import into a computer-aided qualitative data analysis system (CAQDAS) known as NVivo.

Phase 2 – Generating Initial Codes involved broad participant-driven initial coding of the survey submissions to deconstruct the data from its original chronology into initial non-hierarchical general codes.

Phase 3 – Categorization of Codes involved re-ordering codes identified and coded in phase 1 into categories of codes by grouping related codes under these categories and organizing them into a framework that made sense to further the analysis of this particular data set and research questions.

Phase 4 – Coding On involved breaking down the now restructured categories into sub-categories to offer more in-depth understanding of the highly qualitative aspects under scrutiny and to consider divergent views, negative cases, attitudes, beliefs and behaviours coded to these categories and to offer clearer insights into the meanings embedded therein.

Phase 5 –Data Reduction involved consolidating and refining codes into a more abstract and conceptual map or final framework of codes.

Phase 6 – Involved writing analytical memos against the higher-level codes to accurately summarise the content of each category and its codes and propose empirical findings against such categories. These memos considered 4 key areas:
1. The content of the themes and categories of codes on which it was reporting
2. The patterns where relevant (for example levels of coding, although this could be used to identify exceptional cases as well as shared experiences)
3. Background information recorded against respondents and any patterns that may exist in relation to participant profiles and demographics.
4. Situating the code(s) in a storyboard or creating a narrative which considers relatedness of codes to each other and drawing and describing inferences and their importance to addressing the research question, and sequencing disparate codes and clusters of codes into a story which is structured and can be expressed in the form of a coherent and cohesive set of outcome statements or findings.

Phase 7 – Validation involved testing, validating and revising analytical memos to self-audit proposed findings by seeking evidence in the data beyond textual quotes to support the stated findings and seeking to expand on deeper meanings embedded in the data.

Phase 8 – Synthesizing analytical memos into a coherent, cohesive, and well-supported outcome statement or findings report offering a descriptive account of respondents' experiences during The Storm.

5.0 Weather Risk Perception

Three months before the Storm hit Ireland, the project team surveyed more than 6000 households in Ireland. The survey gathered information relevant to six weather-related events: flooding, snow, low temperatures, high temperatures, storm, and drought. Respondents assessed the likelihood of each affecting them or their home on a five-point scale, where 1= extremely unlikely, 2 = very unlikely, 3 = unlikely, 4 = likely, and 5 = very likely. They also identified the level of impact they believed each event would have on them or their home, should it occur, on a five-point scale, with 1 = very low, 2 = low, 3 = moderate, 4 = high and 5 = very high.

Figure 3 sets out the percentage of respondents who stated each possible likelihood-impact combination for each of the weather-related events. In each panel, impact is measured on the horizontal axis (i.e., perceived impact is higher moving rightwards in the table) and likelihood is on the vertical axis (perceived likelihood is higher moving upwards in the table). The values are colour-coded to identify readily the regions of the matrices where respondents' responses are concentrated.

FLOOD

			Impact			
Likelihood	**1**	**2**	**3**	**4**	**5**	**Total**
5	0.2	0.2	0.4	0.4	0.8	2.1
4	0.2	1.3	2.5	2.5	1.4	7.7
3	1.7	7.1	8.2	5.3	3.1	25.3
2	3.2	8.2	5.3	4.0	1.9	22.6
1	20.1	8.6	4.9	5.1	3.6	42.3
Total	25.4	25.4	21.3	17.2	10.8	

SNOW

			Impact			
Likelihood	**1**	**2**	**3**	**4**	**5**	**Total**
5	0.2	1.1	2.7	3.6	2.9	10.5
4	1.5	10.1	19.0	7.3	1.3	39.2
3	3.2	12.3	11.6	2.4	0.6	30.1
2	2.1	6.2	3.9	1.0	0.2	13.4
1	3.2	1.7	1.2	0.4	0.2	6.8
Total	10.2	31.3	38.5	14.8	5.3	

LOW TEMPERATURES

			Impact			
Likelihood	**1**	**2**	**3**	**4**	**5**	**Total**
5	0.6	3.2	6.7	5.4	3.5	19.4
4	2.1	14.0	21.1	7.4	1.2	45.7
3	2.7	9.6	7.3	1.1	0.4	21.0
2	1.6	4.9	2.2	0.6	0.1	9.4
1	2.4	1.3	0.6	0.1	0.2	4.5
Total	9.4	32.9	37.8	14.6	5.3	

HIGH TEMPERATURES

			Impact			
Likelihood	**1**	**2**	**3**	**4**	**5**	**Total**
5	0.3	0.6	0.8	0.4	0.5	2.7
4	0.4	3.2	4.6	1.0	0.3	9.5
3	5.7	17.1	10.8	1.5	0.5	35.5
2	5.9	11.8	5.3	1.2	0.3	24.4
1	13.6	8.7	4.4	0.8	0.4	27.9
Total	25.8	41.4	25.9	4.9	2.0	

STORM

			Impact			
Likelihood	**1**	**2**	**3**	**4**	**5**	**Total**
5	0.1	0.7	3.8	7.0	5.6	17.2
4	0.9	7.1	25.7	16.5	2.4	52.6
3	1.3	7.5	10.3	2.6	0.5	22.2
2	0.6	2.8	1.8	0.8	0.1	6.0
1	0.9	0.5	0.3	0.2	0.2	2.1
Total	3.7	18.7	41.8	27.0	8.7	

DROUGHT

			Impact			
Likelihood	**1**	**2**	**3**	**4**	**5**	**Total**
5	0.3	0.2	0.3	0.7	0.8	2.3
4	0.2	1.3	2.2	1.7	0.4	5.8
3	3.5	9.2	6.7	3.4	1.1	23.9
2	3.9	6.8	4.1	2.3	0.8	18.0
1	23.8	10.5	6.7	5.3	3.7	50.0
Total	31.7	28.0	20.0	13.4	6.9	

Figure 3: Risk Matrices for Weather-Related Events

Individuals' risk ratings for each event are calculated as likelihood * impact, resulting in 14 possible risk values bounded by 1 (extremely unlikely and very low impact) and 25 (very likely and very high impact).

Figure 4, Figure 5, and Figure 6 illustrate the average likelihood, impact and risk ratings of respondents for each weather-related event. The risk associated with storms is rated highest of the events considered, driven by higher ratings for both likelihood and impact.
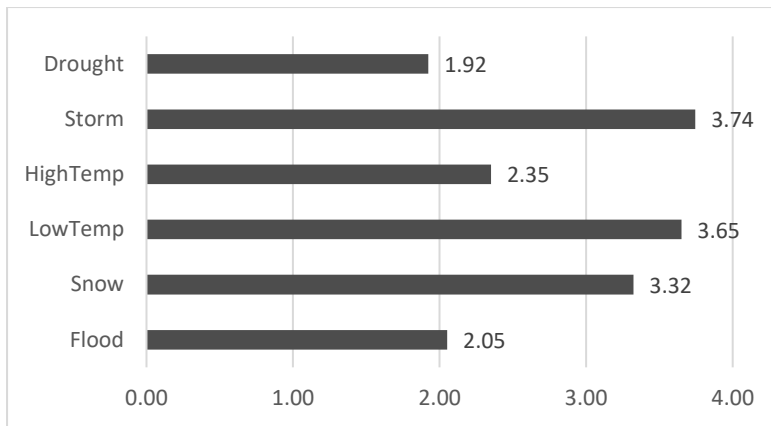
Figure 4: Mean Likelihood Ratings
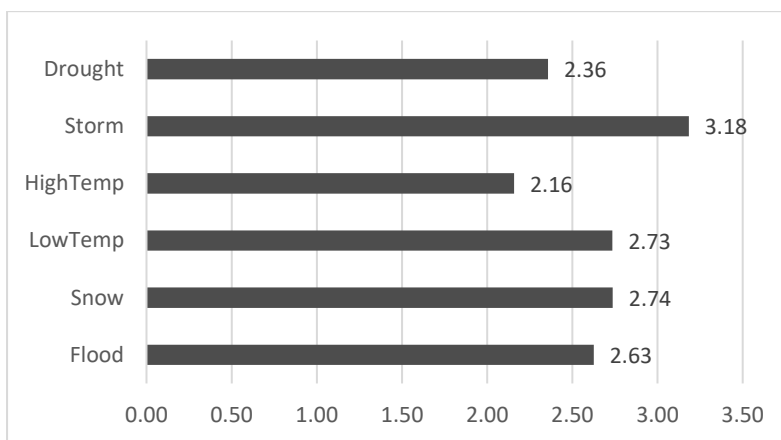
Figure 5: Mean Impact Ratings
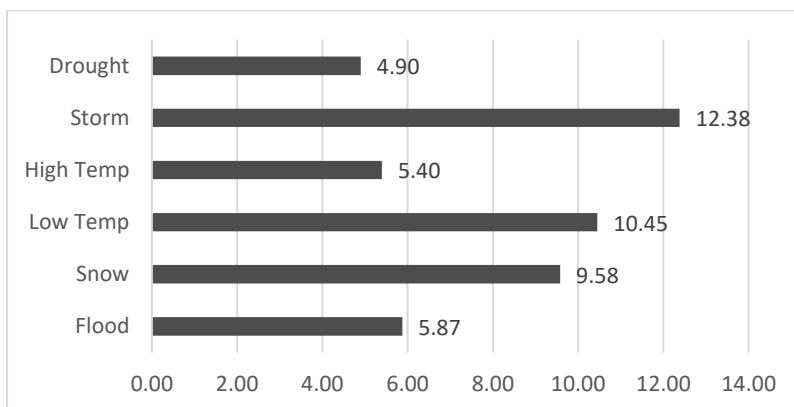
Figure 6: Mean Risk Ratings

The distribution of risk ratings for each event is illustrated in the boxplot below (see Figure 7):
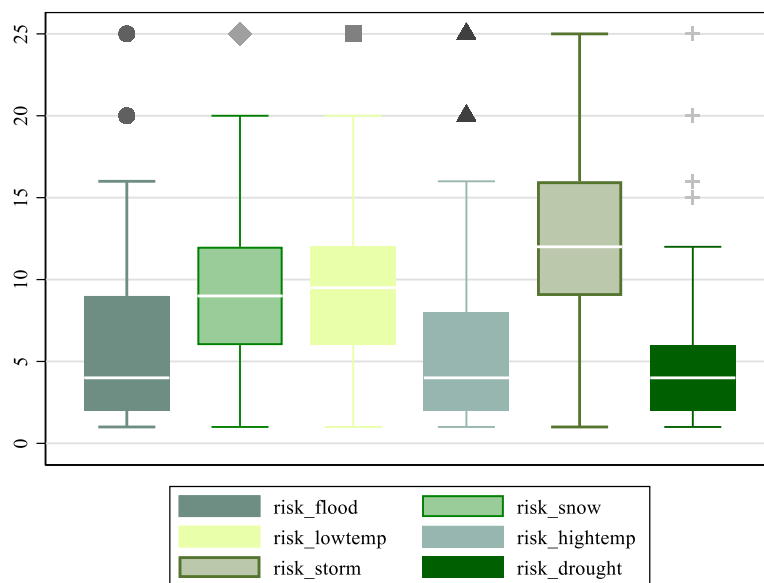
Figure 7: Risk Rating Boxplot

5.1 Risk by Gender

Figure 8 below illustrates comparing risk rating by gender, females on average consistently rate risk associated with weather-related events higher than males. The difference is not large in magnitude, but it is statistically significant in all cases except for High Temperature.
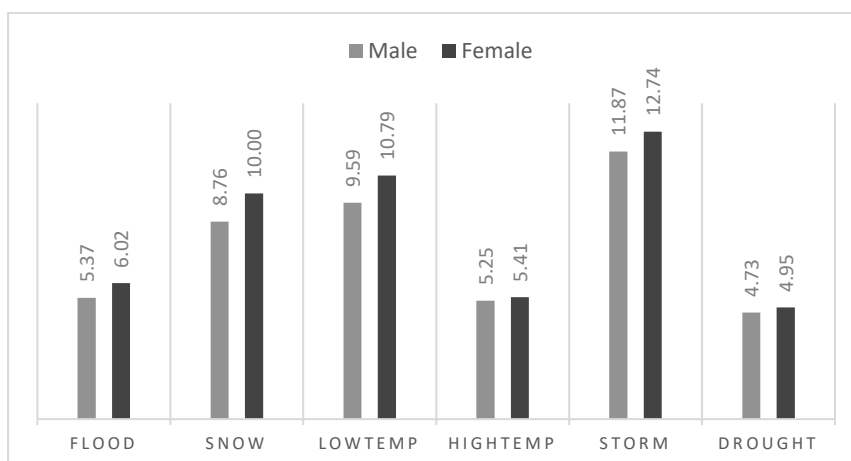
Figure 8: Average Risk Rating by Gender

5.2 Risk by Age

Figure 9 plots the average risk for each weather-related event by age-group. Visually we can see an indication of increased perceived risk in mid-life for snow, low-temperature, and

storm. This quadratic pattern between risk and age is borne out and is statistically significant in ordered logit regressions of risk on age and age^2. In the case of flood, there is a significant negative relationship between perceived risk and age. There is no significant relationship with age for either high temperature or drought.
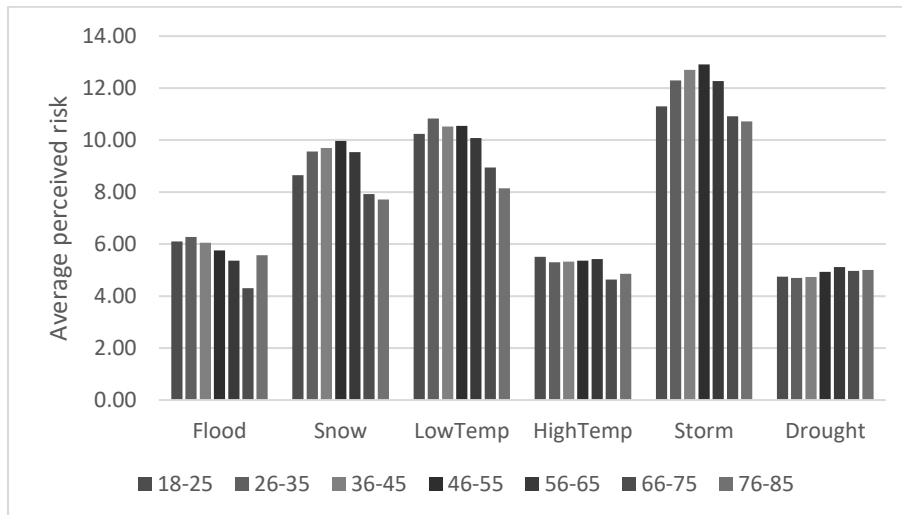
Figure 9: Average Perceived Risk by Age-Group

5.3 Risk by Settlement (Urbanicity)

Figure 10 depicts average risk perception by settlement type. It shows the perceived risk associated with snow, low-temperature and storm is higher the more rural the respondent's dwelling, and this pattern is significant in ordered logit regressions. The variation in risk perception is not so marked for flood, high temperature or drought, but ordered logit results show the difference is significant between city and rural in the case of flood and drought.
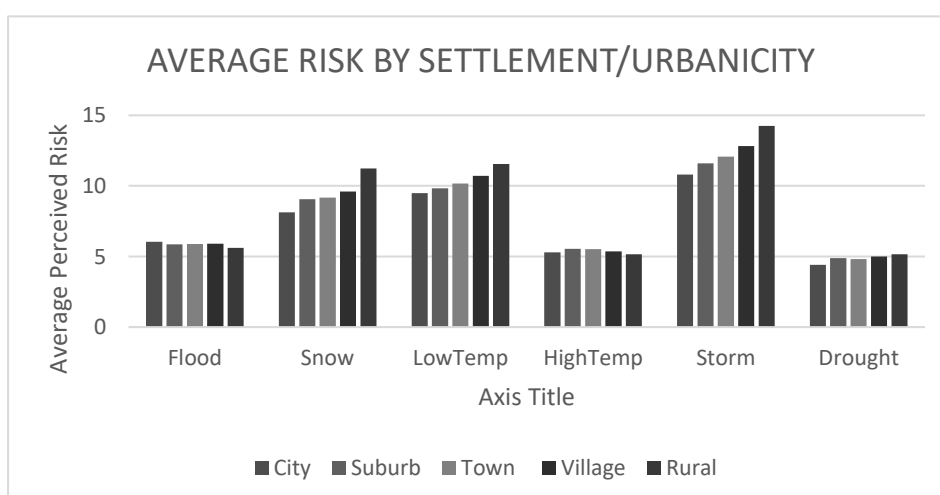
Figure 10: Average Risk by Settlement/Urbanicity

5.4 Risk by County

Table 1 sets out the average perceived risk associated with weather events by county. For Southern Counties, the highest 10 in terms of risk perception are shaded for each event.

Table 1: Average Perceived Risk By County

County	Flood	Snow	Low-Temp	High-Temp	Storm	Drought
Northern Counties						
Antrim	5.14	7.57	9.29	3.29	12.57	3.43
Armagh	5.00	10.00	7.00	3.50	9.00	5.00
Derry	7.00	11.50	12.00	4.13	13.00	2.25
Down	4.91	8.91	7.73	4.27	8.55	4.91
Fermanagh	7.00	11.00	13.11	3.67	12.33	4.22
Tyrone	4.20	14.00	11.60	3.20	14.60	2.60
Southern Counties						
Carlow	4.78	11.88	12.40	5.95	13.83	4.48
Cavan	4.68	12.34	11.86	5.11	13.13	4.30
Clare	6.61	8.69	10.54	5.20	13.40	4.82
Cork	6.18	10.51	11.80	5.44	14.37	5.00
Donegal	5.38	13.15	12.97	4.39	14.36	4.41
Dublin	5.80	8.58	9.31	5.47	10.74	4.74
Galway	6.96	9.30	11.05	5.10	13.76	5.01
Kerry	6.20	9.30	10.70	4.43	15.73	4.36
Kildare	6.99	10.68	10.75	5.89	12.09	5.58
Kilkenny	4.29	9.98	10.58	5.51	13.16	5.32
Laois	6.52	11.58	12.91	6.40	13.63	6.48
Leitrim	5.52	11.66	11.52	4.03	13.93	4.28
Limerick	6.35	9.58	11.30	5.66	14.20	5.18
Longford	6.50	12.56	12.56	6.56	14.44	4.44
Louth	5.22	9.33	10.08	5.36	11.66	4.80
Mayo	5.26	10.22	10.79	5.12	14.18	4.81
Meath	5.55	9.09	9.78	5.30	11.52	4.85
Monaghan	5.10	11.47	11.86	5.02	11.80	3.90
Offaly	6.53	9.69	10.66	4.86	12.63	4.76
Roscommon	6.01	10.01	10.99	5.66	12.59	5.88
Sligo	4.87	11.38	11.74	4.89	13.56	4.52
Tipperary	5.82	9.65	10.59	5.69	13.33	5.21
Waterford	5.41	8.84	9.59	5.45	12.99	5.40
Westmeath	4.53	9.37	10.03	4.76	11.21	4.72
Wexford	4.72	10.87	10.24	5.51	13.69	4.98
Wicklow	4.83	11.18	10.36	5.63	13.12	4.69

5.5 Risk Rating

The data presented in Figure 3 permits the plotting of the modal values for each risk rating in order to examine relative risk across the weather events (See Figure 11 below). It is interesting to see that the three highest rated risks (by mode) are storm, snow, and low temperatures - the three weather events which combined to form Storm Emma and The Beast from the East.
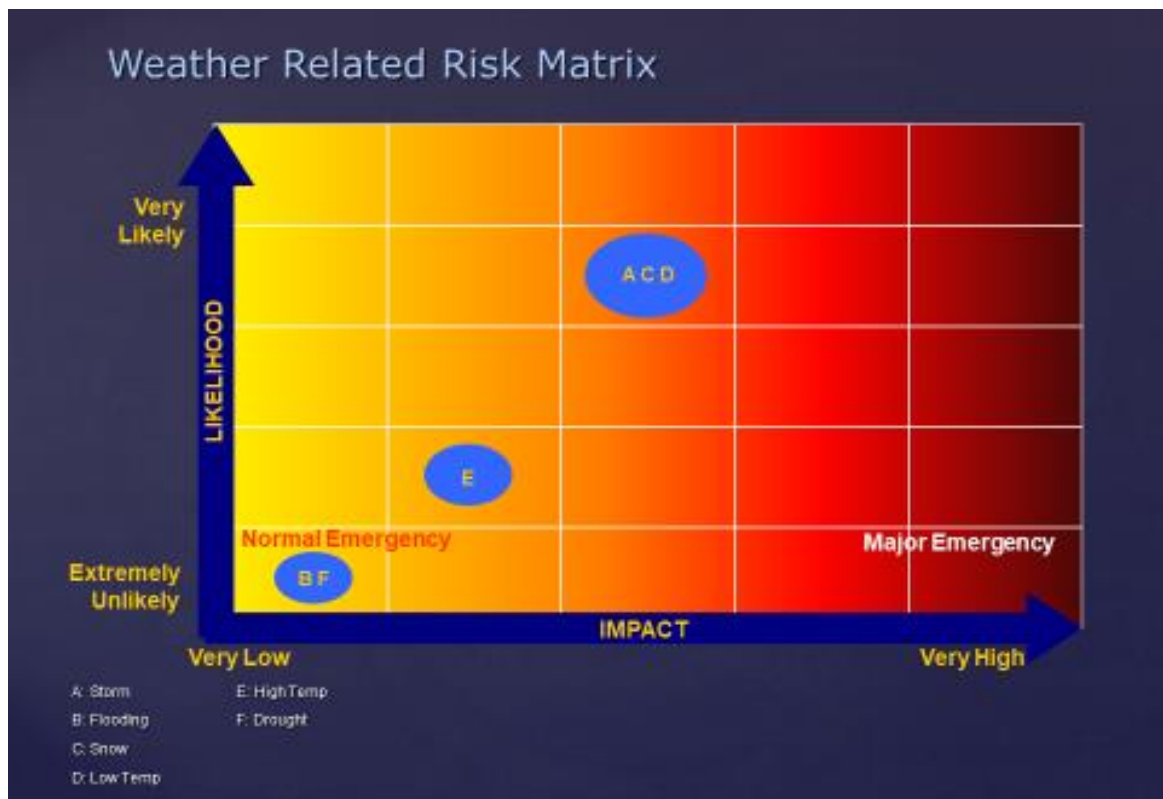
Figure 11: Weather-Related Risk Matrix (Mode)

6.0 Profile of Respondents

The study population comprised of 4,451 respondents, of which 3,503 returned complete questionnaires. The average age of respondents was 41.97 with a minimum of 18 years and a maximum of 100 years of age.

The gender of respondents is displayed in Table 2, and the geographic location, by County, for each respondent is outlined in Table 3 below. Finally, household income is reported in Table 4.

Table 2: Gender of Respondents

	Number of Respondents	Percentage
Female	2766	75.2%
Male	913	24.8%

Table 3: Respondents by County

County	Respondents	County	Respondents
Armagh	6	Leitrim	27
Carlow	35	Limerick	145
Cavan	65	Longford	37
Clare	86	Louth	129
Cork	517	Mayo	148
Derry	1	Meath	223
Donegal	83	Monaghan	37
Down	12	Offaly	140
Dublin	1174	Roscommon	91
Fermanagh	3	Sligo	79
Galway	214	Tipperary	127
Kerry	63	Tyrone	2
Kildare	341	Waterford	128
Kilkenny	84	Westmeath	144
Laois	72	Wexford	144
		Wicklow	94

Table 4: Household Income Levels

Income Bands	Number of Respondents	Percentage
Low (<30K)	444	12.7%
Medium (30->70K)	1827	52.2%
High (>70K)	1232	35.2%

Respondents were asked about their professions to establish expertise in the management of emergency situations. Professions in this category included: emergency services, volunteer support to emergency services, business related to crisis or emergencies, the defence forces and health professionals. Table 5 below shows details of the number of respondents in each profession.

Table 5: Emergency Related Expertise

Expertise	Number of Respondents	Percentage
Yes	814	*22.1%*
No	2873	*77.9%*

Separately to the above expertise, given the importance of weather to farming, respondents were also asked to identify if they were farmers: 102 (2.8%) of respondents identified as members of the farming community.

Whether respondents lived in a house (vs an apartment, etc.) is displayed in Table 6, and owned the home is given in Table 7. Respondents were also asked for long they lived at their current home: the average response was 13.80 years, with a minimum of one month and a maximum of 65 years.

Table 6: Live in a House

	Number of Respondents	Percentage
Yes	3377	*91.8%*
No	303	*8.2%*

Note: respondents who did not live in a house indicated they lived in an apartment or "other".

Table 7: Owns the Home

	Number of Respondents	Percentage
Yes	2576	*70.1%*
No	1099	*29.9%*

Respondents were invited to provide information on the number of children and adults that lived in the household given in Table 8.

Table 8: Children and Adults in the Household

	Number of Children	Number of Adults
Mean	0.92	2.41
Mode	0	2
Minimum	0	1
Maximum	7	16*

Note: while 16 adults in one home is an outlier this data was examined more closely and is believed to be student accommodation.

284 respondents were not at staying at their home for the duration of the Storm. For this reason, both settlement type (urbanicity) for where respondents usually live, and where they were located during the Storm is reported in Table 9.

Table 9: Settlement Type (Urbanicity)

	Usually Located	Located During The Storm
A rural area	30% (1106n)	27.8% (1239n)
A village	12.4% (457n)	12% (532n)
A town	22.6% (834n)	23.9% (1063n)
The suburbs or outskirts of a city	22.2% (819n)	22.8% (1017n)
A city	12.8% (471n)	13.5% (600n)

The breakdown of respondents by whether they work full-time work is specified in Table 10, and by race (white) is given in Table 11.

Table 10: Working full-time

	Number of Respondents	Percentage
Yes	2760	74.9%
No	927	25.1%

Note: respondents who did not live in a house indicated they lived in an apartment or "other".

Table 11: Race (White)

	Number of Respondents	Percentage
Yes	3567	97.8%
No	81	2.2%

The number of responses to different open-ended questions varied greatly. Table 12 below shows the distribution of all 12,164 responses by open-ended question:

Table 12: Number of responses by question

Questions x Number of Responses	n4552
1 - QQ - What caused your level of worry to decrease	808
2 - QQ - What caused your level of worry to increase	1314
3 - QQ - What other actions did you take to prepare for Storm Emma	2220
4 - QQ - On reflection, what else should you have done to prepare for Storm Emma	2460
5 - QQ - Please tell us more about how you gave assistance - Other, please specify	639
6 - QQ - Please tell us about the assistance you received - Other assistance, please specify	309
7 - QQ - During Storm Emma, did you witness any other positive examples of community support (Example farmers transporting locals to work)	2284
8 - QQ - Do you believe the weather warnings are... (Tick all that apply) - Other	818
9 - QQ - Please tell us if there is anything which prevents you from being more active in your community	1312
Total Responses	12164

Table 13 below shows the breakdown of comments by sentiment where sentiment could be recorded:

Table 13: Comments by Sentiment

Sentiment of Comments	Number of Comments
Positive Comments	5934
Negative Comments	5949
Total Comments where Sentiment was Recorded	11883

7.0 The Public Response to the Storm

7.1 Worry about the Storm

This section of the Case Study considers respondents' level of worry regarding Storm Emma and The Beast from the East. First, survey respondents rated their level of worry about The Storm before it arrived. Worry was recorded on a five-point scale from 'not at all' (0) to 'a great deal' (4) and had a mean score of 1.51 (Std Dev: 1.0). The overall results for worry are summarised in Figure 12. 46.6% (3,783n) of respondents were at least moderately worried about The Storm before it arrived while 14.65% (652n) indicated they were not at all worried.
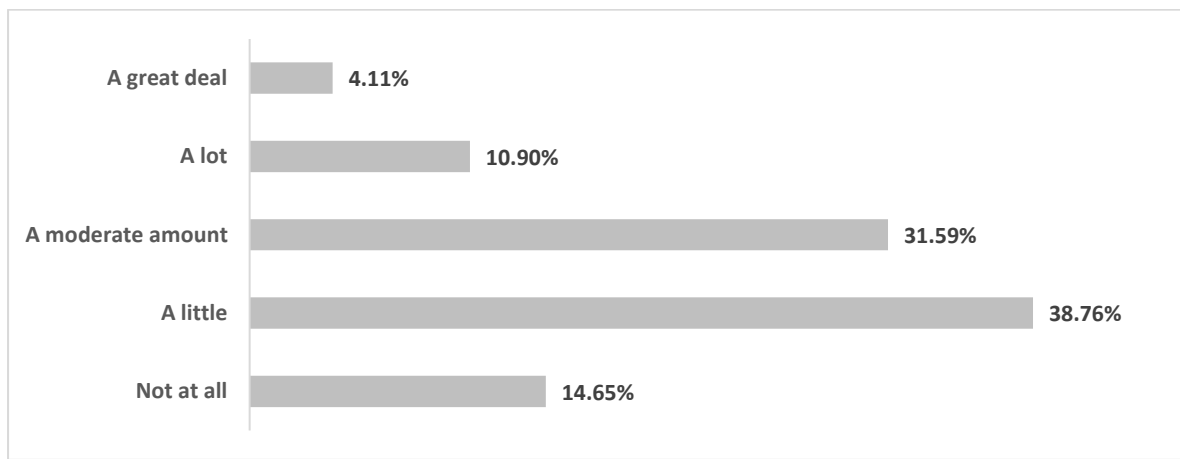
Figure 12: Level of Worry Before The Storm Arrived

Respondents were asked how their levels of worry changed over the course of The Storm. Just below 20% of respondents reported their worry level had decreased, a little under half said their worry level remained the same, while it increased for over 30%, as shown in Figure 13.
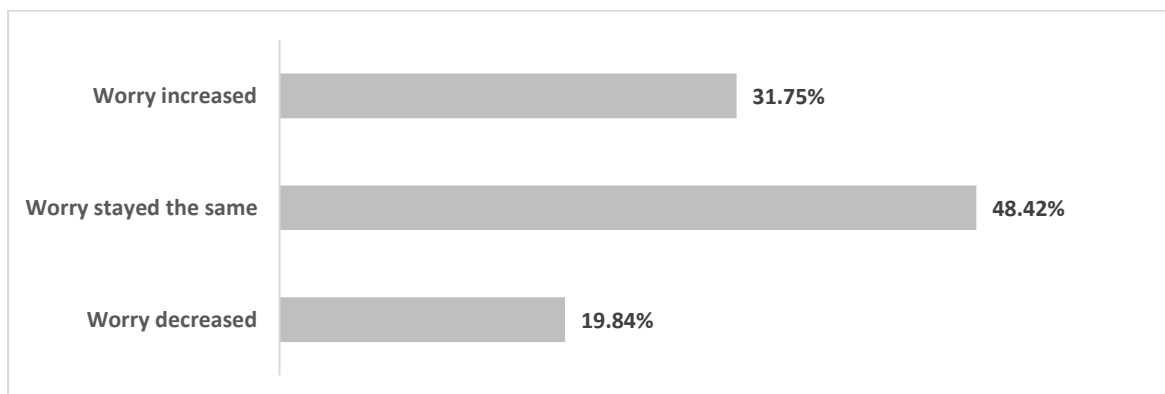
Figure 13: Trajectory of Worry

Respondents were then asked what caused their levels of worry to increase or decrease during the Storm. A total of 808 respondents outlined why their level of worry decreased, providing a total of 1397 explanations. These factors are outlined in Table 14 below.

Table 14: Causes of Decreased Worry

Causes of Decreased Worry	Number of Respondents Citing this as a Reason
The Storm was not as bad as expected	345
Location	147
Being Informed	92
Work or College Cancelled	85
Being Prepared	67
Utilities not Lost	44
Safe Inside	42
Friends and Family Safe	39
Love Snow	23
Not Worried	21
No Damage to House	17
Government Action	17
Still able to Travel	16
Time with Friends and Family	13
Shops Remained Open	9
Roads Cleared Quickly	5
Music	1
Alcohol	1
Religion	1

Not as Bad as Expected

345 of 808 respondents felt that the Storm was not as bad as they had expected. 240 respondents believed that media predictions of the severity of the Storm were over-hyped and over reported resulting in the creation of an expectation amongst respondents that the Storm would be worse than it turned out to be in their location. The fact that expectations regarding severity were unmet resulted in reduced worry for this cohort of respondents.

> *Once I was able to see the actual impact of the Storm in my area, my level of worry decreased. Beforehand, there was a long period of staying indoors (as advised by Met Eireann) and waiting for the Storm to arrive. This added to the worry of what to expect. (R1834)*

Wasn't as bad as forecast. Could get out and enjoy fun in the snow with kids. (R2038)

The actual impact of the storms in my area, blanket warnings caused the stress and upset, and it should have been more specific. (R2358)

Figure 14 below shows the pattern of language use associated with the code "Not as bad as expected".

Figure 14: Word Patterns in Not as Bad as Expected

A further 89 respondents cited the fact that the Storm was mild as the reason for reduced levels of worry but did not link their comments to expectations based on forecasting:

When it became apparent from outside that not much was happening. (R546)

Low impact on my life, shops open, played with the snow with my son, I knew it would not last long. (R1700)

The fact that the Storm was not significant in my area. We did not experience high winds and had only a moderate amount of snow fall. We did not lose power. (R813)

Location

147 respondents cited their geographical location as a reason for a decrease in worry. This factor impacted on both predictions and outcomes:

> *I was told my area would not be affected as much as other areas of Ireland. (R446)*

> *Storm did not directly affect my area, could see by weather updates they we escaped the worst. (R1064)*

Being Informed

Having access to information both ahead of and during the Storm reduced worry levels for 92 respondents.

> *Sufficient media coverage resulting in the majority of people actually staying inside and not going to work. I don't think the same can be said for Storm Ophelia last year. There were better warnings this time around. (R254)*

> *Level of coverage on broadcast mediums outlining any changes sin the forecast model; advice on how to stay safe; what to expect in the coming days etc. (R923)*

Other causes of reduced worry included not having to travel because work or college was cancelled (85 comments), being prepared (67 comments) and stocking up on supplies (61 comments). The language used in relation to stocking up is illustrated by frequency in Figure 15.
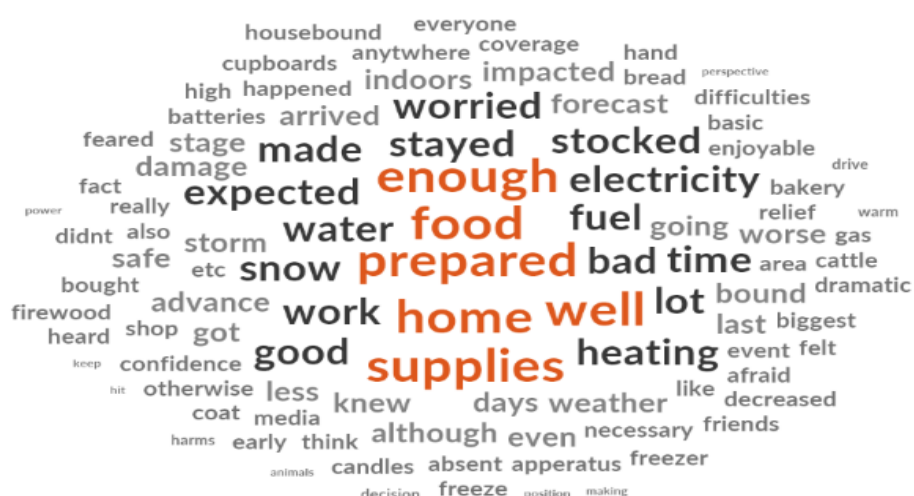
Figure 15: Language use in the discourse on 'Stocking Up'.

Causes of Increased Worry

Where respondents reported an increase in worry during the Storm, they were asked to describe what caused their level of worry to increase. A total of 1314 respondents contributed 2257 comments in answer to this question. Table 15 below shows the nature of these responses:

Table 15: Causes of Increased Worry

Causes of Increased Worry	1314
Getting to Work	319
Volume of Snow	187
Worries about Friends and Family Safety	169
Travelling	162
Being Trapped in House	161
Not Being Prepared	138
Utilities being lost	135
Getting Home	110
Worse than Expected	104
Watching the News	84
Watching the Storm	77
Damage to House	76
No Access to Medical Services	44
Roads Not Cleared	38
Shops Out of Stock	37
The Unknown	35
No Public Transport	31
High Winds	29
Lack of Communication from HSE and management and support for staff	27
Livestock	26
Lack of Communication from Employer	25
Shops Closed	24
Poor Government Response	24
Cancelled Flight	16
Falling Trees	15
Going Outside	11
Childcare	6
Social Unrest	4
Driving Emergency Service Vehicles	4

Causes of Increased Worry	1314
Climate Change	1
No Money in ATM	1
No Access to Veterinarian	1
Total Comments	2257

Getting to Work

Getting to work was the most significant cause of increased worry for 319 respondents. Respondent 711 describes the worry of physically getting into work as well as the additional stress of having an employer whose expectation was that she would arrive, despite the length of her commute in storm conditions:

> *Skidded on the road on the way to work. Car lost control and hit a wall. Notified manager and was unable to make it to work. Was stressed about how my time would be recorded for those days. I was stressed also because we didn't have a 'red' warning present on that day, therefore there was an expectation on me to travel to work. However, the level of snow was greater than expected in my area which then meant that management expected us to attempt to travel to work. (R771)*

> *Travelling to and from work - I was using the train and I was worried I might not get to and then home from work. (R930)*

> *Lack of mobility- not being able to drive to work or make way on public transport. Worry about not being able to attend work and the ramifications of that. (R1348)*

Figure 16 below shows patterns of recurring language use within the 319 comments recorded against worry about getting to work during the Storm:

Figure 16: Word Patterns in Worry about Getting to Work

Amount of Snow

The significant volume of snow increased the level of worry for 187 respondents:

> *I didn't actually realize a full-on snowstorm was about to hit, so when inches of snow started to pile up my level of worry increased. (R181)*

> *How high the snow was and how there was no way in or out of the town because of the level of snow. (R305)*

> *The snow built up in a very short space of time. The council didn't seem up to the task of clearing main roads and towns, I knew it would be a long time before our road was cleared - in the end we had to hire a digger. (R402*

Worry for Safety of Friends and Family

In total, 169 comments centred on worries about the safety of friends and family:

> *The roads were impassable, and the snow continued. Worried in case something happened to my family, there was no way to get to us. (R650)*

> *The level of snow was much higher than anything I've been used to. I worried about family members having to travel. (R748)*

> *My parents live in the country, so I was very concerned about their safety and was unable to get to them. (R805)*

Travelling

Being unable to travel was a cause of worry for 162 respondents. This factor was often closely related to worries about getting to work and concerns about family and friends:

> *How I would get to/from work safely. (R561)*

> *My ability to travel safely. (R3071)*

As illustrated in Figure 17 below, there was overlap in the cited causes of increased worry, with many respondents citing two or three of the most common factors:
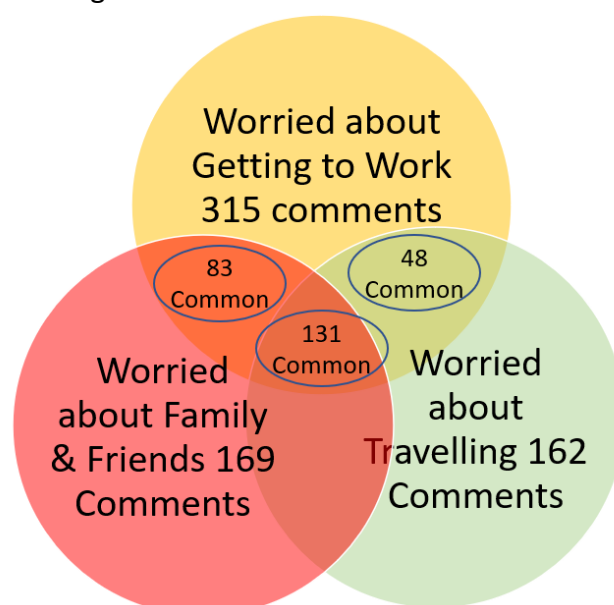
Figure 17: Overlap in Causes of Increased Worry

Being unable to move car to get to work or visit mother living alone. (R1967)

Impact on family, husband had a previous fall/injury in snow, possibility of another injury. afraid to drive, afraid to go to local shops, school closures, childcare issues, responsibility to try to get into work. (R2253)

Being Trapped in the House

161 respondents said being trapped in the house was a cause for worry:

Being trapped in the house - fear the electricity would go leaving us without water as well as electricity and heating. (R390)

Frustration with what will happen and feeling of being blocked and inaccessible by emergency service. (R722)

Other factors leading to increased worry included not being prepared (138 comments); loss of utilities (135 comments), getting home (110 comments), the Storm being worse than expected (104 comments).

Worry by Settlement Type (Urbanicity)

Figure 18 shows the average worry levels before The Storm arrived over the different settlement (urbanicity) types where respondents live. Worry is measured on a five-point scale from 'not at all' (0) to 'a great deal' (4). Respondents who lived in a city on average had the lowest worry levels (1.310) while those who lived in a rural area had the highest (1.741). Only 9.8% of respondents living in a rural area did not worry about The Storm; while the equivalent figure was 16.2% for those living in a City. On the basis of a chi-square test of independence there is evidence that reported worry level is not independent of settlement type ($\chi^2(16)$ 110.115, p<0.001).
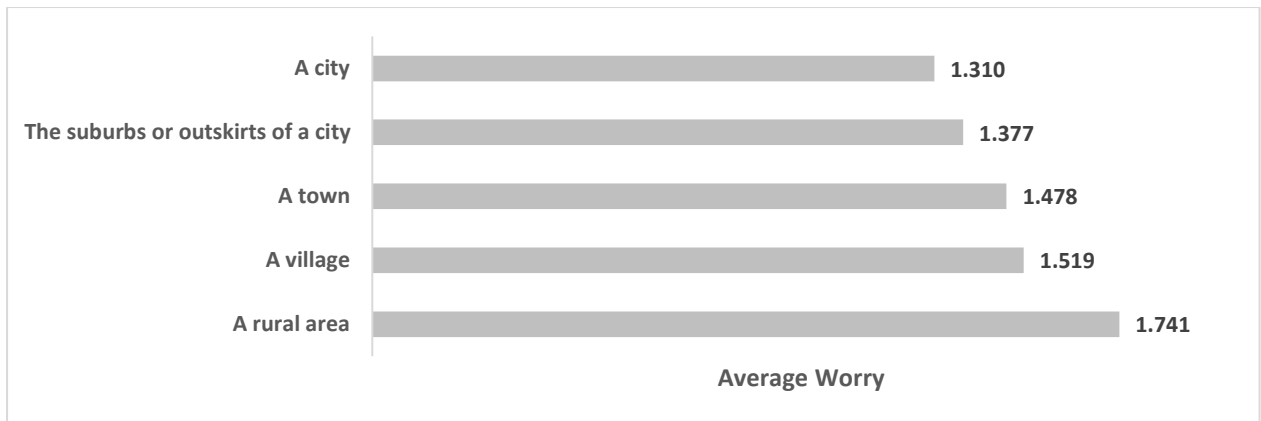
Figure 18: Average Worry Before The Storm by Settlement

Figure 19 depicts the trajectory of worry for respondents based the type of settlement they were staying in at the time of the storm. Visually, we see some evidence that the trajectory of worry varies over locations, with the distributions for those based in rural areas and villages showing higher proportions of increased worry and lower proportions of decreased worry, than is the case in cities for example. The results of a chi-square test of independence between worry trajectory and settlement type is statistically significant, suggesting there is a significant association between the two $\chi 2(8) = 15.548a$, p= 0.049.
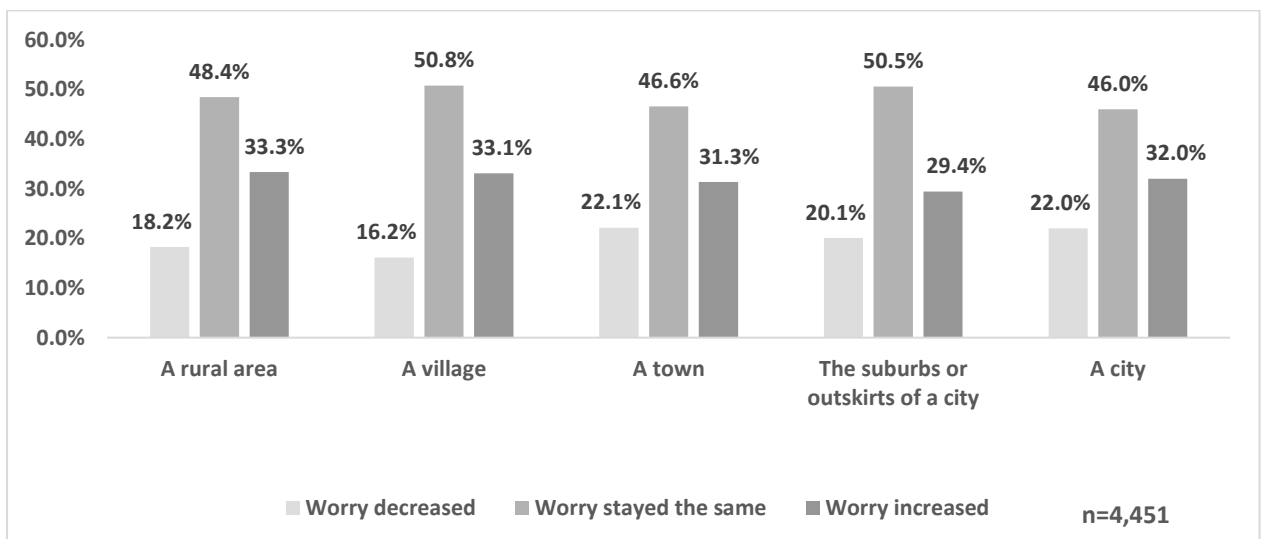
Figure 19: Trajectory of Worry by Settlement type (Urbanicity) at time of The Storm

Worry by County

Table 16 sets out percentages reporting decreased, unchanged, and increased worry over the course of The Storm by county. The six counties with the highest proportions reporting increased worry and the six with the highest proportions reporting decreased worry are highlighted. Also reported are the mean values for worry trajectory (where worry decreased is coded as 1, unchanged is 2, and increased is 3) and the number of observations from each

county. The six highest averages are marked in light purple, while the lowest six, are marked in light blue.

Table 16: Trajectory of Worry by County (During The Storm)

Southern Counties	% worry decreased	% worry same	% worry increased	Mean	Freq.
Carlow	14.29	54.29	31.43	2.17	35
Cavan	10.77	46.15	43.08	2.32	65
Clare	29.07	48.84	22.09	1.93	86
Cork	16.83	50.10	33.08	2.16	517
Donegal	44.58	36.14	19.28	1.75	83
Dublin	19.93	48.55	31.52	2.12	1174
Galway	20.09	49.07	30.84	2.11	214
Kerry	26.98	57.14	15.87	1.89	63
Kildare	10.56	44.57	44.87	2.34	341
Kilkenny	19.05	53.57	27.38	2.08	84
Laois	22.22	50.00	27.78	2.06	72
Leitrim	33.33	44.44	22.22	1.89	27
Limerick	31.72	46.90	21.38	1.90	145
Longford	10.81	51.35	37.84	2.27	37
Louth	14.73	52.71	32.56	2.18	129
Mayo	45.27	41.22	13.51	1.68	148
Meath	17.49	47.98	34.53	2.17	223
Monaghan	10.81	64.86	24.32	2.14	37
Offaly	7.14	60.00	32.86	2.26	140
Roscommon	23.08	53.85	23.08	2.00	91
Sligo	48.10	41.77	10.13	1.62	79
Tipperary	18.11	50.39	31.50	2.13	127
Waterford	12.50	44.53	42.97	2.30	128
Westmeath	19.44	47.92	32.64	2.13	144
Wexford	10.42	36.81	52.78	2.42	144
Wicklow	19.15	56.38	24.47	2.05	94

Note: Worry decreased (1); stayed the same (2); or increased (3)

Figure 20 below shows the counties that dominated the discourse on the most cited reasons for reduced worry: "Emma – not as bad as expected"; "Location"; "Being Informed".

County	Not as bad as expected	Location	Being Informed
Carlow	0.0%	2.1%	1.1%
Cavan	1.2%	2.1%	0.0%
Clare	3.0%	1.4%	1.1%
Cork	9.2%	8.9%	4.3%
Donegal	5.7%	9.6%	2.2%
Dublin	26.8%	14.4%	30.4%
Galway	5.1%	4.1%	8.7%
Kerry	2.1%	2.7%	3.3%
Kildare	2.7%	1.4%	6.5%
Kilkenny	1.5%	1.4%	2.2%
Laois	0.6%	0.0%	2.2%
Leitrim	1.5%	3.4%	0.0%
Limerick	6.5%	5.5%	4.3%
Longford	0.3%	0.0%	1.1%
Louth	2.7%	2.1%	3.3%
Mayo	13.1%	17.1%	7.6%
Meath	2.4%	1.4%	3.3%
Monaghan	0.0%	0.0%	0.0%
Offaly	0.9%	0.7%	4.3%
Roscommon	1.8%	5.5%	3.3%
Sligo	5.7%	12.3%	4.3%
Tipperary	1.8%	1.4%	1.1%
Waterford	1.2%	0.7%	2.2%
Westmeath	2.1%	0.7%	2.2%
Wexford	0.6%	0.0%	1.1%
Wicklow	1.8%	1.4%	0.0%

Legend	
	High range % of reduced worry by county
	Mid range % of reduced worry by county
	Low range % of reduced worry by county

Figure 20: Most Cited Causes of Reduced Worry by County

Figure 20 above has been differentiated by three colour ranges (high - low range) to signify the percentage of reduced worry by each county. The results show that Dublin, Mayo, Sligo, Galway Cork, and Limerick contributed most comments on the causes of reduced worry.

Figure 21 below shows the top three causes of increased worry by County. Whereas all Counties worried about the safety of friends and family, worry about the volume of snow and getting to work was most prevalent in counties Dublin, Kildare, Cork, Meath, Wexford, Waterford, and Westmeath.

County	Getting to work	Volume of Snow	Worries about Friends and Family Safety
Carlow	1.3%	0.0%	1.2%
Cavan	1.6%	0.5%	1.2%
Clare	1.6%	0.0%	1.2%
Cork	14.0%	8.6%	10.1%
Donegal	0.6%	0.5%	0.6%
Dublin	22.9%	29.2%	26.0%
Galway	8.6%	3.2%	5.9%
Kerry	1.9%	0.0%	0.0%
Kildare	7.3%	21.1%	10.7%
Kilkenny	1.9%	1.6%	3.6%
Laois	1.9%	1.6%	0.6%
Leitrim	1.0%	0.0%	1.2%
Limerick	0.6%	1.1%	2.4%
Longford	1.0%	0.0%	1.2%
Louth	2.2%	1.6%	4.1%
Mayo	0.6%	0.5%	3.0%
Meath	7.3%	6.5%	2.4%
Monaghan	1.0%	1.1%	0.0%
Offaly	1.6%	3.2%	3.6%
Roscommon	1.0%	0.5%	1.8%
Sligo	0.6%	0.5%	0.6%
Tipperary	3.8%	2.7%	6.5%
Waterford	4.8%	4.3%	2.4%
Westmeath	4.1%	3.2%	4.7%
Wexford	6.0%	5.9%	4.1%
Wicklow	1.0%	2.2%	1.2%

Legend	
	High range % of increased worry by county
	Mid range % of increased worry by county
	Low range % of increased worry by county

Figure 21: Most Cited Causes of Increased Worry by County

Worry by Gender

Comparing reported levels of worry before the storm over gender, females had a higher average score (1.58) than males (1.35), where worry is measured on a five-point scale from 'not at all' (0) to 'a great deal' (4). Although not large in magnitude, the difference in means is highly significant based on a t-test (t = 6.09, p<0.001).

The responses about worry levels for males and females are illustrated in Figure 22. Based on a Kruskal-Wallis test, there is evidence that the distributions of responses over worry differ significantly between males and females ($\chi 2(1)$ = 35.490, p< 0.001).

The result of a chi-square test for independence between gender and worry, suggests a statistically significant association: $\chi 2(4)$ = 43.967, p< 0.001. The results showed that females reported higher than expected levels of worry ranging from a moderate amount to a great deal; however, the percentage point differences are seldom very large, see Figure 22.
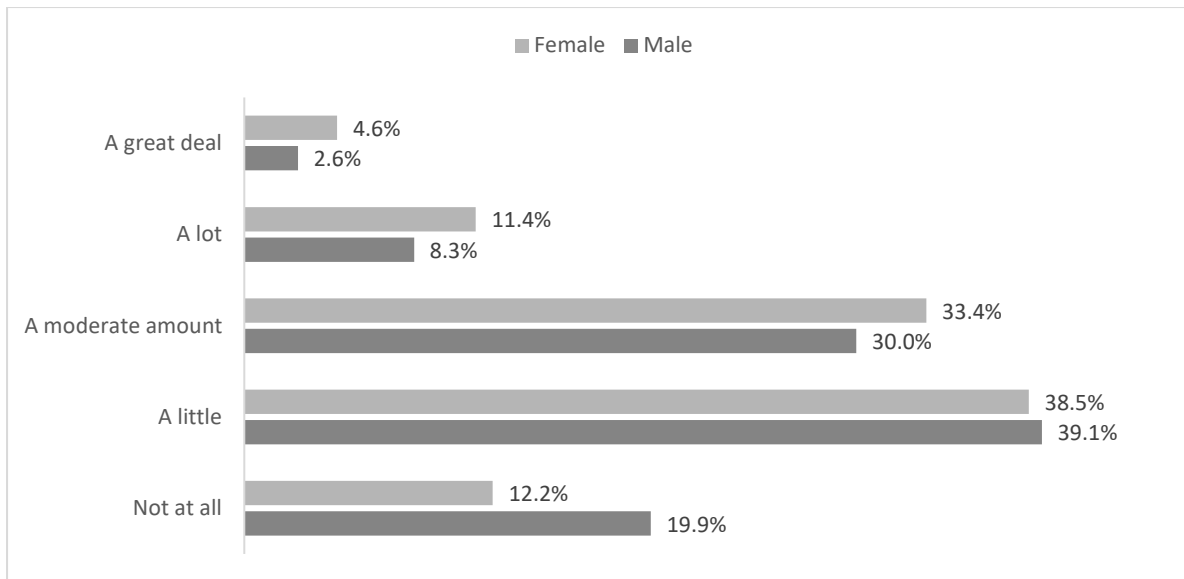
Figure 22: Levels of Worry by Gender

The analysis of the trajectory of worry during the storm shows that a larger percentage of females than males experienced an increase in worry. 33% of females reported that their level of worry increased during The Storm whereas only 23% of males did so. The trajectory of worry by gender is shown in Figure 23. There was a statistically significant difference in the distributions for trajectory of worry between genders (Kruskal-Wallis test: $\chi 2(1) = 27.803$, p< 0.001).
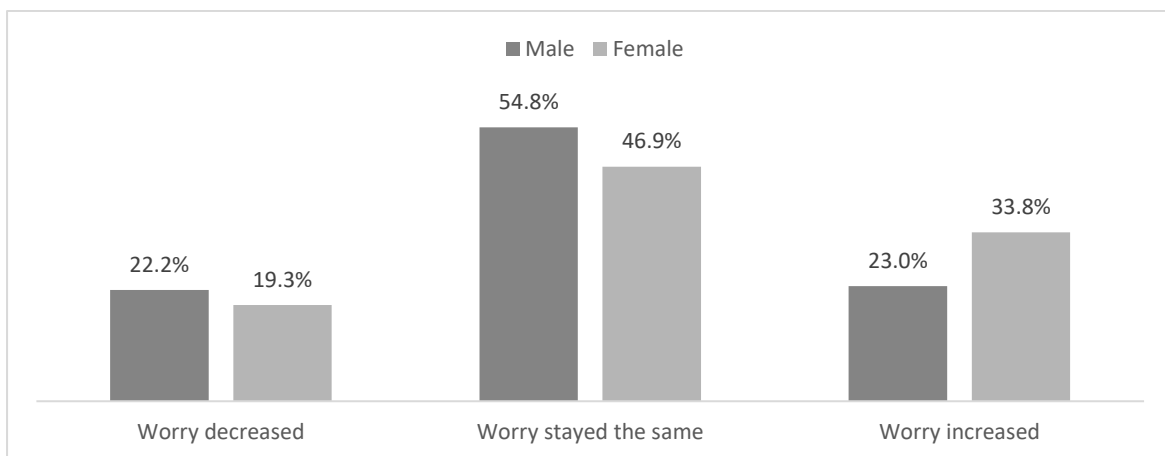
Figure 23: Trajectory of Worry by Gender

Gender & Decreased Worry

As evident in Table 2, there was a 3:1 ratio of female respondents to males in the study population. Table 17 below shows the under/over-representation of males and females in relation to each of the causes of decreased worry codes:

Table 17: Representation of Gender in Factors that Decreased Worry

Factors that Decreased Anxiety	Female	Male	Proportional Representation
Emma - Not as bad as expected	179	103	
Location	96	29	
Being Informed	63	24	
Work or College Cancelled	67	10	
Being Prepared	45	17	
Utilities not Lost	34	8	
Safe Inside	34	4	
Friends and Family Safe	29	4	
Love Snow	13	8	
No Worries	16	5	
No Damage to House	14	1	
Government Action	12	3	
Still Able to Travel	11	1	
Time with Friends and Family	11	2	
Shops Remained Open	6	2	
Roads Cleared Quickly	3	2	
Music	0	1	
Alcohol	0	1	
Religion	1	0	

The first column of Table 17 above shows the causes of decreased worry. The second and third columns show the number of comments from males and females. The fourth column shows the degree to which either group is under or overrepresented proportionate to the study population. A blue marker indicates males were overrepresented in the comments associated with a given factor, while a pink marker indicates the opposite. The size of the marker indicates the degree of over-representation by either group. Therefore, it is clear that males placed a greater emphasis on the Storm not being as bad as expected; being informed; being prepared; loving snow. Females were overrepresented in location; work or college cancelled; no loss of utilities; being safe inside; friends and family being safe; and no damage to the house, as causes of decreased worry.
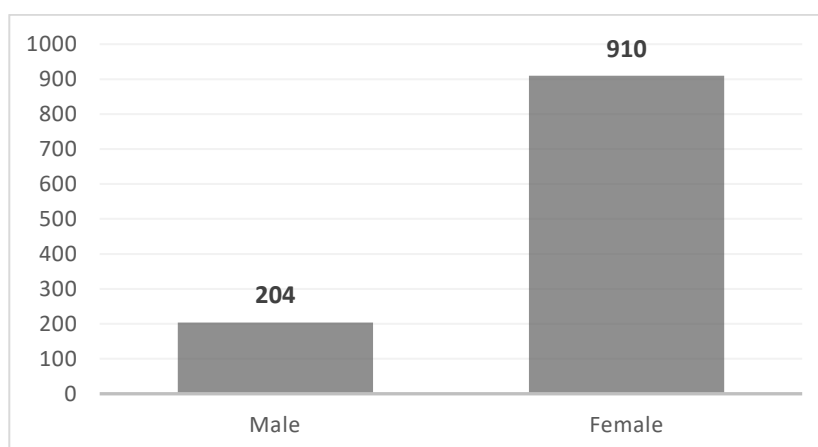
Figure 24: Explanation for Increased Worry by Gender

As shown in Figure 24, the discourse on increased worry was dominated by female respondents. Table 18 below shows the emphasis across each heightened worry code by gender. Female respondents dominated all increased worry codes except two, "High Winds" and "The Unknown", where there was a minor proportionately increase towards males.

Table 18: Representation of Gender in Factors that Increased Worry

Factors that Increased Worry	Female	Male	Proportional Representation
Being Trapped in House	123	19	
Cancelled Flight	12	2	
Childcare	4	0	
Climate Change	1	0	
Damage to House	54	11	
Driving Emergency Service Vehicles	1	1	
Falling Trees	11	3	
Getting Home	79	11	
Getting to Work	240	24	
Going Outside	9	2	
High Winds	17	9	
Lack of Communication from Employer	16	2	
Lack of Communication from HSE and management and support for staff	22	3	
Livestock	22	3	
No Access to Medical Services	32	6	
No Access to Veterinarian	1	0	
No Money in ATM	1	0	
No Public Transport	21	4	
Not Being Prepared	99	21	
Poor Government Response	18	5	
Roads Not Cleared	29	7	
Shops Closed	19	5	
Shops Out of Stock	28	9	
Social Unrest	3	1	
The Unknown	20	8	
Traveling	123	25	
Utilities being lost	99	22	
Volume of Snow	123	36	
Watching the News	57	13	
Watching the Storm	43	17	
Worries about Friends and Family Safety	129	16	
Worse than Expected	71	15	

Table 19: Representation of Household Income in Factors that Decreased Worry

Factors that Decreased Worry x Income	Low (10%)	Mid (41%)	High (28%)
Emma - Not as bad as expected	12%	58%	30%
Location	14%	57%	29%
Being Informed	7%	37%	55%
Work or College Cancelled	9%	51%	40%
Being Prepared	5%	57%	37%
Utilities not Lost	3%	53%	44%
Safe Inside	11%	60%	29%
Friends and Family Safe	0%	45%	55%
Love Snow	12%	57%	31%
No Worries	4%	56%	40%
No Damage to House	4%	35%	61%
Government Action	13%	25%	62%
Still Able to Travel	0%	64%	36%
Time with Friends and Family	0%	60%	40%
Shops Remained Open	12%	75%	13%
Roads Cleared Quickly	0%	35%	65%
Music	0%	0%	100%
Alcohol	0%	0%	100%
Religion	100%	0%	0%

Table 19 above shows the distribution of comments concerning the causes of decreased worry by income levels. It shows the degree to which the income level groups emphasized each factor that decreased worry. For example, 88% of comments regarding the Storm not being as bad as expected came from 69% of the study population comprising mid to high-level income groups. 96% of comments on not being worried also came from this group while.

Table 20 below shows the distribution of comments concerning the causes of increased worry by income levels. It illustrates the emphasis across each heightened worry code by household income.

Table 20: Factors that Increased Worry by Household Income

Factors that Increased Worry by Income	Low	Mid	High
Being Trapped in House	10.88%	60.45%	28.67%
Cancelled Flight	4.62%	20%	75.38%
Childcare	0%	51.06%	48.94%
Climate Change	100%	0%	0%
Damage to House	8.87%	69.50%	21.63%
Driving Emergency Service Vehicles	0%	58.82%	41.18%
Falling Trees	12.44%	73.58%	13.99%
Getting Home	13.44%	50.77%	35.79%
Getting to Work	8.76%	61.27%	29.97%
Going Outside	36.08%	58.25%	5.67%
High Winds	29.50%	31.50%	39%
Lack of Communication from Employer	3.50%	90.12%	6.38%
Lack of Communication from HSE and management and support for staff	0%	61.24%	38.76%
Livestock	3.41%	85.83%	10.76%
No Access to Medical Services	6.32%	57.66%	36.02%
No Access to Veterinarian	0%	100%	0%
No Money in ATM	0%	0%	0%
No Public Transport	8.78%	64.34%	26.88%
Not Being Prepared	17.34%	50.34%	32.31%
Poor Government Response	14.21%	43.49%	42.30%
Roads Not Cleared	23.85%	41.59%	34.56%
Shops Closed	36.44%	34.46%	29.10%
Shops Out of Stock	19.54%	35.08%	45.38%
Social Unrest	0%	92.86%	7.14%
The Unknown	17.10%	55.02%	27.88%
Traveling	13.48%	49.87%	36.65%
Utilities being lost	16.97%	56.74%	26.28%
Volume of Snow	15.54%	62.72%	21.74%
Watching the News	16.81%	56.17%	27.02%
Watching the Storm	18.95%	45.89%	35.16%
Worries about Friends and Family Safety	7.98%	56.23%	35.79%
Worse than Expected	25.27%	50.11%	24.62%

Table 20 above shows, for example, that high-income respondents were more worried due to flight cancellations than mid or low-income respondents. Mid-income respondents were more worried due to damage to their property while low and mid-level income households were more worried about having to go outside.

Finally, Table 21 below shows the causes of increased worry by sentiment:

Table 21: Causes of Decreased Worry by Sentiment

Causes of Decreased Worry by Sentiment	Positive	Negative
Alcohol	1	0
Being Informed	91	1
Being Prepared	64	5
Emma - Not as bad as expected	298	39
Friends and Family Safe	38	1
Government Action	17	0
Location	145	3
Love Snow	23	0
Music	1	0
No Damage to House	17	0
No Worries	21	1
Religion	1	0
Roads Cleared Quickly	5	0
Safe Inside	40	7
Shops Remained Open	8	0
Still Able to Travel	16	1
Time with Friends and Family	13	0
Utilities not Lost	43	2
Work or College Cancelled	85	9
Total Comments	**927**	**69**

Table 21 below shows the sentiment of comments against each code. For example, the code "Emma – not as bad as expected" contains 345 comments. When broken down by sentiment, 298 are positive, and 39 are negative totalling 337, with eight comments deemed to be neutral. Some comments were broken into positive and negative, where a comment contains both sentiments.

Table 21 shows the balance of comments in this category were positive, with some respondents expressing negative comments about the Storm being not as bad as expected:

> *There were no major effects from the Storm, barely had any snow at all.*
> *The warnings caused unnecessary fear. (R865)*

Negative comments in this category often blamed the mainstream media for over-hyping the Storm.

Table 22: Causes of Increased Worry by Sentiment

Causes of Increased Worry by Sentiment	Positive	Negative
Being Trapped in House	1	155
Cancelled Flight	0	16
Childcare	0	6
Climate Change	1	1
Damage to House	0	74
Driving Emergency Service Vehicles	0	4
Falling Trees	1	14
Getting Home	1	108
Getting to Work	5	314
Going Outside	1	11
High Winds	0	29
Lack of Communication from Employer	0	24
Lack of Communication from HSE and management and support for staff	0	27
Livestock	0	26
No Access to Medical Services	1	44
No Access to Veterinarian	0	1
No Money in ATM	0	1
No Public Transport	0	30
Not Being Prepared	1	131
Poor Government Response	0	23
Roads Not Cleared	0	37
Shops Closed	0	24
Shops Out of Stock	1	36
Social Unrest	0	4
The Unknown	1	34
Traveling	23	147
Utilities being lost	5	129
Volume of Snow	0	182
Watching the News	1	83
Watching the Storm	0	77
Worries about Friends and Family Safety	1	165
Worse than Expected	0	103
Total Comments	**44**	**2060**

Table 22 above shows that sentiment in this category was predominantly negative in almost all codes.

7.2 Household Preparedness

This section of the case study examines respondents' level of preparedness for The Storm. Respondents were asked four yes/no questions that related to preparedness actions before The Storm arrived:

1. Did they make any plans for the possible loss of water supply?
2. Did they make any plans for the possible loss of power supply?
3. Did they purchase additional food supplies in preparation for The Storm?
4. As a result of the weather warnings, did they seek any further information on how to prepare?

The percentages who reported 'yes' for each of the preparedness questions are outlined in Figure 25 below.
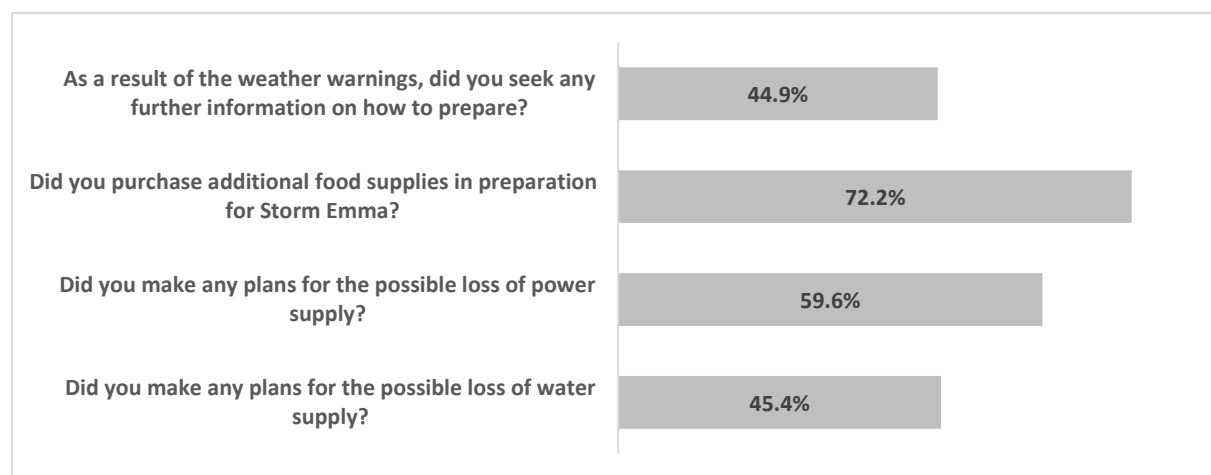
Figure 25: Preparedness Actions Before The Storm

The action most performed by respondents was the purchasing of additional food supplies, 72.2% (2939n), followed by making plans for the possible loss of power 59.6% (2327n). At the same time, less than 50% planned for the loss of water or sought additional information to prepared as a result of the warnings (see Figure 25).

Based on the preparedness questions, an action score, a count of the number of actions completed, ranging from zero to four, was calculated, and the frequency distribution is presented in Table 23. The mean score was 2.22, with a standard deviation of 1.245. Overall, the vast majority of respondents undertook at least one action to prepare (89.5%). Only 10.5% suggested they had not undertaken any of the suggested actions.

Table 23: Number of Actions Before The Storm

Actions	Percentage
Zero Actions completed	10.5% (429n)
One Action completed	19.5% (794n)
Two Actions completed	24.8% (1010n)
Three Actions completed	27.5% (1117n)
Four Actions completed	17.7% (719n)

Note: 4069 responses

Figure 26 below provides a visualisation of the association between respondents' worry levels and their level of response, measured as the number of preparation actions taken. For each stated worry level, the proportion who took 0 up to 4 actions is recorded. From the diagram it appears that the number of actions taken is positively associated with the level of worry stated. For example, this analysis suggests that 33.1% of respondents who worried a great deal about the storm completed four actions completed, whereas only 5.6% of those who were not at all worried did so. A chi-square test shows a statistically significant association between respondents' levels of worry about the Storm and the total number of actions undertaken before its arrival ($\chi^2(16) = 378.175$, $p < 0.001$).

Table 24 provides the average number of actions for each reported worry level before The Storm. Unsurprisingly, respondents who were not worried presented with an average action score of 1.491 compared to 2.710 for those that worried a great deal. A Kruskal-Wallis test indicated a statistically significant difference in the distribution of responses across levels of worry in Table 24 ($\chi^2(4) = 332.065$, $p < 0.001$).
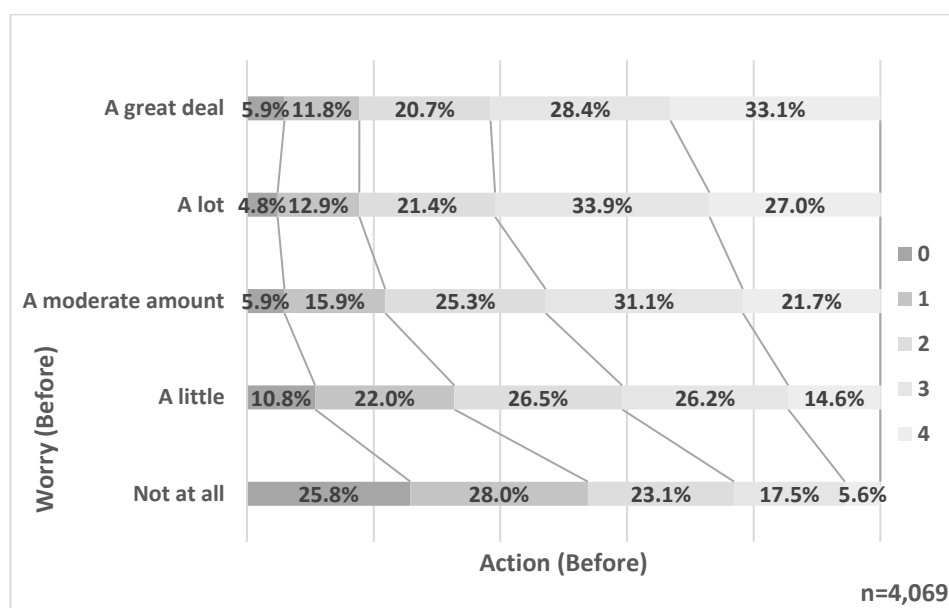
Figure 26: Actions Before The Storm by Worry

	Mean
Not at all	1.491
A little	2.118
A moderate amount	2.468
A lot	2.652
A great deal	2.710

Table 24 Average Worry by Actions Before The Storm

Comparing actions before The Storm by gender, females on average indicated a slightly larger number of actions (2.325) than males (1.981). The difference is not large in magnitude but is statistically significant based on a t-test (t = 7.31, p<0.001). For example, almost 15% of male respondents reported completing zero actions before the storm arrived, whereas only 8.8% of females reported the same. These differences between male and female responses are represented in Figure 27.
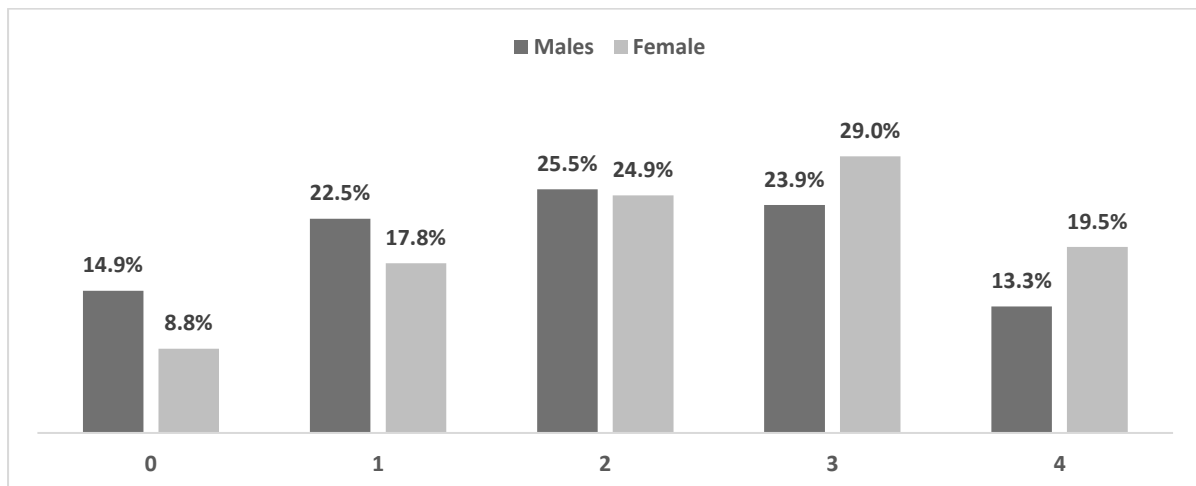
Figure 27: Number of Actions by Gender

Examining differences in the distribution over actions before The Storm by the settlement type in which respondents lived, the pattern displayed in Figure 28 shows the distribution is more weighted to the right for lower levels of urbanicity. For example, around 15% of city respondents took none of the four actions to prepare, while the corresponding figure was only 7% for rural dwellers. A Kruskal-Wallis test rejects the hypothesis that the responses for all settlement types are drawn from the same population distribution (p<0.001).

The mean number of actions taken before the Storm over settlement types is given in Table 25 and shows the average is increasing in the degree of urbanicity. An average of 2.448 actions was taken by households in rural areas, compared to 1.996 for cities.

Table 25: Average Actions Taken Before The Storm, by Settlement

	Mean
A rural area	2.448
A village	2.263
A town	2.210
suburbs or outskirts of a city	2.109
A city	1.996
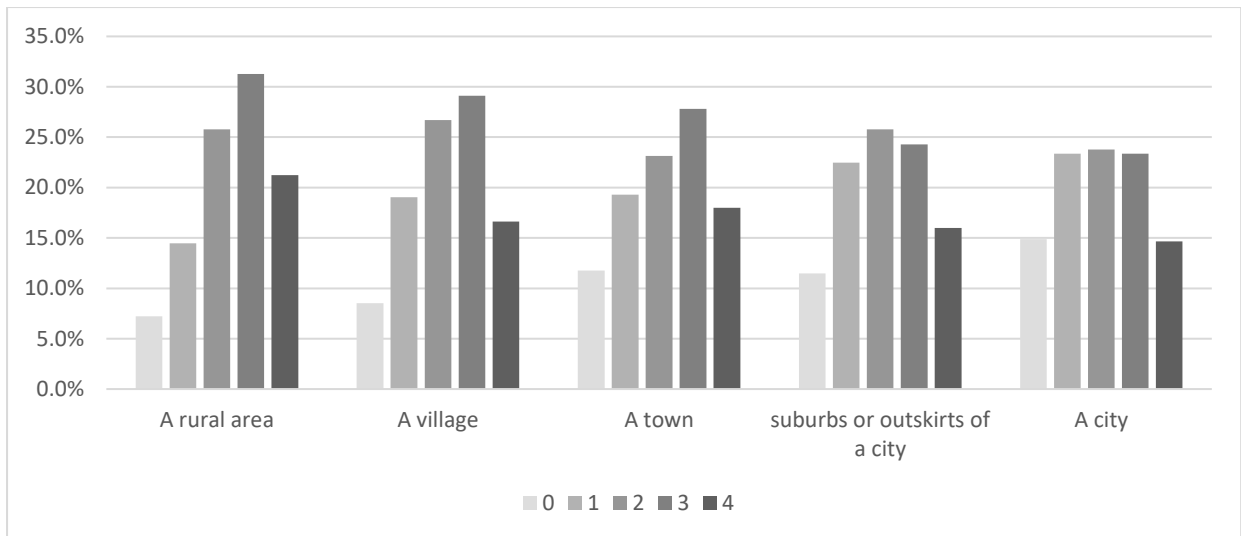
Figure 28: Number of Actions by Settlement

Table 26 sets out the average number of Actions Before The Storm by County. The highest five, in terms of increased actions, are marked in light purple, and the lowest five, in terms of the lowest average number of actions, are marked in light blue.

Table 26: Average number of Actions Before The Storm by County

Southern Counties	Mean	Freq.
Carlow	2.276	29
Cavan	2.207	58
Clare	2.114	79
Cork	2.368	473
Donegal	2.000	70
Dublin	1.988	1056
Galway	2.045	199
Kerry	2.678	59
Kildare	2.417	321
Kilkenny	2.239	71
Laois	2.254	67
Leitrim	2.280	25
Limerick	2.432	125
Longford	2.727	33
Louth	2.260	123
Mayo	2.000	137
Meath	2.194	211
Monaghan	2.029	34
Offaly	2.301	133
Roscommon	2.381	84
Sligo	1.873	71
Tipperary	2.453	117
Waterford	2.564	117
Westmeath	2.281	135
Wexford	2.552	134
Wicklow	2.442	86

Respondents reported whether or not they owned each of the following 12 items: an alternative means of heating; an emergency kit should they need to evacuate; a bag of salt (clearing paths); a battery-powered or hand-crank radio; candles & matches/lighter; emergency cash; emergency contact information (paper format); extra batteries; first aid kit; large drinking water container; shovel; torch. The percentages who report having each of the items are presented in Table 27, with the items in order of frequency of possession.

Table 27: Household Preparedness Items (Before The Storm)

	Yes, I had this…
Candles & Matches/Lighter	95.3% (3876n)
Torch	90.2% (3671n)
First aid kit	80.2% (3264n)
Shovel	77.9% (3171n)
Extra batteries	74.1% (3015n)
An alternative means of heating	64.2% (2612n)
Large drinking water container	54.1% (2203n)
Emergency Cash	50.9% (2072n)
Emergency contact information (paper format)	42.3% (1723n)
Bag of salt (Clearing Paths)	31.3% (1272n)
Battery-powered or hand-crank radio	30.8% (1252n)
An emergency kit should I need to evacuate	9.7% (396n)

Details of additional preparedness actions were provided by 2,220 respondents, with 2,708 individual activities being recorded.

Table 28 below shows the nature of the responses:

Table 28: Additional Actions to Prepare for The Storm

	Freq.
Stocked up on Supplies	543
Nothing	459
Battened Down the Hatches	312
Helped Friends and Family	264
Stayed in House	179
Appropriate Clothing	163
Charged Batteries	99
Prepared to Work from Home	87
Watching the News	70
Kept Pets Safe	59
Moved Closer to Work	51
Protect Livestock	47
Alternative Transport	41
Stocking up on Tools	38
Travelled Home	34
Travel Bag	34
Removing Snow	33
Completed Work Before Storm	31
Already Prepared	31
Alternative Power Source	21
prepared Tyres	21
Alternative Heat Source	20
More Time for Travel	17
Entertainment	17
Alternative Cooking Source	12
Preparing for Emergency service Work	5
Emergency Contact Numbers	5
Melt Snow	4
Childcare	4
No Need to Prepare	4
Over Prepared	2
Prepared for Social Unrest	1
Total Comments	2708

Stocked up on Supplies

The most cited form of preparation was stocking up on supplies, with 543 respondents (24.45%) making these arrangements.

> *Got heating repairs/ boiler service done. Got more turf for fire. Got more bread + frozen food in deep freezer. (R112)*

> *Brought extra clothing, torch, first aid kit and extra food supplies to work in case I couldn't get home. Charged extra battery packs and my old phone in case power went out. Took in loose garden furniture. Bought food that wouldn't require cooking in case power went. (R494)*

> *Extra food shopping including food that could be prepared in no electricity/gas. Additional candles, torches. (R683)*

Figure 29 shows keywords used based on frequency when discussing stocking up indicating that fuel, water and food were mentioned most often:

Figure 29: Word Frequencies for Stockpiling to Prepare for the Storm.

Based on recurring patterns of language, Figure 30 below indicates that bread and milk were high on the list of the items stockpiled:
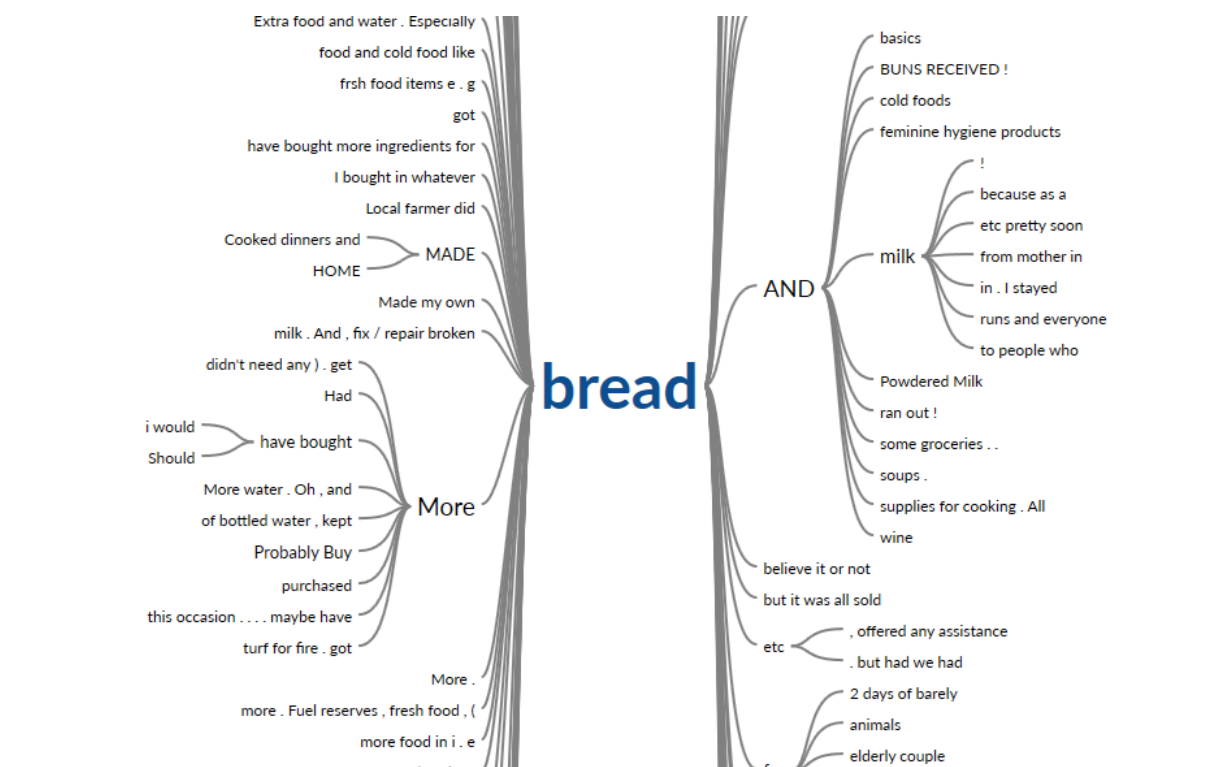
Figure 30: Patterns of Language used Regarding Stockpiling

No Preparation

459 respondents said they did not make any specific preparations for The Storm. For some, this was because they did not think The Storm would not be as bad as it was, while for others it was because they believed the nationwide red weather alert was an over-reaction:

> *None at all. None needed. No snow fell in Sligo. The red weather alert should NOT have been nationwide. (R1466)*

> *Nothing. It's just a little snow. I'm from Canada. You guys can't handle even the smallest bit of snow. (R97)*

> *We did absolutely nothing. (R300)*

For others, not preparing was a source of regret:

> *Not much as I wasn't expecting that my estate would be so bad as well as roads and did not expect shops to close. (R1185)*

> *Our family were really in transit at the time of Storm Emme but as a*

motorist I was very poorly prepared. (R3548)

Didn't think it would be so bad so took no action. (R3662)

No other actions were taken. Didn't think it would get as bad as it did. (T51)

The principal reasons for not preparing were a belief the warnings were overstated, the warnings did not predict that the respondents' locations would be badly impacted, or general apathy. For these reasons, one in every five respondents did not prepare in any way for the impending Storm. Figure 31 below shows the recurrence of keywords across all 459 comments made in this context:
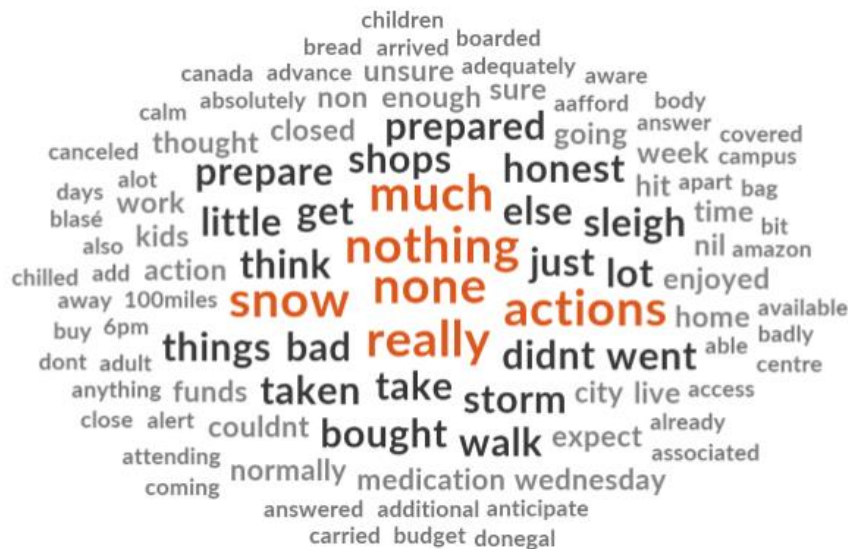
Figure 31: Word Frequencies used by those who did not Prepare for The Storm

Battened Down the Hatches

A total of 312 respondents prepared their homes in anticipation of The Storm's arrival. Many comments centred on securing objects that could become airborne during The Storm and cause additional damage to their homes.

Make sure everything in the garden that could be flipped over was moved and secure. (R151)

On the Monday and Tuesday, we prepared by taking down anything that could move in a blizzard in the garden so that it couldn't hit our windows. (R453)

Fear of freezing pipes resulting in loss of utilities featured in many preparatory actions:

Ran taps. Filled bathtubs and pots with tap water. Insulated our external gas cylinder (it still froze). (R993)

Brought everything from outside into the shed (i.e. plant pots, toys, furniture). Brought the animals into the utility room (dog and rabbit - don't worry, they're friends!), checked all windows and doors were sturdy and closed both shed doors tight. We also got the camping stove and gas down from the attic in case of the gad bottle outside freezing (we wrapped the gas bottle in a duvet to try prevent it from freezing - it worked). (R1199)

Tried to ensure that heat got to the attic to prevent pipes freezing which did not work. (R1334)

Figure 32 below shows the recurring keywords for this type of preparation:

Figure 32: Recurring Keywords in Battening Down the Hatches

Other frequently cited preparations included helping Friends and Family (264 comments), a topic which will be covered in greater depth in the next section of the case study. "Stayed in the house" (179 comments); "Organised Appropriate Clothing" (163 comments); "Charged Batteries" (99 comments) and "Prepared to Work from Home" (87 comments) also featured in the responses.

Figure 33 below shows that normal gender distribution, relative to the study population, applied amongst respondents' actions to prepare for The Storm. Table 2 shows there was a 3:1 ratio of females to male respondents, and this ratio was upheld in the volume of all preparatory actions.
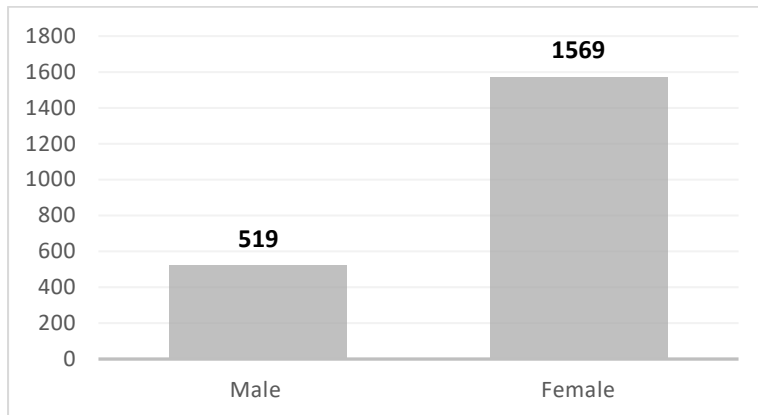
Figure 33: Preparatory Actions by Gender

Table 29 below shows the individual codes and the degree to which males and females placed greater emphasis on various preparatory actions:

Table 29: Additional Preparedness Actions by Gender

Actions to prepare for Storm Emma by gender	Female	Male	Proportional Representation
Already Prepared	17	11	
Alternative Cooking Source	7	5	
Alternative Heat Source	16	4	
Alternative Power Source	14	6	
Alternative Transport	34	4	
Appropriate Clothing	124	31	
Battened Down the Hatches	218	78	
Charged Batteries	78	19	
Childcare	4	0	
Completed Work Before Storm	28	3	
Emergency Contact Numbers	4	1	
Entertainment	15	2	
Helped Friends and Family	213	39	
Kept Pets Safe	51	5	
Melt Snow	3	1	
More Time for Travel	14	3	
Moved Closer to Work	41	6	
No Need to Prepare	0	1	
Nothing	295	120	
Over Prepared	1	1	
Prepared for Social Unrest	1	0	
Prepared to Work from Home	70	14	
prepared Tyres	10	10	
Preparing for Emergency service Work	2	3	
Protect Livestock	32	10	
Removing Snow	22	10	
Stayed in House	126	43	
Stocked up on Supplies	403	120	
Stocking up on Tools	26	12	
Travel Bag	26	6	
Travelled Home	27	6	
Watching the News	51	17	

Table 29 shows that women placed greater emphasis on alternative transport; appropriate clothing; charging batteries; childcare; entertainment; helping friends and families; keeping pets safe; moving closer to work; preparing to work from home; stocking up on supplies and watching the news. Males placed greater emphasis on being already prepared; having an alternative cooking source; battening down the hatches; doing nothing to prepare; preparing tyres; preparing for emergency service work; removing snow; and stocking up on tools.

Table 30 below shows the distribution of comments concerning actions taken to prepare for The Storm by household income levels. It shows the degree to which each of the three income level groups emphasized each preparedness action.

Table 30: Additional Actions to Prepare by Income

Actions to Prepare for Storm Emma by Income	Low (10%)	Mid (41%)	High (28%)
Already Prepared	11.53%	54.89%	33.58%
Alternative Cooking Source	0%	40%	60%
Alternative Heat Source	18.15%	56.30%	25.56%
Alternative Power Source	0%	45.75%	54.25%
Alternative Transport	8.60%	49.35%	42.06%
Appropriate Clothing	10.91%	43.81%	45.28%
Battened Down the Hatches	12.04%	49.17%	38.80%
Charged Batteries	10.71%	52.27%	37.01%
Childcare	0%	76.47%	23.53%
Completed Work Before Storm	14.01%	54.28%	31.71%
Emergency Contact Numbers	0%	57.78%	42.22%
Entertainment	3.96%	31.68%	64.36%
Helped Friends and Family	7.05%	50.39%	42.56%
Kept Pets Safe	6.87%	58.31%	34.81%
Melt Snow	5.81%	34.88%	59.30%
More Time for Travel	11.03%	66.21%	22.76%
Moved Closer to Work	0%	54.52%	45.48%
No Need to Prepare	0%	100%	0%
Nothing	18.79%	52.37%	28.84%
Over Prepared	34.62%	65.38%	0%
Prepared for Social Unrest	0%	100%	0%
Prepared to Work from Home	15.85%	28.19%	55.96%
Prepared Tyres	4.80%	71.20%	24%
Preparing for Emergency service Work	40.16%	18.03%	41.80%
Protect Livestock	7.78%	79.04%	13.17%
Removing Snow	8.36%	64.81%	26.83%
Stayed in House	18.84%	45.13%	36.02%
Stocked up on Supplies	15.18%	52.17%	32.65%
Stocking up on Tools	14.23%	58.46%	27.31%
Travel Bag	3.99%	41.40%	54.61%
Travelled Home	15.53%	62.11%	22.37%
Watching the News	7.07%	59.97%	32.96%

Table 30 above shows, for example, that high-income respondents made more preparations for entertainment and working from home than their 28% of total respondents represents, while actions related to childcare and needing more time for travel were given a greater degree, proportionately, by mid-level earners. Preparing for emergency service work was overrepresented in the low-income group.

Figure 34 below shows the distribution of comments regarding the three most cited actions taken to prepare for The Storm by County:

County	Stocked up on Supplies	Nothing	Battened Down the Hatches
Carlow	0.7%	0.2%	0.3%
Cavan	1.9%	1.1%	1.0%
Clare	1.7%	1.5%	1.3%
Cork	13.4%	9.7%	16.4%
Donegal	0.9%	2.6%	2.3%
Dublin	19.5%	29.2%	18.0%
Galway	3.9%	7.9%	3.5%
Kerry	1.5%	0.9%	2.3%
Kildare	10.4%	6.2%	10.0%
Kilkenny	2.4%	1.8%	1.9%
Laois	1.1%	1.5%	1.9%
Leitrim	0.0%	0.7%	0.6%
Limerick	3.2%	1.8%	2.6%
Longford	0.7%	0.9%	1.0%
Louth	2.8%	4.0%	1.6%
Mayo	1.5%	5.1%	5.5%
Meath	5.2%	4.8%	5.8%
Monaghan	0.9%	1.1%	0.3%
Offaly	4.6%	3.1%	3.5%
Roscommon	2.4%	1.3%	2.9%
Sligo	1.3%	3.1%	1.3%
Tipperary	3.9%	2.2%	2.9%
Waterford	3.5%	2.2%	3.2%
Westmeath	3.5%	3.3%	3.2%
Wexford	5.0%	2.9%	4.5%
Wicklow	3.9%	1.1%	2.3%

Legend	
	High range % of preparations for storm by county
	Mid range % of preparations for storm by county
	Low range % preparations for storm by county

Figure 34: Most Cited Additional Preparations for the Storm by County

Stocking up on supplies was most represented in urban centres such as Dublin, Galway, Limerick, and Cork. Dublin, Galway and Cork, Mayo and Kildare were most represented regarding doing nothing to prepare, while Dublin, Cork and Kildare were most represented in comments concerning battening down the hatches. Table 31 shows that the sentiment in this category was predominantly positive, with one exception – doing nothing to prepare.

Table 31: Additional Actions to Prepare for The Storm by Sentiment

Actions to Prepare for Storm Emma by Sentiment	Positive	Negative
Already Prepared	30	1
Alternative Cooking Source	12	0
Alternative Heat Source	20	0
Alternative Power Source	21	0
Alternative Transport	41	0
Appropriate Clothing	163	0
Battened Down the Hatches	306	2
Charged Batteries	99	0
Childcare	4	1
Completed Work Before Storm	31	0
Emergency Contact Numbers	5	0
Entertainment	17	1
Helped Friends and Family	261	1
Kept Pets Safe	59	0
Melt Snow	4	1
More Time for Travel	17	0
Moved Closer to Work	51	0
No Need to Prepare	1	4
Nothing	18	443
Over Prepared	0	2
Prepared for Social Unrest	1	0
Prepared to Work from Home	87	0
prepared Tyres	21	0
Preparing for Emergency service Work	4	1
Protect Livestock	46	0
Removing Snow	30	2
Stayed in House	178	1
Stocked up on Supplies	538	5
Stocking up on Tools	37	1
Travel Bag	34	0
Travelled Home	34	0
Watching the News	67	1
Total Comments	**2237**	**467**

The percentage of respondents who stated they had the recommended stores of food, water and medication supplies when The Storm arrived are provided in Table 32. 43.9% of the households reported having less than three days' supply of bottled water when the Storm arrived. A smaller proportion, 13.8%, did not have a stock of food for the recommended period (3+ days).

Table 32: Household Preparedness - Percentage with Recommended Water, Food and Medication Supplies When The Storm Arrived

When The Storm arrived…	0 Days	1-2 Days	3-5 Days	6-7 Day	8+ Days
I had enough bottled water for …	14.7% (597n)	29.2% (1189n)	33.9% (1378n)	11.1% (450n)	11.2% (455n)
I had enough food for …	0.7% (27n)	13.1% (534n)	46.6% (1895n)	23.1% (941n)	16.5% (672n)
I had enough medication for …	14.3% (583n)	7.9% (321n)	19.4% (791n)	13.4% (545n)	44.9% (1829n)

Overall, it was important to gauge, on reflection, how respondents felt they coped with The Storm. Their coping appraisal was reported on a scale from 0 to 100, see Figure 35, where 0 indicated not at all prepared, and 100 represented being totally prepared. Overall, the mean response was 62.96. In total, 15% of respondents (595n) had a score of 30 or less, which suggested they felt they were not prepared for The Storm. While on the opposite side, just 35% of respondents presented with a Coping Appraisal of 80 or above.
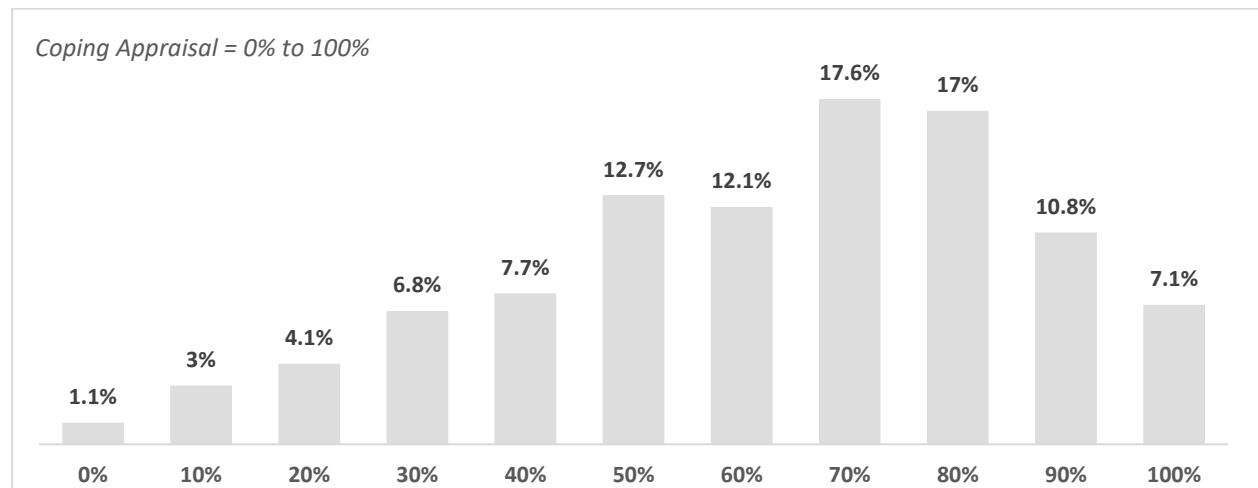
Figure 35: Individual Coping Appraisal

The average response for males was statistically significantly higher than that for females, 66.30 compared to 62.71. However, respondent's reflective post-event coping appraisal, indicating how well respondents felt they coped with The Storm, was not correlated with settlement type (Urbanicity): correlation coefficient = -0.028 (p=0.094). This was also confirmed by a chi-square test that showed no statistically significant association between both factors ($\chi 2(40)$ = 48.350, p=0.171).

Table 33 shows the average reported Coping Appraisal for each county. The six highest in terms of Coping Appraisal are shaded purple while the lowest six are shared in light blue with the difference between the highest (Mayo) and lowest (Carlow) ratings being 13.05 percentage points.

Table 33: Stated Coping Appraisal by County

Southern Counties	Mean	Freq.
Carlow	57.65	34
Cavan	63.05	59
Clare	63.90	82
Cork	62.61	494
Donegal	65.27	74
Dublin	61.15	1104
Galway	64.11	209
Kerry	64.13	63
Kildare	62.99	328
Kilkenny	60.63	80
Laois	64.79	71
Leitrim	66.67	21
Limerick	66.59	135
Longford	66.97	33
Louth	63.44	122
Mayo	70.70	143
Meath	60.19	212
Monaghan	59.46	37
Offaly	63.14	137
Roscommon	70.45	89
Sligo	66.09	69
Tipperary	63.28	122
Waterford	61.08	120
Westmeath	64.62	130
Wexford	62.89	135
Wicklow	62.33	90

7.3 Actions should have been taken to prepare for the Storm

Respondents were asked to describe other actions they should have taken upon reflection, and with the benefit of hindsight. 2,460 respondents made a total of 2,988 comments in this context. Table 34 shows the nature of these comments:

Table 34: Actions Should Have Taken

Additional actions that could have been taken to prepare for The Storm	2460
Stocked up on Supplies-More Supplies	1104
Nothing	525
Stocked Up on Tools-more Tools	148
Alternate Heat Source	111
Removed Snow and Ice	92
Prepared for loss of Utilities	78
Alternative Means of Cooking	72
Stayed at Home	70
Appropriate Clothing	67
Entertainment	65
No Need to Prepare	64
Communicated better with Work	63
Battened down the Hatches	55
Medical Supplies Emergency	53
Alternative Power Source	51
Believe the News	45
Help Friends and Family	41
Emergency Contact Numbers	34
Cash	32
Bug Out Bag	31
Alternative Means of Transport	31
Prepared Tyres	29
Charged Batteries	25
Moved Closer to Town	20
Travelled Home	19
Prepared to Work from Home	13
Bug Out Plan	10
Protect Livestock	8
Stayed in Work	8
Checked Heating Working Properly	7
Travel Bag	7

Additional actions that could have been taken to prepare for The Storm	2460
Access to Car	6
Kept Pets Safe	2
Cancelled Plans	1
Childcare	1
Total Comments	2988

Stocked up on Supplies

1,104 (45%) of respondents felt, on reflection, they did not stock up enough in preparation for The Storm:

> *Should have planned and prepared my getting extra food, water, back up plans. (R29)*

> *I should have been more worried and therefore filled up water bottles and bought food that didn't require electricity to prepare. (R446)*

> *I tried to buy some extra food for the storm however shops were sold out of a lot of supplies. I was working in a hospital for two days; on reflection I should have got some better footwear for wearing in and out of the hospital. It didn't occur to me to buy extra water. (R490)*

Figure 36 below shows an analysis of the types of supplies most cited in comments:
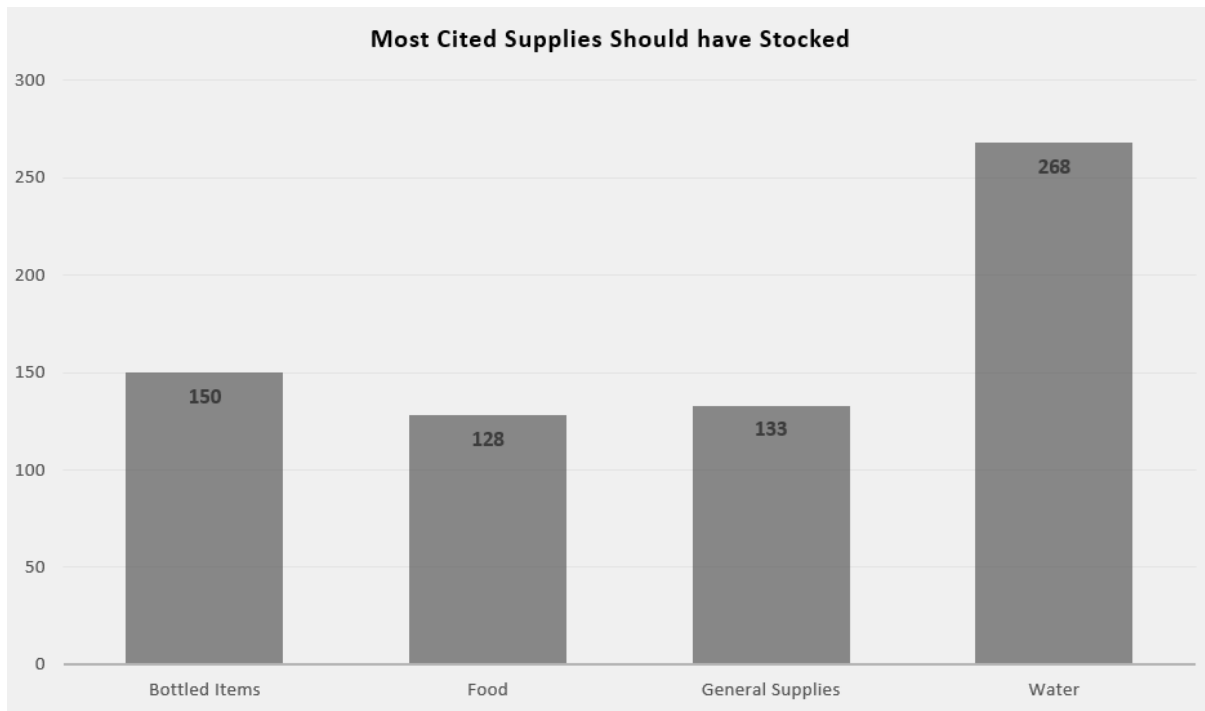
Figure 36: Most Cited Supplies Should have Stocked

Nothing Needed

A total of 525 respondents felt that they did not need to make any additional preparations for The Storm:

All that could be prepared was already done. (R54)

Not all that much, we survived pretty comfortably, the only real negative effect was the cabin fever of not being able to leave. (R168)

There was nothing else we could have done - we could not do anything about being snowed in for 5 days. (R390)

Figure 37 below shows the keywords most cited by those who felt they were well prepared and did not wish, on reflection, they had done more:

Figure 37: Keywords Most Cited by Well-Prepared Respondents

Stocked up on Tools

148 respondents wished they had bought tools, primarily a shovel, before the arrival of The Storm:

> *I wish I'd gotten shovel and salt for potentially clearing paths outside complex (R632)*

> *A shovel to clear the car in case I really needed to get out on the Saturday. (R1388)*

Other items frequently listed as something that should have been purchased before The Storm included: torches; salt, extra shovels so multiple people can help clear snow; grit; candles; and snowshoes. Two in every three respondents who replied to this question selected items in the top three categories (see Table 34). Other lost opportunities to prepare included: not securing alternative heat sources (111 comments); not removing snow and ice earlier (92 comments); being better prepared for the loss of utilities with flashlights, generators, and stored bottled water (78 comments).

Female respondents were marginally overrepresented for comments made regarding things they should have done to prepare for The Storm. Figure 38 below shows females submitted a greater number of comments than their 3:1 ratio within the study population:
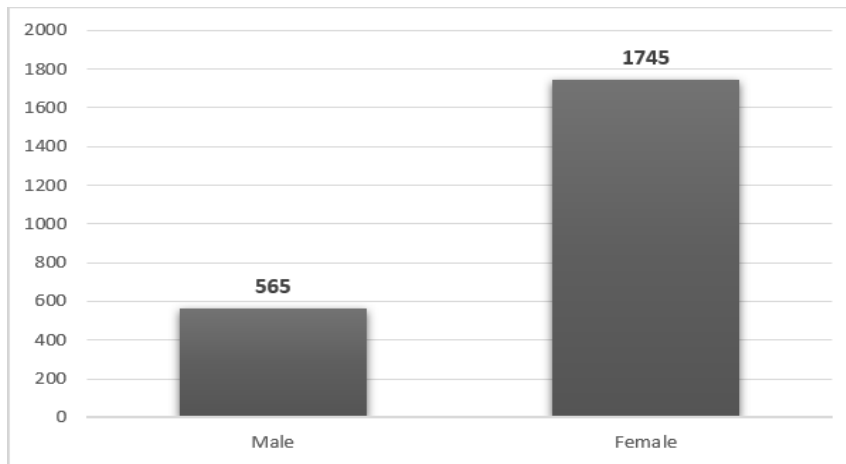
Figure 38: Actions that Should have been Taken by Gender

Table 35 below shows the degree to which males and females placed greater emphasis on various preparedness actions which they should have taken:

Table 35: Actions that should have been taken by Gender

Actions that should have been taken by Gender	Female	Male	Proportional Representation
Access to Car	5	1	
Alternative Heat Source	84	23	
Alternative Means of Cooking	51	18	
Alternative Means of Transport	21	6	
Alternative Power Source	29	20	
Appropriate Clothing	52	13	
Battened down the Hatches	38	14	
Believe the News	27	15	
Bug Out Bag	22	9	
Bug Out Plan	9	1	
Cancelled Plans	1	0	
Cash	25	5	
Charged Batteries	18	7	
Checked Heating Working Properly	7	0	
Childcare	1	0	
Communicated with Work Better	57	4	
Emergency Contact Numbers	26	7	
Entertainment	48	12	
Help Friends and Family	30	10	
Kept Pets Safe	2	0	
Medical Supplies Emergency	47	5	
Moved Closer to Town	15	4	
No Need to Prepare	43	19	
Nothing	344	143	
Prepared for loss of Utilities	57	18	
Prepared to Work From Home	10	2	
prepared Tyres	16	11	
Protect Livestock	5	2	
Removed Snow and Ice	71	17	
Stayed at Home	58	8	
Stayed in Work	7	0	
Stocked up on Supplies-More Supplies	809	224	
Stocked Up on Tools-more Tools	114	30	
Travel Bag	5	2	
Travelled Home	14	5	

Distribution was normal for all codes in this category except one which was skewed mainly towards female respondents. Males placed a marginally greater emphasis on putting in place alternative power sources; believing the news; not needing to do any more than they did; and preparing tyres. Females wished they had communicated better with work; and stayed at home. However, the most significant difference related to stocking up with more supplies - 809 females to 224 males wished they had stocked up with more supplies.

Table 36 below shows the distribution of comments concerning actions that, on reflection, could have been taken by household income level. It shows the degree to which each income level group emphasized actions they should have taken.

Table 36: Actions that should have been taken by Income

Actions should have been taken to prepare by Income	Low (10%)	Mid (41%)	High (28%)
Access to Car	0%	70%	30%
Alternative Heat Source	22.93%	38.54%	38.54%
Alternative Means of Cooking	8.27%	46.09%	45.64%
Alternative Means of Transport	1.19%	67.86%	30.95%
Alternative Power Source	5.64%	51.10%	43.26%
Appropriate Clothing	16.63%	56.77%	26.60%
Battened down the Hatches	12.88%	50.38%	36.73%
Believe the News	18.90%	47.52%	33.58%
Bug Out Bag	3.64%	74.09%	22.27%
Bug Out Plan	0%	82.93%	17.07%
Cancelled Plans	0%	0%	100%
Cash	1.98%	60.40%	37.62%
Charged Batteries	29.51%	48.63%	21.86%
Checked Heating Working Properly	9.40%	71.14%	19.46%
Childcare	0%	0%	100%
Communicated with Work Better	4%	60.47%	35.53%
Emergency Contact Numbers	4.04%	32.83%	63.13%
Entertainment	27.47%	50.27%	22.25%
Help Friends and Family	6.36%	71.05%	22.59%
Kept Pets Safe	86.21%	13.79%	0%
Medical Supplies Emergency	6.17%	74.68%	19.16%
Moved Closer to Town	10.12%	54.76%	35.12%
No Need to Prepare	13.24%	64.57%	22.19%
Nothing	13.66%	50.75%	35.60%
Prepared for loss of Utilities	25.69%	40.93%	33.38%
Prepared to Work From Home	0%	81.03%	18.97%
prepared Tyres	18.42%	50%	31.58%
Protect Livestock	15.38%	62.64%	21.98%
Removed Snow and Ice	10.70%	52.11%	37.19%
Stayed at Home	23.08%	60.46%	16.47%
Stayed in Work	9.78%	67.39%	22.83%
Stocked up on Supplies-More Supplies	16.34%	49.62%	34.04%
Stocked Up on Tools-more Tools	9.78%	51.35%	38.87%
Travel Bag	24.64%	52.90%	22.46%
Travelled Home	16.04%	49.20%	34.76%

Table 36 above shows, for example, that high-income respondents regretted not having made more arrangements for childcare, while those in the mid-level income bracket regretted not communicating better with work and not planning more to work from home. Low-income respondents regretted not making more arrangements to keep pets safe.

Figure 39 below shows the distribution of comments relating to the top three most cited actions which respondents wished they had taken to prepare for The Storm by County:

County	Stocked up on more Supplies	Nothing	Stocked Up on more Tools
Carlow	0.3%	0.6%	0.0%
Cavan	0.7%	0.6%	0.7%
Clare	1.9%	1.3%	2.0%
Cork	13.0%	11.1%	10.9%
Donegal	1.1%	1.7%	0.0%
Dublin	29.4%	21.3%	32.7%
Galway	4.7%	4.2%	4.8%
Kerry	0.9%	1.9%	1.4%
Kildare	10.2%	5.4%	14.3%
Kilkenny	1.9%	1.7%	1.4%
Laois	1.7%	1.5%	0.7%
Leitrim	0.4%	0.6%	0.0%
Limerick	2.4%	3.1%	2.7%
Longford	0.6%	1.3%	0.0%
Louth	2.2%	5.2%	1.4%
Mayo	1.6%	7.7%	2.0%
Meath	5.4%	4.6%	5.4%
Monaghan	0.6%	1.2%	0.0%
Offaly	3.3%	3.8%	3.4%
Roscommon	1.5%	2.7%	0.0%
Sligo	0.8%	3.5%	0.7%
Tipperary	2.8%	2.9%	3.4%
Waterford	3.5%	3.1%	1.4%
Westmeath	3.5%	3.5%	2.7%
Wexford	3.4%	2.5%	4.8%
Wicklow	2.2%	3.1%	3.4%

Legend	
	High range % of ways should have been taken by county
	Mid range % of ways should have been taken by county
	Low range % of ways should have been taken by county

Figure 39: Top Three Actions by County

While Dublin and Cork respondents topped the list of those wishing they had stocked up more, there were frequent contributions from Kildare, Waterford, Wexford, Meath, Louth, Offaly, Tipperary, Galway, and Limerick. Those who believed they had done enough tended to live in Cork, Kerry, Galway, Sligo, Mayo, Cavan, and Dublin. Those wishing they had invested more in equipment were primarily from Dublin, Kildare, and Cork.

Below shows a sentiment analysis of comments in this category:

Table 37: Actions not taken by Sentiment

Actions not taken to prepare by Sentiment	Positive	Negative
Access to Car	0	6
Alternative Heat Source	3	108
Alternative Means of Cooking	1	70
Alternative Means of Transport	0	31
Alternative Power Source	0	51
Appropriate Clothing	0	67
Battened down the Hatches	1	55
Believe the News	0	45
Bug Out Bag	0	31
Bug Out Plan	0	10
Cancelled Plans	0	1
Cash	1	31
Charged Batteries	0	25
Checked Heating Working Properly	0	7
Childcare	0	1
Communicated with Work Better	1	62
Emergency Contact Numbers	0	34
Entertainment	0	65
Help Friends and Family	0	41
Kept Pets Safe	0	2
Medical Supplies Emergency	0	51
Moved Closer to Town	0	20
No Need to Prepare	62	2
Nothing	498	27
Prepared for loss of Utilities	1	76
Prepared to Work From Home	0	13
prepared Tyres	1	28
Protect Livestock	0	8
Removed Snow and Ice	0	92
Stayed at Home	0	69
Stayed in Work	0	8
Stocked up on Supplies-More Supplies	8	1092
Stocked Up on Tools-more Tools	1	147
Travel Bag	0	7
Travelled Home	0	19

Table 37 above shows that apart from those who did nothing or did not feel they needed to prepare, all other comments in this category were negative in sentiment.

7.4 Actions taken following the Storm

We examined whether respondents had undertaken any actions to protect themselves or their home against future severe weather following The Storm. Of the 3685 respondents who answered this section, 12.9% (474n) had undertaken subsequent protective actions within the 8-12 weeks following the Storm.

Figure 40 shows the percentage of individuals who took actions to enhance their preparedness after the Storm by stated change in worry experienced during the storm, and suggests respondents whose levels of worry increased during the storm were more likely to undertake additional preparedness actions afterwards. A chi-square test for independence indicates that there is a significant association between the trajectory of worry attached to The Storm and whether the respondent took actions to enhance their preparedness following the Storm ($\chi 2(2) = 23.709$, p<0.001).
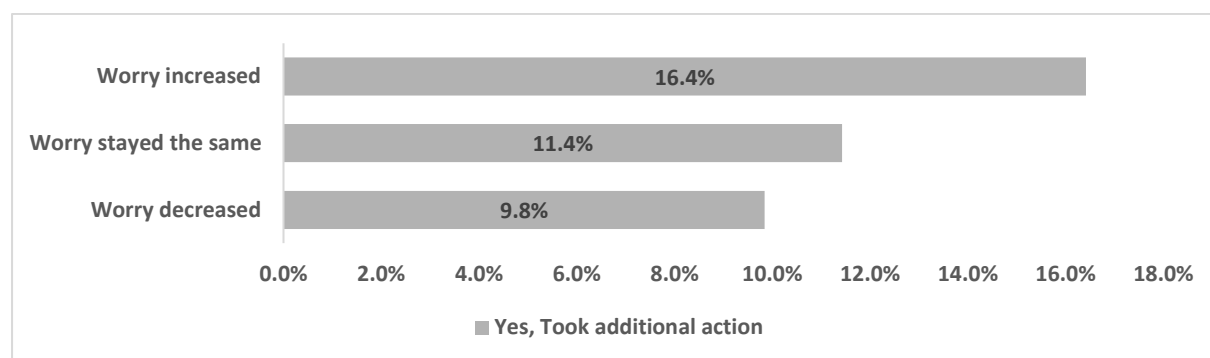
Figure 40: After-Action by Change in Worry

A t-test was undertaken to compare after-actions by gender, which suggested no statistically significant difference (t = 0.470, p=0.639). Furthermore, based on a point-biserial correlation, after-action was found to be extremely weakly (given its proximity to zero) but statistically significantly correlated with age, correlation coefficient = 0.089 (p<0.001).

A chi-square test shows a statistically significant association between respondents' who took after-action and settlement type (urbanicity): ($\chi 2(4) = 20.291$, p< 0.001). Table 38 sets the associated cross-tab analysis and shows a higher proportion of those living in a rural area undertook additional actions following the Storm compared to respondents who lived in a city.

Table 38: After-Action by Settlement Type (Urbanicity)

After-Action	A rural area	A village	A town	The suburbs or outskirts of a city	A city
No	29.08% (935n)	12.13% (390n)	22.52% (724n)	23.02% (740n)	13.25% (426n)
Yes	36.23% (171n)	14.19% (67n)	23.31% (110n)	16.74% (79n)	9.53% (45n)

7.5 Community Response

This section of the Case Study examines the role played by community at a time of an adverse weather event. Respondents were asked whether they provided assistance and whether they received assistance, from family members and neighbours, see Figure 41 and Figure 42. 50.4% (2029n) indicated that they provided support to a neighbour in person while 31.1% (1253n) of the respondents indicated that a neighbour had assisted them. Of those who received assistance, 78.2% (675n) found it was either very useful or extremely useful, see Figure 43.
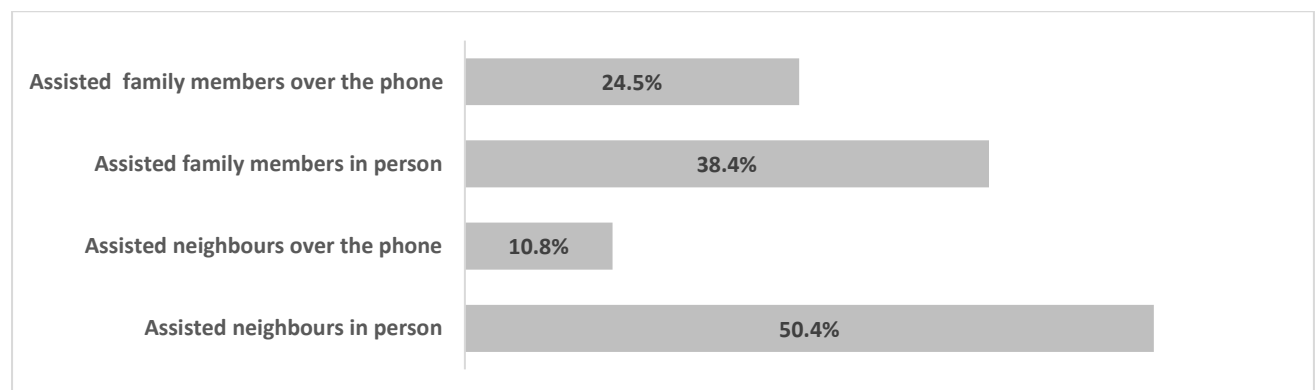
Figure 41: Community Support – Provided
Note, respondents could select multiple options.
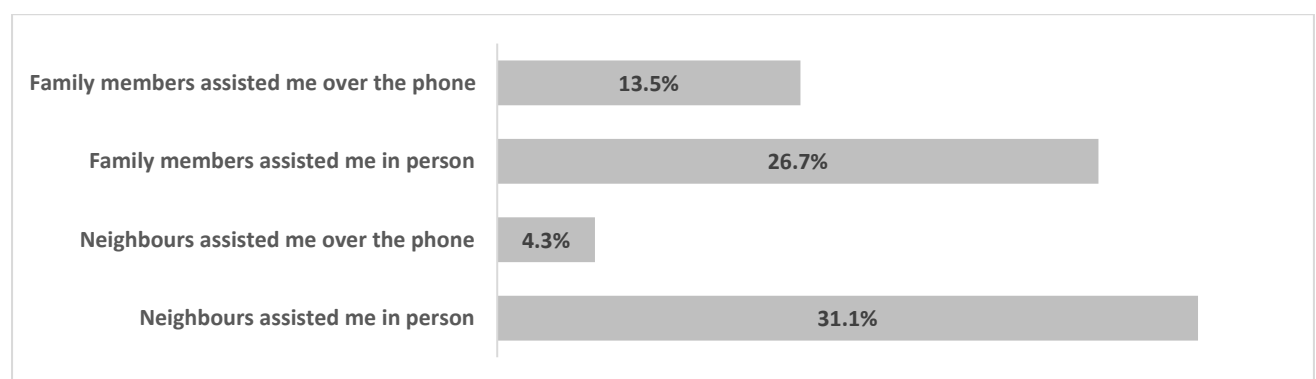
Figure 42: Community Support – Received
Note, respondents could select multiple options.
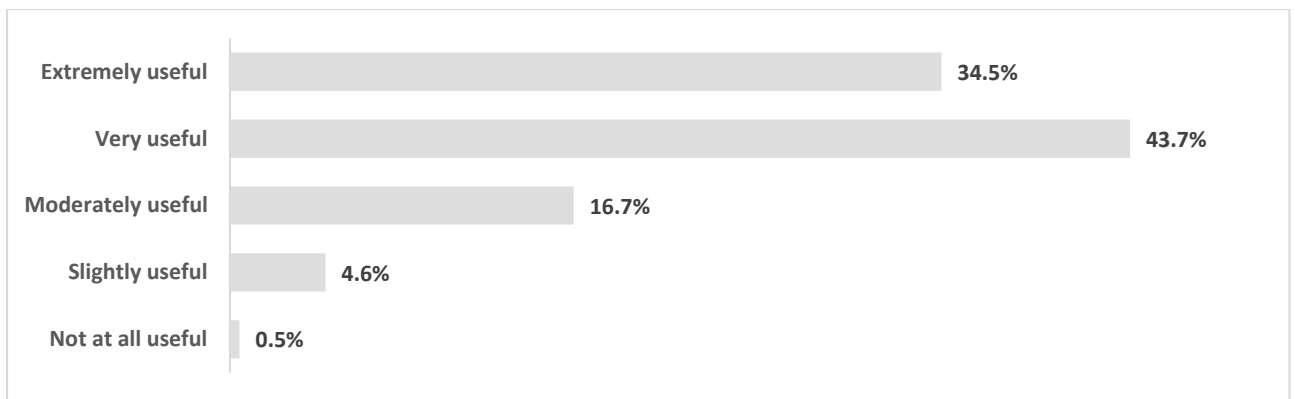
Figure 43: Assistance received was useful

Comparing levels of support provided over the phone between genders (see Table 44) females on average were more likely to have provided support. t-tests conducted show the differences are highly statistically significant: assisting neighbours over the phone t-test (t = 3.76, p<0.001); assisting family members over the phone t-test (t = 4.77, p<0.001).

Examining the levels of support provided in person by gender (see Figure 44), males on average were more likely to have provided support. Again, two t-tests were run to determine if these differences statistically significant. The difference in means for assisting neighbours in person by gender was significant based on a t-test (t = 1.92, p=0.055); however, assisting family members in person was not statistically significant (t = 0.83, p=0.406).

Figure 44: Percentage Support Provided By Gender

Four t-tests were run to determine if there were differences in support received between males and females. Females were on average significantly more likely to have received support in all cases except for neighbours assisted over the phone. Similarly, to support provided, the difference were not large in magnitude, see Figure 45.

Results of the t-tests:
- Neighbours assisted me in person: a statistically significant difference of 3.84 percentage points (t = 2.17, p=0.030)
- Neighbours assisted me over the phone: no statistically significant difference (t = 0.55, p=0.582)
- Family members assisted me in person: a statistically significant difference of 6.51 percentage points (t = 3.88, p<0.001)
- Family members assisted me over the phone: a statistically significant difference of 4.53 percentage points (t = 3.47, p<0.001)
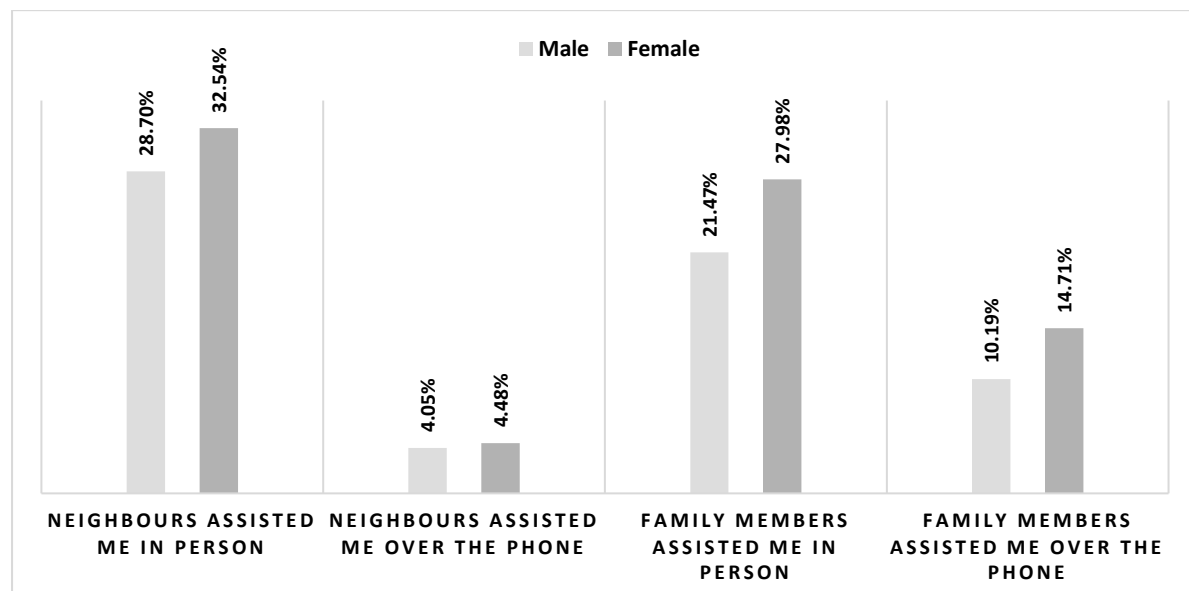
Figure 45: Percentage Support Received By Gender

Levels of support provided tended to differ by settlement type (urbanicity) at the time of The Storm, with on average, city dwellers providing less support compared with those in a more rural setting, see Table 39. Except for 'assisting family members over the phone' chi-square tests of independence indicate a significant relationship between each measure of support and settlement type, where the comparison of expected and observed values supports the existence of a negative relationship between the degree of urbanicity and degree of community support.

Table 39: Average Community Support – Provided by Settlement location at the time of The Storm (Urbanicity)

	Assisted neighbours in person	Assisted neighbours over the phone	Assisted family members in person	Assisted family members over the phone
A rural area	53.03%	15.89%	46.44%	23.79%
A village	57.26%	11.04%	39.47%	27.81%
A town	51.52%	10.05%	38.95%	25.24%
The suburbs or outskirts of a city	50.49%	8.34%	35.46%	24.81%
A city	36.48%	5.29%	23.82%	20.79%

Notes: Assisted neighbours in person: χ2(4) = 53.800, p<0.001

Assisted neighbours over the phone: χ2(4) = 53.524, p<0.001

Assisted family members in person: χ2(4) = 82.419, p<0.001

Assisted family members over the phone: non-significant.

Average levels of support received by settlement type are reported in Table 40. Table 40 highlights that respondents who lived in a rural setting were more likely to receive support in person and from neighbours over the phone, compared to those in a city at the time of the Storm. Only for the case 'Family members assisted me over the phone' do we accept independence between settlement type and the support measure, based on chi-square tests.

Table 40: Average Community Support Received by Settlement location at the time of The Storm (Urbanicity)

	Neighbours assisted me in person	Neighbours assisted me over the phone	Family members assisted me in person	Family members assisted me over the phone
A rural area	35.03%	7.11%	34.77%	13.26%
A village	36.61%	3.89%	29.04%	14.72%
A town	31.62%	3.98%	26.49%	12.57%
The suburbs or outskirts of a city	29.97%	2.41%	21.30%	13.72%
A city	18.90%	2.84%	17.01%	13.99%

Notes: Neighbours assisted me in person: χ2(4) = 52.461, p<0.001

Neighbours assisted me over the phone: χ2(4) = 32.554, p<0.001

Family members assisted me in person: χ2(4) = 78.165, p<0.001

Family members assisted me over the phone: non-significant.

Table 41 sets out the percentages reporting they provided each type of community support by county. The five counties with the highest percentages are marked in light purple, and the lowest five are marked in light blue.

Table 41: Community Support Provided by County

Southern Counties	Assisted neighbours in person	Assisted neighbours over the phone	Assisted family members in person	Assisted family members over the phone
Carlow	24.14%	10.34%	44.83%	31.03%
Cavan	57.89%	10.53%	42.11%	28.07%
Clare	41.03%	15.38%	41.03%	24.36%
Cork	42.77%	8.30%	35.96%	24.89%
Donegal	17.65%	14.71%	41.18%	13.24%
Dublin	50.48%	6.73%	32.69%	23.46%
Galway	34.52%	13.20%	29.95%	26.90%
Kerry	45.76%	16.95%	38.98%	25.42%
Kildare	77.04%	11.64%	42.45%	31.13%
Kilkenny	47.14%	18.57%	38.57%	27.14%
Laois	53.73%	19.40%	44.78%	31.34%
Leitrim	41.67%	12.50%	37.50%	25.00%
Limerick	35.54%	15.70%	34.71%	19.83%
Longford	60.61%	18.18%	45.45%	27.27%
Louth	45.90%	13.11%	46.72%	24.59%
Mayo	36.57%	13.43%	35.82%	14.93%
Meath	62.86%	9.05%	44.29%	26.19%
Monaghan	44.12%	5.88%	52.94%	14.71%
Offaly	64.66%	12.03%	48.87%	30.83%
Roscommon	51.81%	10.84%	39.76%	22.89%
Sligo	25.35%	21.13%	30.99%	21.13%
Tipperary	43.97%	12.07%	48.28%	17.24%
Waterford	57.26%	8.55%	32.48%	27.35%
Westmeath	52.24%	11.19%	43.28%	23.13%
Wexford	67.42%	15.15%	48.48%	24.24%
Wicklow	60.00%	15.29%	42.35%	23.53%

Table 42 sets out the percentage who state they received support received by county. The highest five are marked in light purple, and the lowest five are marked in light blue.

Table 42: Community Support Received by County

Southern Counties	Neighbours assisted me in person	Neighbours assisted me over the phone	Family members assisted me in person	Family members assisted me over the phone
Carlow	20.69%	3.45%	37.93%	10.34%
Cavan	24.56%	3.51%	24.56%	8.77%
Clare	21.79%	6.41%	26.92%	11.54%
Cork	26.60%	2.98%	23.62%	10.85%
Donegal	10.29%	4.41%	20.59%	13.24%
Dublin	28.65%	2.21%	19.81%	14.81%
Galway	18.78%	4.06%	21.83%	11.68%
Kerry	11.86%	6.78%	20.34%	13.56%
Kildare	64.47%	3.77%	38.99%	14.15%
Kilkenny	28.57%	4.29%	28.57%	12.86%
Laois	32.84%	2.99%	31.34%	13.43%
Leitrim	4.17%	4.17%	12.50%	12.50%
Limerick	19.01%	4.96%	23.14%	11.57%
Longford	33.33%	3.03%	36.36%	9.09%
Louth	21.31%	5.74%	31.15%	11.48%
Mayo	14.93%	8.96%	21.64%	9.70%
Meath	40.95%	3.33%	35.24%	13.81%
Monaghan	14.71%	5.88%	32.35%	17.65%
Offaly	39.85%	8.27%	32.33%	18.05%
Roscommon	24.10%	3.61%	22.89%	10.84%
Sligo	9.86%	4.23%	9.86%	12.68%
Tipperary	29.31%	9.48%	33.62%	16.38%
Waterford	32.48%	6.84%	25.64%	17.95%
Westmeath	34.33%	6.72%	32.09%	14.18%
Wexford	60.61%	5.30%	44.70%	18.18%
Wicklow	45.88%	10.59%	43.53%	10.59%

Following on from examining whether respondents provided or received assistance, respondents were asked to provide further explanations via a series of closed and open-ended questions.

Types of Assistance Provided

Of the respondents who provided assistance, 2941 went on to explain the types of assistance they gave, see Figure 46. Respondents could select multiple predefined options while also free to specify the types of assistance they provided via an open text box. Of those who had acted to provide assistance, 63.2% (1860n) said they spent some time talking with the person, while 53% (1558n) suggested they helped clear snow around the person's home.
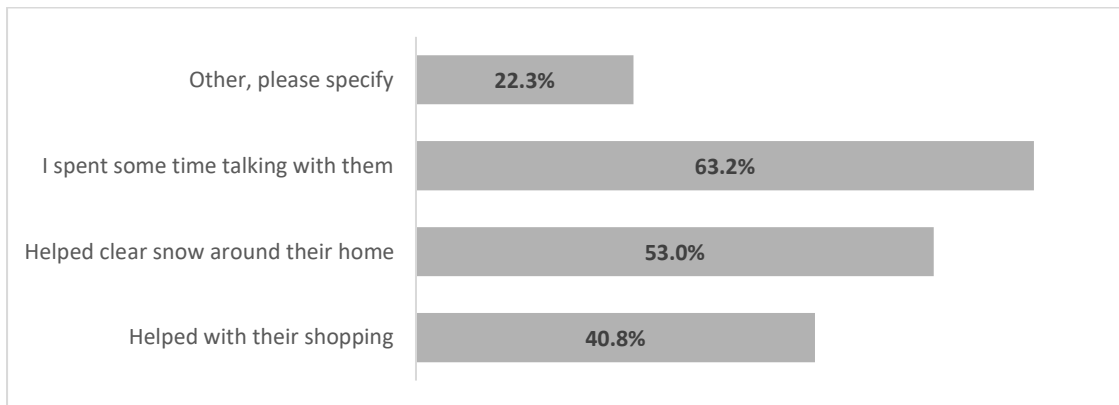
Figure 46: Types of Assistance Provided – pre-defined categories

639 respondents responded to the "other, please specify" invitation and provided detailed describing the assistance they provided to others during The Storm. Table 43 below shows the nature of their responses.

Table 43: Nature of Assistance Provided to Others

Assistance Given to Others	639
Supplies	145
Delivered Food	76
Offered General Assistance	70
Shelter	56
Cars Stuck	53
Cleared Roads	44
Offered Transport	42
Company	32
Assisted People Getting to Hospital and Home	30
Livestock and Farming	30
Health Workers	25
Battened Down the Hatches	22
Delivered Medication	22
Assisted Medical Staff Get to and from Work	20
Providing Information About Storm	19
Medical Assistance	14
Home Care Assistance	12
Entertainment	11
Childcare	10
Means to Cook	10
Provided Alternative Heat Source	9
Elderly or Reduced Mobility Walk	7
Repaired Heating	7
Removed Fallen Trees	6
Keep Pets Safe	5
Nothing	5
Appropriate Clothing	4
Dug Out Trapped People	4
Power Source	4
Assisted Gardai and Related Workers get to Work	2
Fixed Pipes	2
Break In	1
Helped People Back into Homes	1

Supplies

145 respondents, almost 1 in every 4 respondents cited helping neighbours and vulnerable relatives by making sure they had adequate supplies during the storm. Supplies ranged from food, to fuel to equipment such as candles and torches.

> *Checked to make sure they had enough supplies to make it through. (R40)*

> *I didn't lose power (and so didn't lose water), but my neighbours did, so I was able to give them my stock. (R617)*

> *My mother-in-law who lives on her own. I helped her as much as possible making sure she had heat and enough food and water. She does not come out in that kind of weather, but we helped as much as we could. (R1214)*

Figure 47 below shows the recurring keywords used to describe the provision of supplies to neighbours and relatives:

Figure 47: Frequency of keywords describing the Provision of Supplies

Delivered Food

76 respondents delivered food as well as checking on vulnerable neighbours and relatives:

> *I went with my Dad with homemade soup to make sure they had something hot, apart from tea and coffee. (R1199)*

> *Cooked Hot Dinner & Chicken for elderly family member who lives alone. (R1235)*

I brought hot meals where there was a loss of power. (R1888)

Offered General Assistance

Other respondents offered more general assistance:

I checked on elderly neighbour to see if they needed food or any help. (R587)

Offered assistance in case elderly neighbours did not want to venture out in the snowy conditions to buy groceries etc. Generally checked on neighbours in terms of their safety and well-being. (R1482)

Some used social media to keep in touch during The Storm. Respondent 1371 described a localised community-based approach to communicate and offer advice and assistance across the community:

Set up a Facebook page - Helping Each Other Out – [county name] where locals offered help, gained and shared advice and just kept in touch with each other with updates. (R1371)

A smaller number of respondents reported being members of community groups, where offers of assistance were more formalised:

I am a member of the community association. We let people know if they needed us, we were there to help. (R1573)

Other assistance offered included offering shelter to those without power, freeing cars that were stuck in the snow, clearing roads, and offering transport. See Table 43 above for a full list of all types of assistance offered.

Assistance by Gender

The gender balance of respondents describing how they offered assistance was in line with the study population (3:1 ratio female to males) as shown in below:
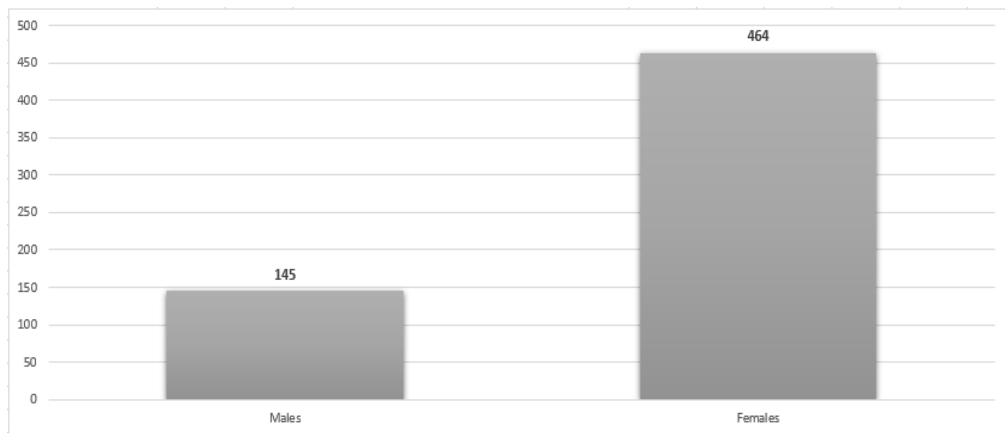
Figure 48: Assistance offered by Gender

Table 44 below shows the type of assistance provided and the breakdown between that provided by males and females.

Table 44: Type of Assistance Provided to Others by Gender

Assistance provided to others by Gender	Female	Male	Proportional Representation
Appropriate Clothing	3	1	
Assisted Gardai and Related Workers get to Work	0	2	
Assisted Medical Staff Get to and from Work	5	14	
Assisted People Getting to Hospital and Home	15	14	
Battened Down The Hatches	15	5	
Break In	1	0	
Cars Stuck	28	23	
Childcare	7	3	
Cleared Roads	25	15	
Company	26	5	
Delivered Food	69	6	
Delivered Medication	19	2	
Dug Out Trapped People	2	1	
Elderly or Reduced Mobility Walk	6	0	
Entertainment	7	3	
Fixed Pipes	2	0	
Health Workers	17	5	
Helped People Back into Homes	0	1	
Home Care Assistance	12	0	
Keep Pets Safe	5	0	
Livestock and Farming	19	9	
Means to Cook	5	5	
Medical Assistance	11	1	
Nothing	4	0	
Offered General Assistance	56	11	
Offered Transport	29	12	
Power Source	4	0	
Provided Alternative Heat Source	5	3	
Providing Information About Storm	17	2	
Removed Fallen Trees	6	0	
Repaired Heating	4	3	
Shelter	41	11	
Supplies	118	24	

Table 44 above shows that while the overall distribution was in line with the study population at a macro level, there was nevertheless greater disparity at the level of individual codes. Males were overrepresented when it came to helping with transport and getting people to and from work; helping those who had cars stuck or clearing roads and footpaths; helping with livestock and farming; and helping to repair heating systems. By comparison, females provided assistance by ensuring neighbours and vulnerable people had adequate supplies; provided shelter; offered generalised assistance; helped by keeping pets safe and delivering food; and providing company and entertainment for others.

Assistance Provided by Income Level

Table 45 below shows the distribution of comments concerning the assistance provided to others by income level.

Table 45: Assistance Provided to Others by Income Level

Assistance provided to others by Income	Low (10%)	Mid (41%)	High (28%)
Appropriate Clothing	0%	60.71%	39.29%
Assisted Gardai and Related Workers get to Work	0%	100%	0%
Assisted Medical Staff Get to and from Work	26.32%	60.32%	13.36%
Assisted People Getting to Hospital and Home	7.85%	51.57%	40.58%
Battened Down The Hatches	15.61%	69.62%	14.77%
Break In	0%	100%	0%
Cars Stuck	11.84%	42.07%	46.10%
Childcare	0%	34.92%	65.08%
Cleared Roads	6.36%	55.99%	37.65%
Company	17.35%	65.29%	17.35%
Delivered Food	14.12%	43.50%	42.37%
Delivered Medication	7.04%	61.31%	31.66%
Dug Out Trapped People	34.09%	13.64%	52.27%
Elderly or Reduced Mobility Walk	6.42%	61.47%	32.11%
Entertainment	0%	32.43%	67.57%
Fixed Pipes	0%	100%	0%
Health Workers	1.09%	82.35%	16.56%
Helped People Back into Homes	100%	0%	0%
Home Care Assistance	12.82%	52.99%	34.19%
Keep Pets Safe	0%	84.85%	15.15%
Livestock and Farming	6.58%	41.56%	51.85%
Means to Cook	0%	49.15%	50.85%
Medical Assistance	0%	60%	40%
Nothing	21.21%	39.39%	39.39%
Offered General Assistance	5.71%	55.92%	38.37%
Offered Transport	5.40%	68.89%	25.71%
Power Source	0%	100%	0%
Provided Alternative Heat Source	0%	90.91%	9.09%
Providing Information About Storm	3.93%	46.63%	49.44%
Removed Fallen Trees	0%	7.41%	92.59%
Repaired Heating	0%	55.56%	44.44%
Shelter	13.28%	46.72%	40%
Supplies	5.36%	63.07%	31.57%

Table 45 shows, for example, that higher-income respondents were more represented proportionately when it came to helping with fallen trees, mid-level respondents had greater involvement in fixing pipes, and lower-level income respondents were more involved in helping people to get back into their homes.

Assistance Provided by County

Figure 49 below shows the distribution of comments regarding the three most cited types of assistance offered by County:

County	Supplies	Delivered Food	Offered General Assistance
Carlow	0.0%	0.0%	1.4%
Cavan	2.8%	1.3%	4.3%
Clare	3.4%	1.3%	5.7%
Cork	13.8%	15.8%	14.3%
Donegal	2.1%	0.0%	0.0%
Dublin	15.2%	25.0%	14.3%
Galway	4.1%	6.6%	1.4%
Kerry	2.1%	0.0%	0.0%
Kildare	6.2%	7.9%	5.7%
Kilkenny	2.8%	2.6%	2.9%
Laois	2.8%	3.9%	2.9%
Leitrim	0.0%	0.0%	1.4%
Limerick	3.4%	5.3%	4.3%
Longford	1.4%	1.3%	1.4%
Louth	4.1%	2.6%	2.9%
Mayo	2.1%	5.3%	5.7%
Meath	1.4%	1.3%	4.3%
Monaghan	1.4%	2.6%	0.0%
Offaly	4.8%	5.3%	8.6%
Roscommon	2.1%	3.9%	0.0%
Sligo	3.4%	0.0%	1.4%
Tipperary	4.1%	3.9%	8.6%
Waterford	2.8%	1.3%	1.4%
Westmeath	4.8%	0.0%	0.0%
Wexford	5.5%	1.3%	5.7%
Wicklow	3.4%	1.3%	1.4%

Legend	
	High range % of assistance provided by county
	Mid range % of assistance provided by county
	Low range % of assistance provided by county

Figure 49: Assistance Provided by County

Offers to assist with supplies were recorded across the Counties, and the volume of assistance was in line with the proportion of the study population. Similarly, offers to deliver food were evident across the country with some overrepresentation in Counties Kildare, Tipperary, Roscommon, Kilkenny, Galway, Dublin, Cork, and Limerick. More general assistance was

disproportionately represented in Kildare, Wexford, Meath, Cavan, Offaly, Tipperary, Mayo, Clare, Cork, and Limerick.

Assistance Provided & Sentiment

The table below provides sentiment analysis of the comments in this category and shows that except for five of 797 comments, the sentiment expressed was positive:

Table 46: Assistance Provided to Others by Sentiment

Assistance Provided to Others by Sentiment	Positive	Negative
Appropriate Clothing	4	0
Assisted Gardai and Related Workers get to Work	2	0
Assisted Medical Staff Get to and from Work	20	0
Assisted People Getting to Hospital and Home	30	0
Battened Down The Hatches	22	0
Break In	1	0
Cars Stuck	52	0
Childcare	10	0
Cleared Roads	44	0
Company	32	0
Delivered Food	76	0
Delivered Medication	22	0
Dug Out Trapped People	4	0
Elderly or Reduced Mobility Walk	7	0
Entertainment	11	0
Fixed Pipes	2	0
Health Workers	23	0
Helped People Back into Homes	1	0
Home Care Assistance	12	0
Keep Pets Safe	5	0
Livestock and Farming	30	0
Means to Cook	10	0
Medical Assistance	14	0
Nothing	0	5
Offered General Assistance	70	0
Offered Transport	42	0
Power Source	4	0
Provided Alternative Heat Source	9	0
Providing Information About Storm	19	0
Removed Fallen Trees	6	0
Repaired Heating	7	0
Shelter	56	0
Supplies	145	0
Total Comments	**792**	**5**

Types of Assistance Received

Of the respondents who received assistance, 2030n went on to explain the types of assistance they received, see Figure 50. Respondents could select multiple pre-defined options and could also specify other types of assistance they received using an open text box. Clearing snow (54.9%, 1114n) and checking to see if they needed assistance (43.5%, 883n) was most selected.

Figure 50: Types of Assistance Received – pre-defined categories

A total of 309 respondents provided details of additional assistance they received during The Storm- providing a total of 340 comments. Table 47 below shows the type of help they received.

Table 47: Assistance Received

Assistance Received	Incidence
Transport Assistance	73
Supplies	39
Cars Stuck	34
Cleared Roads	26
Emotional Support	21
Childcare	18
Help with Farm and Livestock	16
Batten Down the Hatches	14
None	14
Received Shelter	11
Keep Pets Safe	8
Accommodation for Work	8
Food Delivered	8
Heating Repair	7
Advice on Preparation	6
Dug Out Trapped People	6
Elderly or Reduced Mobility Walk	4
Offered Assistance	3
Removed Fallen Tree	3
Road Condition Tips	3
Help Getting a Doctor	3
Getting to Hospital	3
Provided Power Source	3
Tools Provided	2
Medicine Delivery	2
Preparing to Work from Home	1
Provided Alternative Heat Source	1
Palliative Care	1
Power Restored	1
Assistance from News and Media Outlets	1

Received Assistance with Transport

Assistance with transport was reported by 73 respondents. They received help in a variety of ways, including:

Our neighbour has a 4 x 4 and my husband asked for a lift on Day 3 so that we could get some supplies from the shop. (R1712)

Assistance offered to my husband when his jeep broke down - difficulty accessing the farm and looking after the animals. (R1786)

Neighbours with 4 x 4's and tractors called to houses bringing us to nearest supermarkets as our local shop was closed after day 1- severe snowstorm due to lack of supplies and ability to reach our village. (R2132)

Received Assistance with Supplies

Supplies were offered or provided to 39 respondents:

Neighbour offered food if necessary. (R862)

Neighbours supplied 5 litre bottles of water so we could wash and cook with. Our water supply was halted, and they were ok. (R1650)

Figure 51 below summarises the type of supplies received:
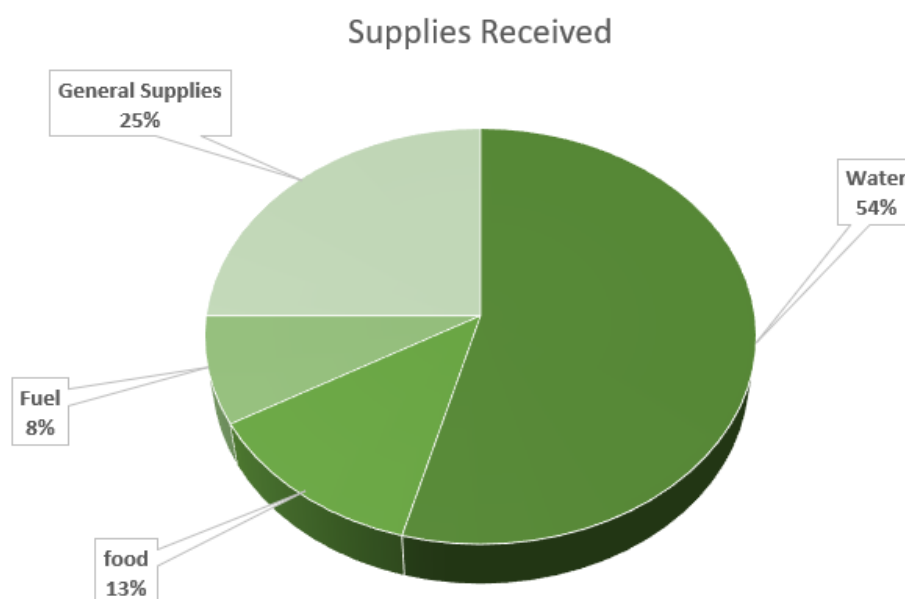
Figure 51: Type of Supplies Received

Received Assistance with Car

A total of 34 respondents reported receiving help with cars that were stuck in the snow:

> *My husband's car got stuck on one of the roads near us and neighbours help dig him out. It took about an hour. (R993)*

> *Neighbour pulled my car out of snowdrift with tractor. (R2567)*

Other types of help received included: clearing roads (26 comments), emotional support (21 comments), assistance with childcare (18 comments), help with farm and livestock (16 comments), and help to batten down the hatches (14 comments).

Assistance Received by Gender

Females were disproportionately represented in the number reporting that they received assistance (see Figure 52).
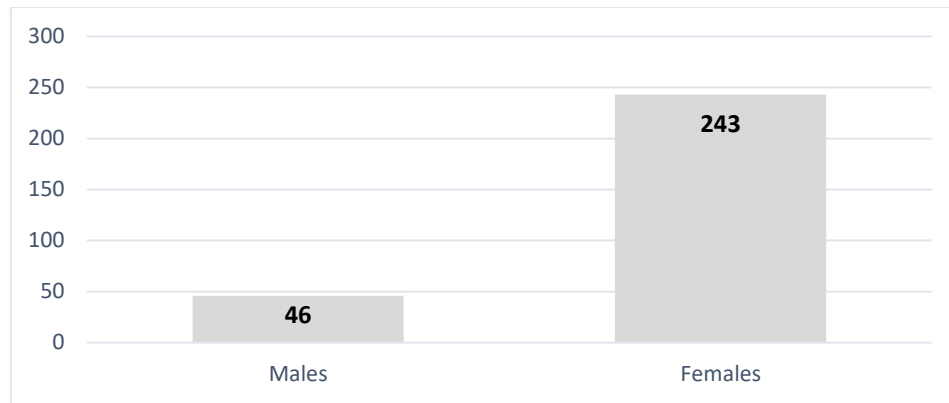
Figure 52: Assistance Received by Gender

Table 48 below shows the gender distribution for individual codes in this category:

Table 48: Assistance Received by Gender

Assistance Received by Gender	Female	Male	Proportional Representation	
Accommodation For Work	7	0		
Advice on Preparation	5	1		
Assistance from News and Media Outlets	0	1		
Batten Down the Hatches	11	2		
Cars Stuck	23	5		
Childcare	16	2		
Cleared Roads	22	2		
Dug Out Trapped People	5	1		
Elderly or Reduced Mobility Walk	2	1		
Emotional Support	19	1		
Food Delivered	8	0		
Getting to Hospital	2	0		
Heating Repair	4	1		
Help Getting a Doctor	3	0		
Help with Farm and Livestock	10	5		
Keep Pets Safe	8	0		
Medicine Delivery	1	0		
None	9	5		
Offered Assistance	3	0		
Palliative Care	1	0		
Power Restored	1	0		
Preparing to Work from Home	1	0		
Provided Alternative Heat Source	1	0		
Provided Power Source	3	0		
Received Shelter	8	2		
Removed Fallen Tree	3	0		
Road Condition Tips	2	1		
Supplies	32	7		
Tools Provided	2	0		
Transport Assistance	58	11		

Table 48 above shows that apart from assistance from news and media outlets; help with farm and livestock; and no help received, responses were dominated by female contributions.

Assistance Received by Income Level

Table 49 below shows the distribution of comments concerning assistance received by household income level. It shows the degree to which the income level groups received various types of assistance.

Table 49: Assistance Received by Income Level

Assistance Received by Income Level	Low (10%)	Mid (41%)	High (28%)
Accommodation For Work	16.44%	56.16%	27.40%
Advice on Preparation	15.46%	68.04%	16.49%
Assistance from News and Media Outlets	0%	100%	0%
Batten Down the Hatches	20.95%	67.62%	11.43%
Cars Stuck	0%	55.02%	44.98%
Childcare	0%	30.43%	69.57%
Cleared Roads	7.89%	59.03%	33.08%
Dug Out Trapped People	25.88%	74.12%	0%
Elderly or Reduced Mobility Walk	0%	43.75%	56.25%
Emotional Support	23.53%	69.33%	7.14%
Food Delivered	0%	90.32%	9.68%
Getting to Hospital	14.81%	0%	85.19%
Heating Repair	0%	80%	20%
Help Getting a Doctor	43.33%	56.67%	0%
Help with Farm and Livestock	1.82%	50.91%	47.27%
Keep Pets Safe	0%	84.42%	15.58%
Medicine Delivery	0%	100%	0%
None	2.17%	64.13%	33.70%
Offered Assistance	63.16%	0%	36.84%
Palliative Care	0%	100%	0%
Power Restored	0%	0%	100%
Preparing to Work from Home	0%	0%	100%
Provided Alternative Heat Source	0%	100%	0%
Provided Power Source	0%	100%	0%
Received Shelter	31.15%	44.26%	24.59%
Removed Fallen Tree	0%	48.15%	51.85%
Road Condition Tips	0%	100%	0%
Supplies	2.67%	71.84%	25.49%
Tools Provided	0%	100%	0%
Transport Assistance	2.88%	59.91%	37.21%

Table 49 above shows, for example, that respondents from higher-income households were more represented proportionately when it came to getting help with freeing cars; childcare; getting to a hospital; having power restored; and preparing to work from home. Respondents from the middle-income households were over-represented in almost every category and were the only group in receipt of assistance with tools; provision of alternate heat sources; medical deliveries; palliative care; and reporting assistance from news and media outlets. Lower-income respondents were proportionately overrepresented among those in receipt of shelter; being offered assistance generally; gaining access to a doctor; getting to a hospital; receiving emotional support; being dug out; having their homes secured; getting advice on preparation; and being accommodated workwise.

Assistance Received by County

Figure 53 below shows the distribution of the three most cited forms of assistance received by County:

County	Transport Assistance	Supplies	Cars Stuck
Cavan	0.0%	0.0%	2.9%
Clare	2.8%	2.6%	0.0%
Cork	12.7%	15.4%	14.7%
Donegal	2.8%	0.0%	2.9%
Dublin	12.7%	10.3%	23.5%
Galway	1.4%	5.1%	2.9%
Kerry	2.8%	0.0%	0.0%
Kildare	11.3%	15.4%	26.5%
Kilkenny	0.0%	5.1%	0.0%
Laois	1.4%	0.0%	0.0%
Leitrim	1.4%	0.0%	0.0%
Limerick	5.6%	0.0%	2.9%
Longford	0.0%	0.0%	2.9%
Louth	7.0%	0.0%	0.0%
Mayo	1.4%	2.6%	0.0%
Meath	5.6%	7.7%	0.0%
Monaghan	1.4%	0.0%	0.0%
Offaly	1.4%	5.1%	2.9%
Roscommon	0.0%	2.6%	0.0%
Sligo	1.4%	0.0%	0.0%
Tipperary	4.2%	2.6%	0.0%
Waterford	1.4%	2.6%	5.9%
Westmeath	7.0%	5.1%	0.0%
Wexford	11.3%	15.4%	8.8%
Wicklow	2.8%	2.6%	2.9%

Legend	
	High range % of assistance received by county
	Mid range % of assistance received by county
	Low range % of assistance received by county

Figure 53: Assistance Received by County

In the above Figure, Counties Cork, Dublin, Kildare, Louth, Westmeath and Wicklow showed a high percentage of assistance received.

Assistance Received by Sentiment

Below Table 50 shows a sentiment analysis of comments in this category. It reveals that all bar six comments were positive. Unsurprisingly, these were recorded by respondents who reported not being in receipt of any help.

Table 50: Assistance Received by Sentiment

Assistance Received by Sentiment	Positive	Negative
Accommodation For Work	8	0
Advice on Preparation	6	0
Assistance from News and Media Outlets	1	0
Batten Down the Hatches	14	0
Cars Stuck	34	0
Childcare	18	0
Cleared Roads	26	0
Dug Out Trapped People	6	0
Elderly or Reduced Mobility Walk	4	0
Emotional Support	20	0
Food Delivered	8	0
Getting to Hospital	3	0
Heating Repair	7	0
Help Getting a Doctor	2	0
Help with Farm and Livestock	14	0
Keep Pets Safe	8	0
Medicine Delivery	2	0
None	8	6
Offered Assistance	3	0
Palliative Care	1	0
Power Restored	1	0
Preparing to Work from Home	1	0
Provided Alternative Heat Source	1	0
Provided Power Source	3	0
Received Shelter	9	0
Removed Fallen Tree	3	0
Road Condition Tips	3	0
Supplies	39	0
Tools Provided	2	0
Transport Assistance	73	0
Total Comments	328	6

Community Support Witnessed

The survey also invited respondents to provide information on any local community support witnessed during The Storm. First respondents were asked about the community coming together to clear snow. The results show that nearly 50% of respondents witnessed individuals coming together to clear snow from the paths and roads, see Figure 54.

Individuals coming together to clear the snow from... Paths	49.8
Individuals coming together to clear the snow from... Roads	46.1
The Residents' Committee clearing snow from... Paths	21.6
The Residents' Committee clearing snow from... Roads	16.8
Community organisations clearing snow from... Paths	26.6
Community organisations clearing snow from... Roads	35.4

Figure 54: Community Support to clear snow

Respondents were also asked to describe other examples of community support which they witnessed during The Storm. More than half of the respondents, 2,284, provided a total of 2,929 inputs in this regard.

Table 51 below shows the nature of the community supports witnessed.

Table 51: Community Support Provided

Examples of Community Support	Freq.
Clearing Roads	486
General and Unspecified Community Support	397
Assisted Medical Staff getting to and from Work	230
Transport Assistance	207
No community Support	850
Cars Stuck	118
Clearing Snow	107
Supplies	92
Shopping	77
Shops Stayed Open	53
Medical Staff Keeping Service Running	53
Entertainment	46
Getting to Hospital and Home	39
Aiding Emergency Services	33
Delivering Food	31
Protect Livestock	30
Accommodation for Work	26
Road Condition Tips	16
Sheltering Homeless	9
Getting to Hospital	9
Elderly or Reduced Mobility Walk	5
Delivering Medication	5
Work Cancelled	4
Providing Shelter	3
Childcare	2
Repairing Power Lines	1
Total Comments	2929

Clearing Roads

486 comments related to witnessing others clearing roads for the good of the community, making this the single most cited cross-community activity witnesses during The Storm:

Heard from my parents who are elderly farmers in country how neighbours arrived with JCB to help dig them out and clear roads. Brilliant people helping those who needed it. (R1184)

Locals were trying to clear roads to the main hospital on campus. (R1253)

My Dad and uncle are farmers and they cleared the local road all day with the digger. (R1350)

Figure 55 below shows the recurring keywords used to describe this activity. The role played by farmers was evident in many comments, a theme which will be explored further in the case study.

Figure 55: Recurring keywords for Clearing Roads

General Community Support

Almost 400 respondents (n397) reported witnessing selfless acts of community support while not specifying the nature of this support.

As noted, we all helped out one another, which occurs on a regular basis in rural Ireland. (R436)

Living in the city it's harder to tell. I certainly saw a lot online about people offering and receiving help. There was definitely a nice community feeling out and about. (R521)

Community got together, looked out for each other, community spirit was alive. (R992)

Figure 56: below reflects the commonly recurring keywords used in these less defined acts of community support:

Figure 56: Recurring Keywords in Acts of Community Support

Assisted Medical Staff getting to and from Work

The community became quite involved in assisting health professionals who were having difficulty getting to and from their place of work. 230 respondents reported examples of this type of activity:

> *I am aware of people who work in the psychiatric hospital I work in being brought to work etc (R801)*

> *My husband brought my neighbour who is a doctor to work. (R984)*

Some of these community support activities were organised through social media:

> *Yes. Locals driving care workers to their place of work organised through Facebook (R1312)*

Community Assistance with Transport

Transport presented a significant challenge during The Storm, and 207 respondents witnessed community assistance in this regard:

> *Farmers transporting people places. (R119)*

A taxi driver didn't charge me for the ride since, as a student on any other given day, I would have just taken a bus, had they been running. (R152)

There was a Dublin bus going up a road offering lifts to anyone walking in the snow. (R297)

Figure 57 shows the recurring keywords used in the context of transport-related community support:

Figure 57: Recurring Keywords for Transport-Related Community Support

No Community Support

850 respondents reported not being aware of any community support being provided in their area. Of these, 98 felt this was because The Storm was not severe enough to warrant such a response:

Not needed. I walked to and from work on dry roads, but patients did not come as they had been terrified by the news despite there being NO snow in Sligo. (R1466)

This didn't really apply to our area as the storm didn't really impact on us. (R2213)

No, I didn't. In my area streets were basically empty, no people at all. (R721)

Some respondents reported not being witness to acts of community support but being aware of them through social and mainstream media:

No, although we were in the city, we felt isolated. we saw almost no one. but we witnessed kind acts on the news. (R1025)

I've seen it on the television screen, but not in my area. (R882)

Other community support activities included: freeing stranded cars (118 comments); clearing snow (107 comments); provision of supplies (92 comments); shopping for others (77 comments); and local shops staying open beyond normal trading hours to help the community stock up (53 comments).

Respondents frequently cited individual actors as well as community support acts. Table 52 below provides an analysis of the community support activities intersected with group/actors.

Table 52: Community Support Activities by Group/Actor

Community Support Activities by Group/Actor	Community Members	Farmers	Civil Defence	Health Professinals	Army	Volunteer Ambulance & Fire Brigade	Coast Guard	Employers-Managers	Gardaí	Community Groups	Council Workers
No Community Support	0	0	0	0	0	0	0	0	0	0	0
Clearing Roads	49	440	5	1	8	0	0	0	0	0	6
General and Unspecified Community Support	338	50	11	2	3	6	2	0	1	3	1
Assisted Medical Staff getting to and from Work	95	61	37	6	28	26	12	5	8	2	0
Transport Assistance	108	86	10	1	6	2	5	4	2	0	0
Cars Stuck	77	43	1	1	1	0	0	0	2	0	0
Clearing Snow	79	25	0	0	6	0	0	0	0	1	2
Supplies	70	22	1	0	0	1	0	0	0	1	0
Shopping	58	18	0	0	0	0	0	0	0	1	0
Shops Stayed Open	52	2	0	0	0	0	0	0	0	0	0
Medical Staff Keeping Service Running	7	2	1	51	0	0	0	0	1	0	0
Entertainment	43	1	0	0	0	0	0	0	0	1	0
Getting to Hospital and Home	22	7	3	1	2	8	4	0	1	1	0
Aiding Emergency Services	12	14	2	0	3	3	0	0	1	0	0
Delivering Food	28	1	1	1	0	0	0	0	1	3	0
Protect Livestock	6	23	0	0	0	1	0	0	0	0	0
Accommodation For Work	15	0	0	1	1	0	0	12	0	0	0
Road Condition Tips	15	0	0	0	0	0	0	0	0	1	0
Sheltering Homeless	4	0	0	0	0	0	0	0	0	5	0
Getting to Hospital	4	1	1	0	0	3	0	0	0	0	0
Elderly or Reduced Mobility Walk	5	0	0	0	0	0	0	0	0	0	0
Delivering Medication	4	1	0	0	0	0	0	0	0	0	0
Work Cancelled	1	0	0	0	0	0	0	4	0	0	0
Providing Shelter	3	0	0	0	0	0	0	0	0	0	0
Childcare	2	0	0	0	0	0	0	0	0	0	0
Repairing Power Lines	0	0	0	0	0	0	0	0	0	0	1
Total Citations	1097	797	73	65	58	50	23	25	17	19	10

Table 52 above shows that individual members of the community and farmers were the most proactive when it came to witnessed examples of positive community support.

Comments on witnessed acts of community support were marginally skewed in favour of females at the macro level when the 3:1 ratio of the study population is considered (see Figure 58).
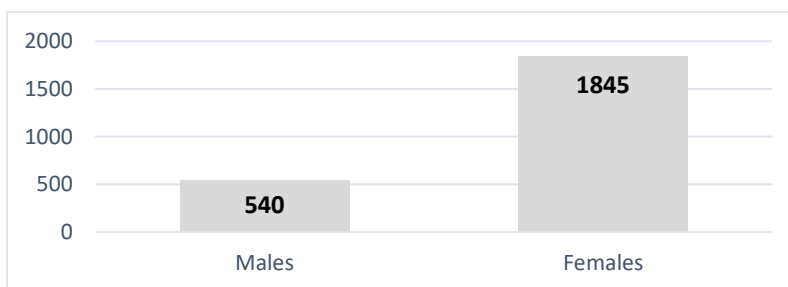
Figure 58: Witnessed Community Support by Gender

Table 53 below shows the distribution by types of activity witnessed:

Table 53: Witnessed Community Support by Gender

Witnessed Community Support by Gender	Female	Male	Proportional Representation
Accommodation For Work	24	1	
Aiding Emergency Services	17	16	
Assisted Medical Staff getting to and from Work	194	31	
Cars Stuck	81	34	
Childcare	2	0	
Clearing Roads	381	90	
Clearing Snow	81	23	
Delivering Food	25	4	
Delivering Medication	3	2	
Elderly or Reduced Mobility Walk	4	1	
Entertainment	37	8	
General and Unspecified Community Support	303	78	
Getting to Hospital	4	5	
Getting to Hospital and Home	26	11	
Medical Staff Keeping Service Running	43	8	
No Community Support	450	193	
Protect Livestock	27	2	
Providing Shelter	2	1	
Repairing Power Lines	1	0	
Road Condition Tips	14	2	
Sheltering Homeless	6	3	
Shopping	57	15	
Shops Stayed Open	43	7	
Supplies	69	21	
Transport Assistance	169	33	
Work Cancelled	4	0	

Table 53 above shows that males were proportionately overrepresented when it came to witnessing aid to emergency services; people getting help with cars that were stuck; and no community support noticed or needed. Females disproportionately reported people being accommodated for work; medical staff being assisted in getting to work; roads being cleared; clearing snow; delivering food; entertainment; general acts of community support; medical staff keeping services running; protecting; shopping for others; shops remaining open; and assistance with transport.

Table 54 below shows the distribution of codes for this category by income levels:

Table 54: Witnessed Community Support by Income Level

Witnessed Community Support by Income Level	Low (10%)	Mid (41%)	High (28%)
Accommodation For Work	3.60%	33.63%	62.76%
Aiding Emergency Services	8.03%	77.62%	14.36%
Assisted Medical Staff getting to and from Work	3.51%	53.31%	43.18%
Cars Stuck	12.36%	49.13%	38.50%
Childcare	0%	0%	100%
Clearing Roads	11.91%	56.05%	32.04%
Clearing Snow	20.76%	56.06%	23.18%
Delivering Food	0%	47.72%	52.28%
Delivering Medication	11.63%	88.37%	0%
Elderly or Reduced Mobility Walk	14.58%	54.17%	31.25%
Entertainment	12.14%	41.48%	46.37%
General and Unspecified Community Support	9.56%	52.13%	38.31%
Getting to Hospital	25%	48.86%	26.14%
Getting to Hospital and Home	11.14%	54.55%	34.32%
Medical Staff Keeping Service Running	3.52%	42.25%	54.23%
No Community Support	12.96%	58.53%	28.52%
Protect Livestock	6.49%	62.98%	30.53%
Providing Shelter	32.56%	46.51%	20.93%
Repairing Power Lines	0%	100%	0%
Road Condition Tips	0%	42.79%	57.21%
Sheltering Homeless	15.13%	46.22%	38.66%
Shopping	13.75%	53.98%	32.26%
Shops Stayed Open	20.48%	53.01%	26.51%
Supplies	7.80%	54.83%	37.37%
Transport Assistance	9.62%	50.84%	39.54%
Work Cancelled	0%	56.36%	43.64%

Table 54 above shows that respondents from higher-income households were overrepresented in witnessing; being accommodated for work; childcare delivering food; entertainment; medical staff keeping the services running; and road condition tips. Middle-income responders were more present in aiding emergency services; delivering medication; and repairing power lines while lower-income respondents witnessed clearing snow; getting people to a hospital; providing shelter; and shops staying open beyond normal trading hours.

Figure 59 below shows the top 3 most cited witnessed acts of community support by county:

County	Clearing Roads	General and Unspecified Community Support	Assisted Medical Staff getting to and from Work
Carlow	1.2%	0.5%	0.9%
Cavan	1.2%	1.0%	2.6%
Clare	1.0%	3.0%	2.6%
Cork	6.2%	15.9%	17.0%
Donegal	0.2%	0.8%	1.7%
Dublin	6.8%	22.0%	10.4%
Galway	2.9%	3.5%	2.6%
Kerry	1.2%	2.5%	1.3%
Kildare	18.5%	8.9%	4.8%
Kilkenny	2.1%	1.5%	4.8%
Laois	3.5%	2.0%	3.0%
Leitrim	0.0%	0.5%	0.4%
Limerick	1.2%	3.8%	1.3%
Longford	1.5%	1.3%	0.4%
Louth	4.1%	3.5%	3.9%
Mayo	1.2%	2.3%	1.3%
Meath	11.6%	4.1%	6.5%
Monaghan	0.6%	1.5%	1.3%
Offaly	7.1%	2.8%	3.9%
Roscommon	2.3%	1.8%	1.3%
Sligo	0.2%	1.0%	0.4%
Tipperary	1.9%	4.6%	5.7%
Waterford	4.6%	2.8%	9.1%
Westmeath	6.4%	1.8%	4.8%
Wexford	8.9%	3.8%	7.0%
Wicklow	3.3%	2.8%	0.9%

Legend	
	High range % of community support witnessed by county
	Mid range % of community support witnessed by county
	Low range % of community support witnessed by county

Figure 59: Witnessed Community Support by County

While contributions were received from almost all counties, respondents reporting acts of community support involving clearing roads were overrepresented in Kildare and Meath. Many comments citing general and unspecified acts of community support came from Dublin and Cork. Assisting medical staff was dominated by Cork and Dublin.

Table 55 below shows a sentiment analysis of witnessed community support:

Table 55: Witnessed Community Support by Sentiment

Witnessed Community Support by Sentiment	Positive	Negative
Accommodation For Work	24	0
Aiding Emergency Services	32	1
Assisted Medical Staff getting to and from Work	227	1
Cars Stuck	117	0
Childcare	2	0
Clearing Roads	478	2
Clearing Snow	106	0
Delivering Food	31	0
Delivering Medication	5	0
Elderly or Reduced Mobility Walk	5	0
Entertainment	45	0
General and Unspecified Community Support	386	1
Getting to Hospital	9	0
Getting to Hospital and Home	39	0
Medical Staff Keeping Service Running	52	0
No Community Support	98	574
Protect Livestock	30	0
Providing Shelter	3	0
Repairing Power Lines	1	0
Road Condition Tips	16	0
Sheltering Homeless	9	0
Shopping	76	0
Shops Stayed Open	53	0
Supplies	90	1
Transport Assistance	203	2
Work Cancelled	4	0
Total Comments	2141	582

Table 50 shows that respondents reported all acts of community support in a positive light. Only those that did not witness acts of support, or felt there was no need for such support, were negative in this respect.

7.6 Weather Warnings

This section of the case study reports on respondents' opinions of weather warnings and The Storm alerts they received. Respondents were first asked how satisfied they were with the current Met Éireann weather warning system on a 7-point scale from extremely dissatisfied (coded as 1) to extremely satisfied (coded as 7). Overall, a large majority of respondents (88.2%, 3416n) were at least somewhat satisfied with the current Met Éireann weather warning system, see Figure 60. Only 5.3% (207n) of respondents' state satisfaction levels at or below 'somewhat dissatisfied'.
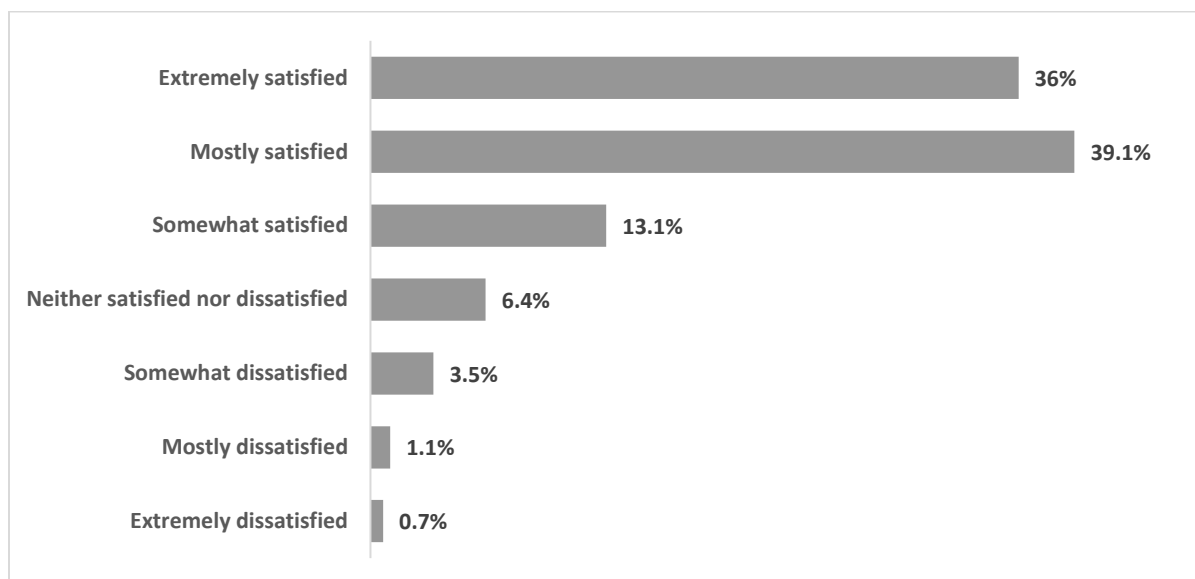
Figure 60: Satisfaction Met Éireann weather warning system

The overall satisfaction with the Met Éireann weather warning system was 5.91. The difference in average satisfaction with Met Éireann weather warning system between males and females is small but highly significant based on a t-test (t = 6.20, p<0.001). The average satisfaction for males is lower than that for females, 5.71 compared to 5.99.

Figure 61 shows that average satisfaction with Met Eireann weather warnings decreases with urbanicity. Respondents from rural settings gave the Met Éireann weather warning system a higher average satisfaction rating (6.01) compared to respondents living in a city (5.69). This difference is highly significant based on a t-test (t = 4.50, p=0.001).

Based on a Kruskal-Wallis test, there is evidence that the distributions of responses over satisfaction with the Met Éireann weather warning system differ significantly by settlement type (urbanicity) ($\chi2(4)$ = 25.242, p< 0.001).
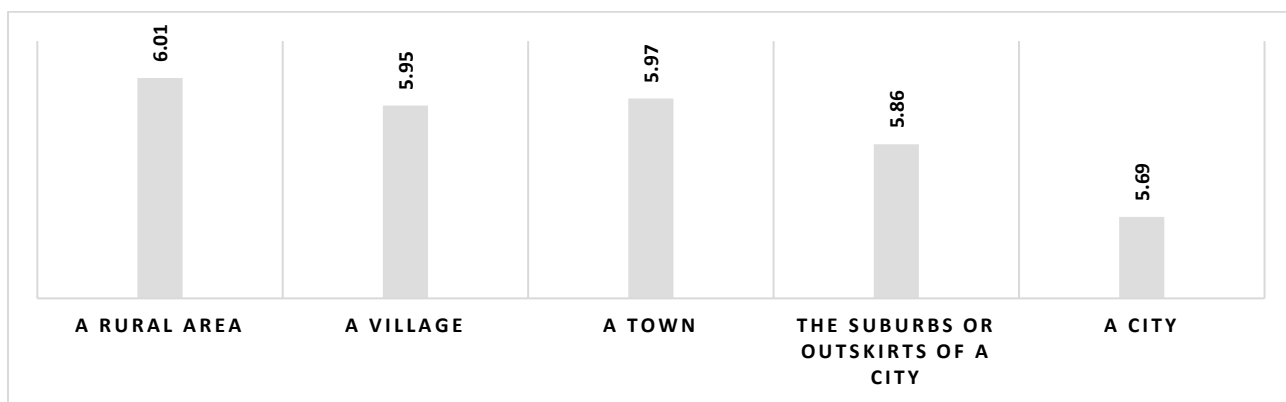
Figure 61: Average Satisfaction Met Éireann weather warning system by settlement type (urbanicity)

Average satisfaction with Met Éireann weather warning system by county is given in Table 56. The highest five, in terms of average satisfaction, are marked in light purple, and the lowest five are marked in light blue. Again, the differences are not large, but they are significant.

Table 56: Average Satisfaction Met Éireann weather warning system by county

	Mean	Freq.
Carlow	5.59	29
Cavan	5.71	55
Clare	5.72	75
Cork	5.73	445
Donegal	5.06	65
Dublin	5.45	996
Galway	5.79	194
Kerry	5.98	56
Kildare	5.70	303
Kilkenny	5.84	68
Laois	5.75	65
Leitrim	5.74	23
Limerick	5.77	116
Longford	5.87	31
Louth	5.74	115
Mayo	5.46	132
Meath	5.62	203
Monaghan	5.81	32
Offaly	5.88	129
Roscommon	5.68	81
Sligo	5.41	69
Tipperary	5.97	113
Waterford	5.82	113
Westmeath	5.77	130
Wexford	5.88	130
Wicklow	5.79	82

Respondents who did not select "Extremely Satisfied", in Figure 60 above, were asked to provide additional feedback on the weather warning system. 38.5% (953n) suggested that the warnings were issued too frequently, while 14.7% (363n) indicated they were difficult to understand. Respondents were also asked to expand on the data they provided in response to the quantitative questions, and 818 respondents provided 1,008 comments concerning weather warnings. It was evident from the outset of the analysis that respondents were divided with 44.05% (444n) of the comments being positive; Figure 62 below shows this divide weighted by sentiment.

WEATHER WARNINGS BY SENTIMENT

Positive Comments, 444

Negative Comments, 564
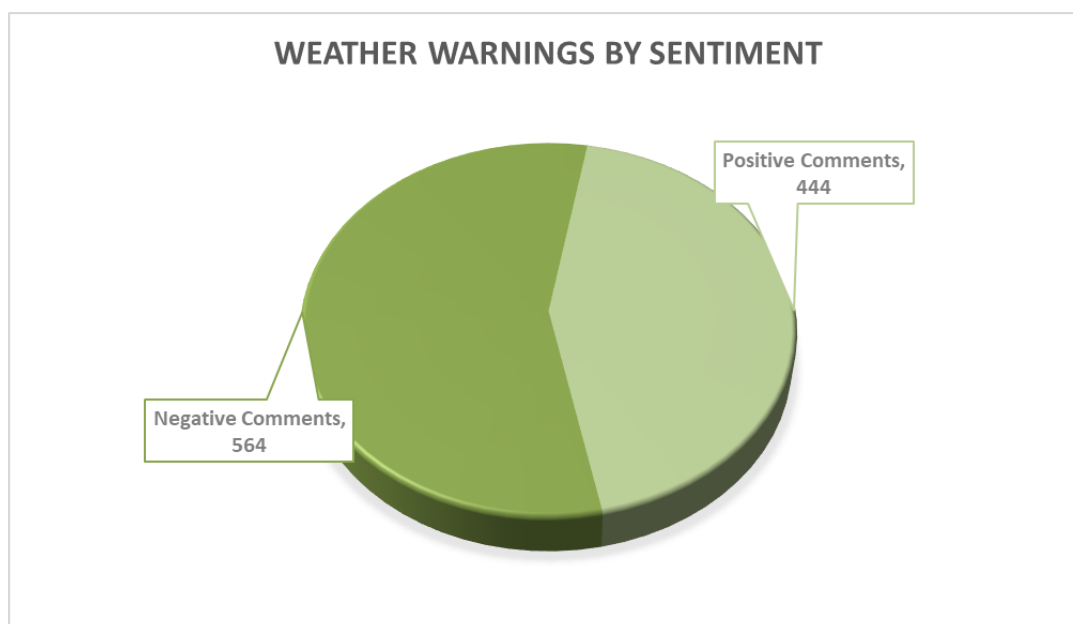
Figure 62: Weather Warnings by Sentiment

Table 57 below shows the coding detail regarding weather warnings:

Table 57: Belief in Weather Warnings

Belief in Weather Warnings	818
Negative	564
Too Frequent	102
More Localised Warnings	101
Not Taken Seriously	98
Warning not Clear	84
Overly Dramatic	78
Inaccurate	53
Issued too Late	33
Better Communication	7
Not Frequent Enough	3
Over Reaction Affecting Hospital	3
Afraid to go to Hospital	1
Unacceptable	1
Positive	444
Acceptable Standard	203
Accurate	39
Cautious	19
Clear Warning	73
In Good Time	11
Not too Frequent	91
Taken Seriously	8
Total Comments	1008

Negative Comments

There were 564 negative comments in this category

Too Frequent

102 respondents thought weather warnings were issued too frequently:

Too frequently and sometimes too exaggerated (R132)

It seems as if there is a yellow/orange warning ever second week??? (R286)

Yellow warnings are issued very frequently, so I tend not to take note of them that much. (R618)

Figure 63 below shows the recurring words in the 102 comments in this context:

Figure 63: Recurring words Warnings too Frequent

More Localised Warnings

Many of the 102 comments reported under the "Too Frequent" code were qualified by a commentary concerned with localised warnings (101 comments). Respondents believed that weather warnings were often too broad and so lost credibility in areas not affected by the weather warning in question:

The issued too frequently is in relation to hearing different coloured weather warnings on national news when they may only apply to a very local area. They lose strength then. E.g., if an orange alert has been issued many times and you never have experience of anything happening then you get somewhat immune to hearing orange alert and neglect to hear it as the caution it is meant to be and may not take adequate preparations. Feels a little bit like a boy who cried wolf scenario, and you could be caught out if the warning is regional. (R1461)

I believe yellow warnings are not really needed and red warnings need to be more tailored to specific areas. The whole country probably didn't need to be on red for Emma. (R2596)

Figure 64 below shows common language preceding and following the word "warning". When respondents were speaking negatively about weather warnings, the word "yellow" frequently preceded the word "warning".

Figure 64: Patterns of Language use Preceding and Following "Warning"

Not Taken Seriously

98 respondents believed that because warnings were too frequent and insufficiently localised citizens do not take warnings seriously, and sometimes to their detriment:

> *I feel like something needs to be done so people understand the emphasis behind the severity of the warnings, I don't think people really took it seriously until the storm actually hit and they saw first-hand how bad it was. If possible, I think the public*

should be better educated about the warnings so when a Red Warning is announced people aren't silly and disregarding it. (R244)

Seem to issue weather warnings for a bit of wind and then when an actual storm does hit people haven't taken it seriously because previous warnings have led to nothing. (R112)

There are weather warnings almost every day. On one occasion there were 9 weather warning issued...ridiculous. As I pointed out to Met-Eireann, if they keep issuing weather warnings then people will just ignore them. Red warning only should be issued to highlight serious weather conditions. For the rest let's just look out the window because the warnings have become too much. (R2038)

Other comments included: clarity of warnings (84 comments), over-hyping and dramatization of weather warnings by mainstream media (78 comments) and inaccurate warnings (53 comments).

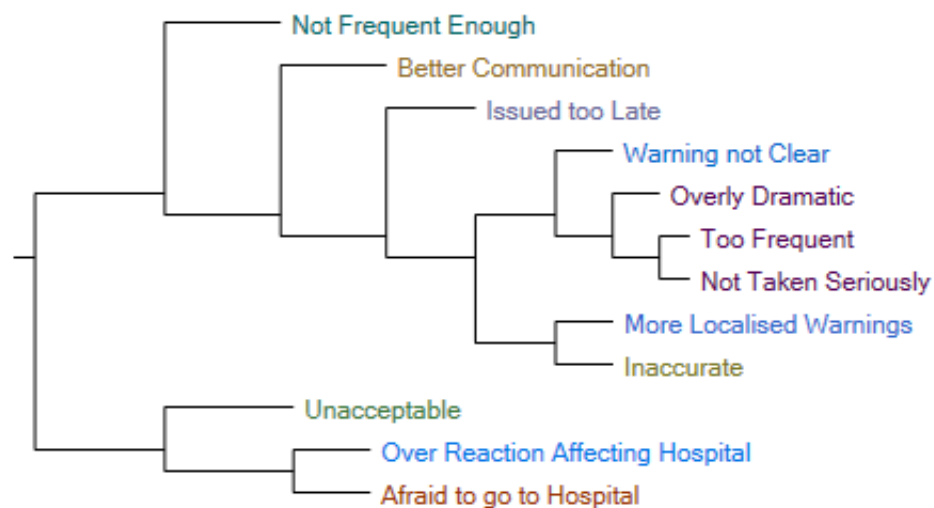Figure 65 shows the overlap between negative comment codes.

Figure 65: Overlap between Negative Comment Codes

Positive Comments

There were 444 positive comments made in relation to weather warnings.

Acceptable Standard

More than 200 respondents (n203) believed weather warnings were at an acceptable standard:

Meteorologists don't have all-knowing powers. I would rather receive a weather warning that didn't end up being necessary, than being told, last minute, that very bad weather is imminent. I believe they are well-explained and understandable, especially during Emma. Great lengths were clearly taken to ensure everyone was aware of what status orange and red warnings indicated and what weather to expect. (R128)

They make sense. The red warnings over the last 12 months seemed to have been issued appropriately. (R583)

I believe they are adequate. (R667)

Figure 66 below illustrates the recurring keywords from the comments which described weather warnings as being at an acceptable standard:

Figure 66: Recurring Keywords Acceptable Standard of Weather Warnings

Not too Frequent

91 respondents did not believe weather warnings were issued too frequently:

If we didn't have these warnings people would do stupid things. Despite the warnings I did see a lot of people in the Phoenix park having to be rescued from the snow and

behaving foolish and irresponsible. (R1330)

It's good to hear updates regularly. (R1776)

I don't think that they are issued too frequently or difficult to understand. (R2017)

Figure 67 below illustrates the recurring keywords from the comments which described weather warnings as being not too frequent:

Figure 67: Key Words Describing Weather Warnings as Not too Frequent

Clear Warnings

73 respondents believed weather warnings were clear and easy to understand:

Useful and easy to understand. (R583)

In the case of Storm Emma, weather warnings were very easy to understand and were given in good time of what was due to happen. (R3211)

They are easy to understand and issued when appropriate. (R1037)

Figure 68 illustrates the recurring keywords from the comments which described weather warnings as being clear and easy to understand:

Figure 68: Key Words Describing Clarity of Weather Warnings

Other comments included a belief that weather warnings were accurate (39 comments); cautious (19 comments) and issued in good time (11 comments).

Figure 69 below shows that the 3:1 ratio of females to males was proportionately represented at a macro level in comments about respondents' assessment of weather warnings.
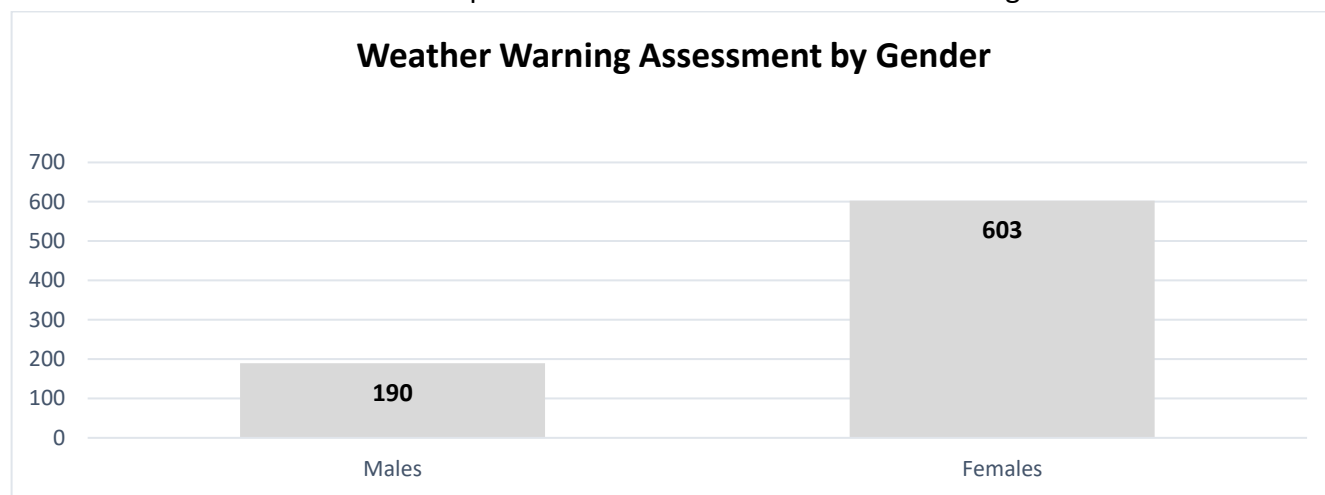

Figure 69: Weather Warning Assessment by Gender

Table 58 below shows the gender balance in both positive and negative individual codes related to weather warnings:

Table 58: Weather Warning Assessment by Gender

Weather Warning Assessment by Gender	Female	Male	Proportional Representation
Negative	324	101	
Afraid to go to Hospital	0	1	
Better Communication	6	1	
Inaccurate	40	12	
Issued too Late	28	4	
More Localised Warnings	71	24	
Not Frequent Enough	2	1	
Not Taken Seriously	78	19	
Over Reaction Affecting Hospital	2	1	
Overly Dramatic	51	27	
Too Frequent	79	22	
Unacceptable	0	1	
Warning not Clear	66	16	
Positive	276	85	
Acceptable Standard	139	55	
Accurate	29	10	
Cautious	15	4	
Clear Warning	56	13	
In Good Time	9	2	
Not too Frequent	74	14	
Taken Seriously	8	0	
Total Comments	1353	413	

Table 58 shows that females placed proportionately greater emphasis on warnings being issued too late; warnings not being taken seriously; warnings being too frequent; and unclear in their negative comments. However, in their positive comments, the opposite viewpoint was evident with females also emphasizing that warnings were clear and not too frequent. Males placed greater emphasis on reports being overly dramatized by mainstream media and standards being acceptable.

Table 59 below shows the weather warning comments distributed by income levels:

Table 59: Weather Warning Assessment by Income Level

Weather Warning Assessment by Income Level	Low (10%)	Mid (41%)	High (28%)
Negative	16.72%	55%	28.28%
Afraid to go to Hospital	0%	0%	100%
Better Communication	3.25%	96.75%	0%
Inaccurate	19.35%	52.15%	28.49%
Issued too Late	8.74%	71.33%	19.93%
More Localised Warnings	6.03%	66.70%	27.27%
Not Frequent Enough	0%	54.17%	45.83%
Not Taken Seriously	17.63%	47.94%	34.44%
Over Reaction Affecting Hospital	0%	0%	100%
Overly Dramatic	29.06%	47.09%	23.85%
Too Frequent	9.94%	54.21%	35.85%
Unacceptable	0%	100%	0%
Warning not Clear	20.83%	57.51%	21.66%
Positive	11.81%	59.99%	28.20%
Acceptable Standard	12.82%	65.49%	21.69%
Accurate	27.05%	44.54%	28.42%
Cautious	15.18%	65.85%	18.97%
Clear Warning	3.48%	61.27%	35.25%
In Good Time	0%	75.51%	24.49%
Not too Frequent	3.72%	68.80%	27.48%
Taken Seriously	21.71%	78.29%	0%

Table 59 above shows that lower-income respondents placed a proportionately greater emphasis on warnings being overly dramatic, unclear, and inaccurate. Within the positive comments, there was a focus on warnings being accurate, taken seriously, and being cautious. Middle-income respondents emphasised: better communications; warnings being issued too late; the need for more localised warnings; too infrequent; and inaccurate warnings under their negative comments. Their positive comments described warnings as being taken seriously; being issued in good time; and not being too frequent. Higher-income respondents emphasised: the perceived hype by mainstream media impacting on hospitals; people being afraid to go to the hospital; warnings being too infrequent and overly dramatic. From a positive perspective, they felt warnings were clear and easy to understand.

Table 60 below, shows the distribution of the three most cited negative weather warning comments by county:

Table 60: The 3 Most Cited Negative Comments by County

County	Too Frequent	More Localised Warnings	Not Taken Seriously
Carlow	2.0%	0.0%	1.0%
Cavan	0.0%	1.0%	0.0%
Clare	2.0%	2.0%	0.0%
Cork	15.7%	12.9%	11.3%
Donegal	2.0%	9.9%	3.1%
Dublin	30.4%	13.9%	35.1%
Galway	4.9%	5.9%	6.2%
Kerry	3.9%	1.0%	1.0%
Kildare	6.9%	4.0%	8.2%
Kilkenny	3.9%	0.0%	4.1%
Laois	0.0%	0.0%	0.0%
Leitrim	1.0%	3.0%	1.0%
Limerick	0.0%	2.0%	1.0%
Longford	2.0%	0.0%	1.0%
Louth	1.0%	1.0%	2.1%
Mayo	2.9%	13.9%	3.1%
Meath	3.9%	3.0%	5.2%
Monaghan	0.0%	0.0%	0.0%
Offaly	4.9%	2.0%	4.1%
Roscommon	1.0%	3.0%	1.0%
Sligo	1.0%	9.9%	2.1%
Tipperary	2.9%	1.0%	1.0%
Waterford	2.0%	0.0%	1.0%
Westmeath	2.0%	6.9%	2.1%
Wexford	2.9%	3.0%	4.1%
Wicklow	1.0%	1.0%	1.0%

Legend	
	High range % of negative comments by county
	Mid range % of negative comments by county
	Low range % ofnegative comments by county

Table 60 above shows that comments from respondents in Dublin and Cork were most likely to suggest that weather warnings were issued too frequently. Mayo, Sligo, and Cork were overrepresented in comments calling for more localised warnings. Respondents from Dublin, Kildare and Cork placed greater emphasis on warnings not being taken seriously as they were issued too frequently or were not localised enough. Table 61 below shows the same information for the top three most cited positive comments by county:

Table 61: The 3 Most Cited Positive Comments by County

County	Acceptable Standard	Not too Frequent	Clear Warning
Carlow	1.0%	1.1%	0.0%
Cavan	1.5%	3.3%	0.0%
Clare	2.0%	3.3%	2.7%
Cork	12.4%	15.6%	13.7%
Donegal	1.5%	2.2%	2.7%
Dublin	27.2%	21.1%	20.5%
Galway	2.5%	1.1%	2.7%
Kerry	0.5%	3.3%	1.4%
Kildare	9.4%	7.8%	16.4%
Kilkenny	1.5%	3.3%	4.1%
Laois	1.5%	1.1%	2.7%
Leitrim	0.0%	0.0%	1.4%
Limerick	2.5%	2.2%	2.7%
Longford	0.5%	0.0%	0.0%
Louth	4.5%	4.4%	2.7%
Mayo	4.0%	3.3%	2.7%
Meath	8.4%	5.6%	5.5%
Monaghan	0.5%	1.1%	0.0%
Offaly	4.0%	4.4%	1.4%
Roscommon	1.0%	4.4%	2.7%
Sligo	1.0%	1.1%	2.7%
Tipperary	3.0%	1.1%	1.4%
Waterford	4.0%	2.2%	4.1%
Westmeath	2.0%	4.4%	1.4%
Wexford	2.5%	1.1%	2.7%
Wicklow	1.5%	1.1%	1.4%

Legend	
	High range % of positive comments by county
	Mid range % of positive comments by county
	Low range % of positive comments by county

Table 61 above shows that respondents from Dublin, Kildare, Meath, and Cork were most vocal in commenting on weather warning standards being at an acceptable standard. Dublin, Cork, and Meath were overrepresented in feeling warnings were not too frequent and Dublin, Kildare and Cork respondents felt warnings were clear and easy to understand.

7.6.1 Preparedness Action Linked to the Met Éireann Weather Warnings

Met Éireann's objective for the issuance of weather warnings is "To protect lives and livelihoods of all of the nation's citizens and to mitigate damage to property and disturbance to economic activity at times of severe weather" (Met Éireann, 2018a). Implemented in 2013, Met Éireann's weather warnings

employ a 'threshold' weather advisory system focusing on localised and national impacts with three escalating categories:

- Status Yellow – Weather Alert – Be Aware
  Status Yellow events do not threaten the general population, but they carry the potential for hazardous conditions on a localised scale (Met Éireann, 2021). Hence, action may be required at this stage for persons exposed to danger by the nature of their activity or specific location.

- Status Orange – Weather Warning – Be Prepared
  Status Orange events are "Infrequent and dangerous weather conditions which may pose a threat to life and property" (Met Éireann, 2021). This warning advises the population, within the warning area, that people and assets in the warning areas may be significantly impacted and they should now make the appropriate preparedness arrangements, depending on activity and location (Met Éireann, 2021).

- Status Red – Severe Weather Warning – Take Action
  Status Red events are "Rare and very dangerous weather conditions from intense meteorological phenomena" (Met Éireann, 2021). Anyone in the warning is advised to take preparedness action and follow the instructions and advice provided by the authorities.

Given these three weather warnings, we would anticipate the general population within the warning area, revise or begin to prepare at the issuing of a status orange warning. However, the percentage of respondents who stated they would take action to prepare at a status orange was 34.3% (1326n). A further 6.3% (242n) suggested they would take action before this, at a status yellow. With 55.4% (2143n) having indicated they only take action on a Status Red warning. Only 160 individuals (4.1%) specified they would not take action at any of the three warnings.

Given that a series of weather warnings were issued before the Storm impacted Ireland, we examine whether a statistically significant association existed between the number of recommended actions completed before the Storm arrived (zero to four actions) and the weather warnings respondents indicated they would first begin to prepare (e.g., Status Yellow or Status Orange, etc.). The results are presented below the frequency chart, (Figure 72) and show a statistically significant association between each warning respondents would first take on and the number of actions taken.

Moving from left to right in the chart, that is, from individuals stating they would take action on a yellow warning through to those who state they would take action on none, we see behaviour patterns in line with decreasing risk aversion. For example, for those who could be considered most risk averse (taking action on a yellow warning) 36.36% had taken all four recommended actions, while only 3.75% of those who stated they would not respond to any warning had.
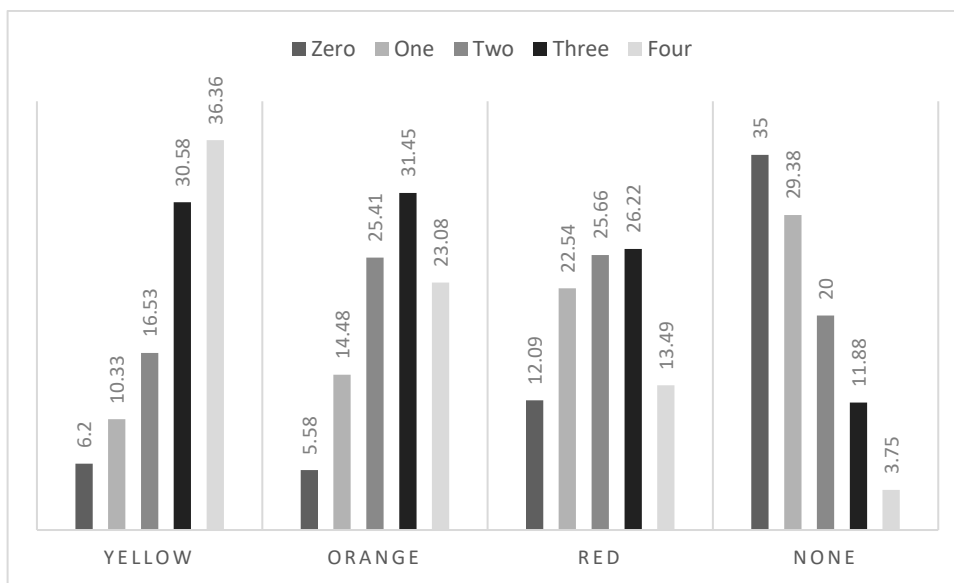
Figure 70: Number of actions taken before The Storm by Weather Warning First Inducing Response

Note: χ2(12) = 318.702, p<0.001

The variable "Warning Acted On", ranging from zero to three, summarises respondents' answers about which weather warnings they would react to. It is defined as zero for individuals who do not react to any of the weather warnings, one for those who only act on the issue of a status red, two for those who first react on a status orange and three for respondents who state that they begin to prepare at a status yellow. A higher value therefore reflects that an individual will act in response to a less severe weather warning, which could be interpreted as indicating a higher degree of risk aversion. The overall average for this scale was 1.43.

A chi-square test was conducted to examine if any association existed between which weather warning respondents first take action on and settlement type (urbanicity). It showed a statistically significant association: χ2(12) = 34.819, p<0.001. Table 62 presents the averages for Warning Acted On. The average is slightly higher for rural dwellers (1.50) compared with city dwellers (1.37), indicating that on average rural dwellers will take action in response to less severe warnings. While this difference is not large, an independent-samples t-test determined a statistically significant difference between both means (t = 3.38, p=0.001).

Table 62: Taking action on weather warning by settlement type (urbanicity)

	Mean	Freq
A rural area	**1.50**	**1106**
A village	**1.41**	**457**
A town	**1.44**	**834**
suburbs or outskirts of a city	**1.36**	**819**
A city	**1.37**	**471**

The averages for Warning Acted On for each County are given in Table 63. Counties with the highest and lowest averages are highlighted.

Table 63: Taking action on weather warning by County

	Mean	Freq.
Carlow	1.66	29
Cavan	1.55	55
Clare	1.29	75
Cork	1.45	445
Donegal	1.31	65
Dublin	1.35	996
Galway	1.33	194
Kerry	1.54	56
Kildare	1.57	303
Kilkenny	1.47	68
Laois	1.52	65
Leitrim	1.57	23
Limerick	1.28	116
Longford	1.52	31
Louth	1.43	115
Mayo	1.44	132
Meath	1.44	203
Monaghan	1.53	32
Offaly	1.54	129
Roscommon	1.48	81
Sligo	1.19	69
Tipperary	1.40	113
Waterford	1.44	113
Westmeath	1.49	130
Wexford	1.58	130
Wicklow	1.50	82

Finally, comparing the weather warning respondents state they first take action on over genders, females on average take action at less severe warnings. The average figures are Males: 1.32; Females: 1.47, with a t-test showing the difference is statistically significant.

7.7 Satisfaction with the National Response

This section reports on the level of satisfaction with the national response to The Storm; respondents' satisfaction was measured on a 7-point scale with 1 = extremely dissatisfied up to 7 = extremely satisfied. The mean response was 5.58, and Figure 71 shows the distribution of responses. Overall, there was a positive sentiment towards the national response with 66.61% (2430n) stating they were mostly or extremely satisfied with the overall response.
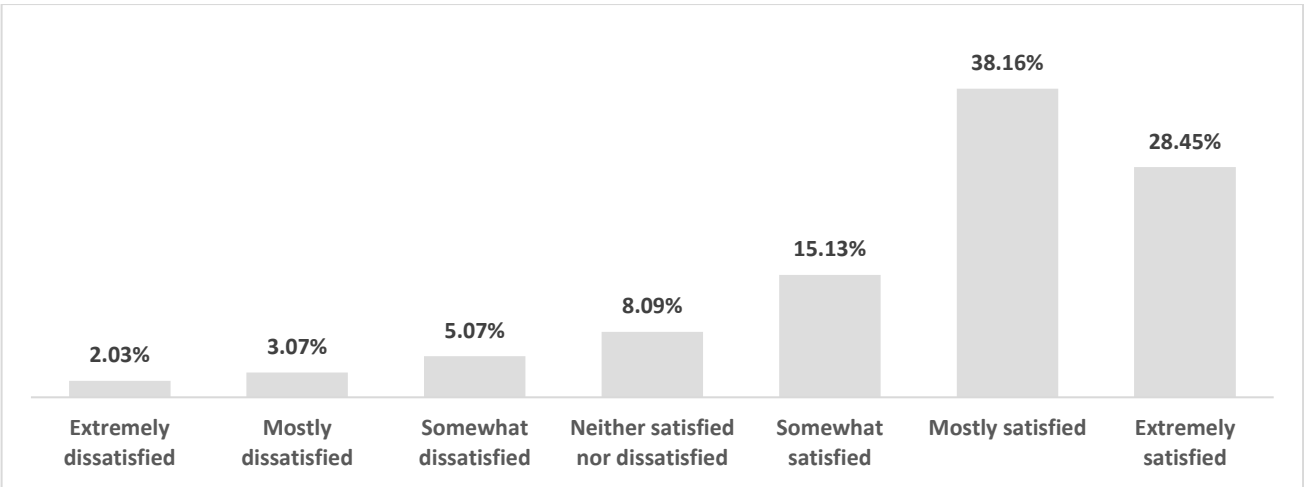

Figure 71: Satisfaction with the national response to The Storm

Examining satisfaction with the national response to the Storm across genders, average satisfaction for females was statistically significantly higher than that for males, 5.65 compared to 5.41, though the magnitude of difference was not large.

Table 64 shows the average satisfaction with the national response to The Storm across settlement types. Based on a Kruskal-Wallis test, there is only weak evidence of differences in the distribution of satisfaction across settlements.

Table 64: Satisfaction with the national response to The Storm by Settlement Type (Urbanicity)

	Mean	Freq.
A rural area	5.63	1106
A village	5.47	457
A town	5.68	833
Suburbs or outskirts of a city	5.59	818
A city	5.45	471

Each county's average satisfaction rating for the national response to The Storm is set out in Table 65. Kerry, Monaghan and Leitrim were the three counties with the highest levels of satisfaction about the

national response to The Storm (the six highest are marked in light purple), while Dublin, Sligo and Donegal were found to have the lowest average satisfaction ratings (the lowest six are marked in light blue).

Table 65: Satisfaction with the national response to The Storm by County

	Mean	Freq.
Carlow	5.62	29
Cavan	5.65	55
Clare	5.68	75
Cork	5.57	445
Donegal	5.18	65
Dublin	5.41	994
Galway	5.81	194
Kerry	6.30	56
Kildare	5.44	303
Kilkenny	5.78	68
Laois	5.74	65
Leitrim	6.04	23
Limerick	5.90	116
Longford	5.90	31
Louth	5.61	115
Mayo	5.47	132
Meath	5.56	203
Monaghan	6.06	32
Offaly	5.83	129
Roscommon	5.99	81
Sligo	5.32	69
Tipperary	5.88	113
Waterford	5.63	113
Westmeath	5.65	130
Wexford	5.45	130
Wicklow	5.49	82

Respondents' reflective post-event coping appraisal indicating how well respondents felt they coped with The Storm, was positively and statistically significantly correlated with satisfaction regarding the national response to The Storm, correlation coefficient = 0.234 (p<0.001). Table 66 reports the average stated satisfaction with the national response for each level of Coping Appraisal.

Table 66: Satisfaction with the national response to The Storm by Individual Coping Appraisal

Coping Appraisal: 0% to 100%	Mean	Freq.
0	5.11	38
10	4.67	112
20	4.59	143
30	4.96	241
40	5.41	274
50	5.45	469
60	5.67	454
70	5.80	671
80	5.83	654
90	6.01	425
100	5.76	289

Average levels of satisfaction with the national response to The Storm were negatively associated with the trajectory of worry during The Storm. That is, increased worry during The Storm is associated with lower levels of satisfaction. Table 67 sets out the average satisfaction with the national response to The Storm for each change in worry. Independence of the two variables is strongly rejected based on a chi-squared test ($\chi^2(12) = 122.81$, $p<0.001$).

Table 67: Satisfaction with the national response to The Storm by Change in Worry

	Mean	Freq.
Worry decreased	5.85	776
Worry stayed the same	5.67	1894
Worry increased	5.29	1199

8.0 Regression Analysis: Protection Motivation Theory

8.1 Theoretical Framework

In an emergency management context, PMT studies are generally focused on the pre-emergency event and people's perceived ability to undertake effective protective actions. They are not generally conducted immediately after the impacts of a hazard were witnessed.

To explain how the public's decision-making response process might work when faced with an imminent threat, and the issuing of emergency warning messages, Mileti (1995) suggested a six-phase continual process (see Figure 72). Mileti (1995, p.2-3) outlined that first people must become aware of the threat; they must understand the information - both the hazard and the warning; they must believe that the message is accurate (trust); consider the impacts, personalised for their situation; and then decide to take action, or not. As this process continues, people actively validate the information they obtain and search for new information: the continual confirmation phase (Mileti 1995, p.3).
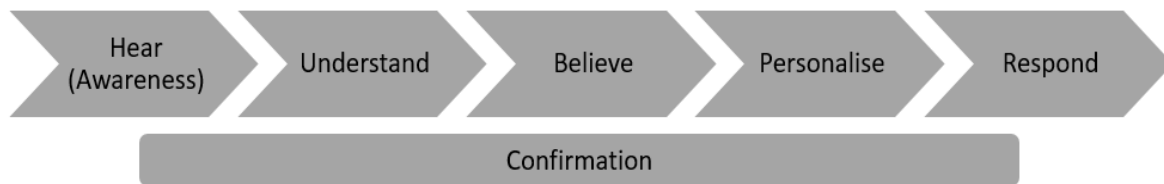

Figure 72: Response Process (Mileti 1995)

Coping appraisal in PMT studies tended to focus on the pre-event and people's perceived ability to undertake effective protective actions. In this study, we asked people to reflect on how well they coped during the storm–which we refer to as a reflective post-event coping appraisal. We were also interested in examining if a relationship existed between the trajectory of worry and its influence on this post-event coping appraisal.

To investigate whether elements of protection motivation theory, namely understanding and believing weather warnings, worry and a post-event coping appraisal, contributed towards households undertaking preparedness actions, following a severe weather event, we applied elements from both PMT (Figure 2) and Mileti's (1995) response process to formulate a theoretical framework Figure 73. The theoretical framework was divided into four stages of analysis and is described in the subsequent sections.
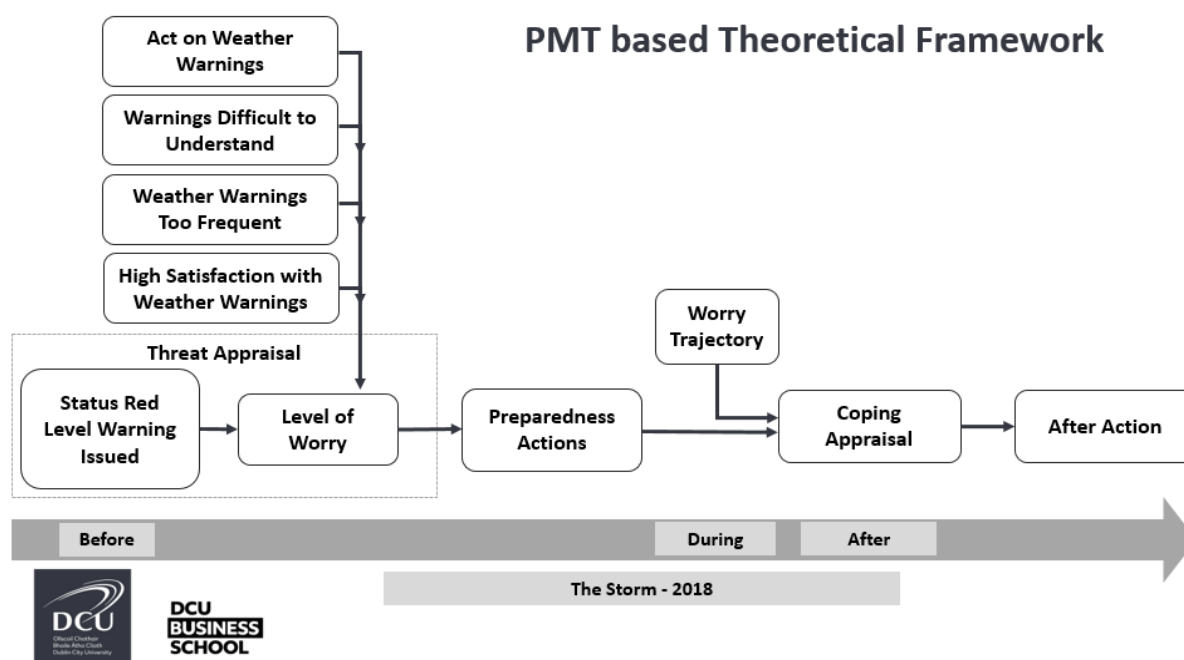
Figure 73: PMT based theoretical framework: the response process and after-action to the Storm, 2018

Sections 5.8.1 to 5.8.4 summarise results from the analysis using various regression models: Probit, Ordered Probit, and Ordinary Least Squares (OLS). Four levels of statistical significance were used across all stages of analysis. 10% significance is indicated using the symbol: ‡, which we term as 'weakly significant'; 5% is indicated using the symbol: *, and 1% is indicated using the symbol: **. Both are termed as 'significant'. Finally, significance at 0.1%, as indicated by the symbol: ***, is termed as 'highly significant'. No symbol present indicates insignificance.

8.2 Determinants of Worry Before the Storm (Stage One)

In the case of this Storm, people were not left alone to form their threat appraisal. Instead, this was informed by the Met Éireann weather warnings; namely, the countrywide status red severe weather warning, along with the other warnings issued before the Storm. Inspired by both PMT (Figure 2) and Mileti (1995) response process, we theorised that the level of worry attributed to the Storm would be influenced by people's attitudes towards the weather warnings (stage one of the analysis). In essence, we hypothesised that respondents' prior understanding of weather warnings, their belief in the warnings—their willingness to act on them, and satisfaction with the warnings would contribute towards forming a fear appeal—in this case, measured as worry towards the Storm. This is visualised in both Figure 74 and the general form for the "Stage One" regression below.
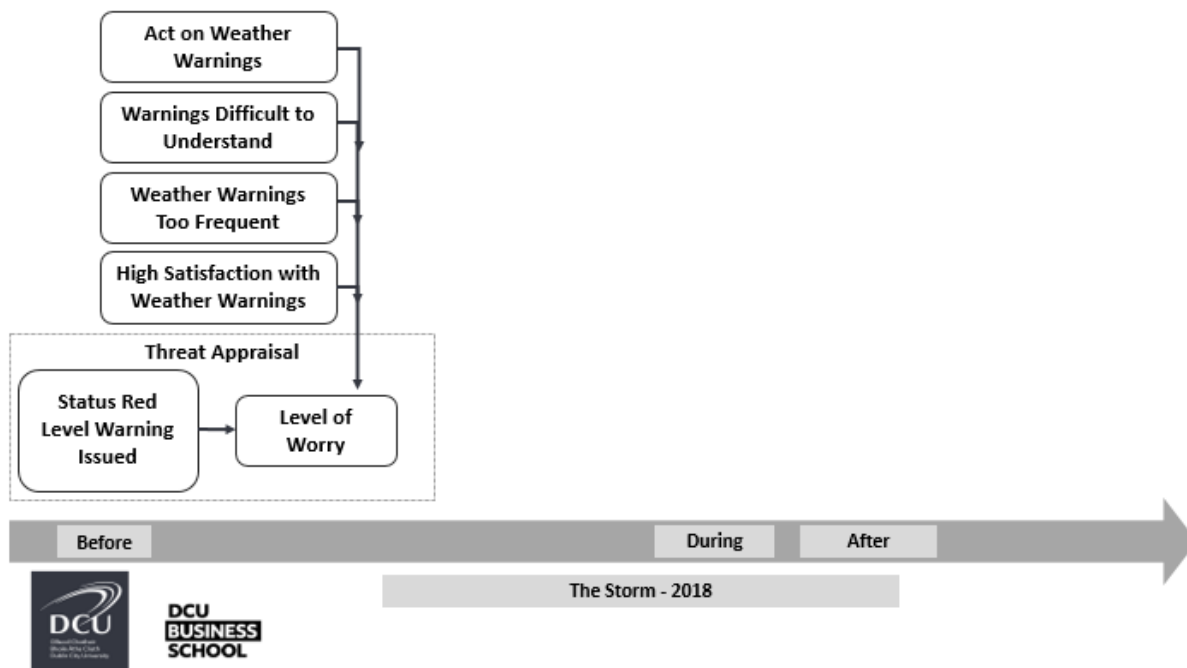
Figure 74: Stage One of the PMT based theoretical framework

Stage One: $\textbf{\textit{Level of Worry (Before)}} = \textbf{\textit{f}}[\textbf{\textit{socio}} - \textbf{\textit{demographics, act on weather warnings,}}$
$\textbf{\textit{perceived understanding of the warnings, satisfaction with the warning system}}]$

Overview of the independent variables for stage one:

- Act on weather warnings was coded in three dummy variables: "Takes action on red" = 1 if the respondent first takes action on a status red warning, 0 otherwise; "takes action on orange" = 1 if the respondent takes action first on a status orange warning, 0 otherwise; and "takes action on yellow" = 1 if the respondent first takes action on a status yellow warning, 0 otherwise. The base category was those who do not take action in response to any of the weather warnings.
- Satisfaction with the Met Éireann weather warning system was measured using a seven-point Likert scale - extremely satisfied to extremely dissatisfied.
- Weather Warnings are too frequent was coded as a dummy variable: yes = 1, no = 0.
- Weather Warnings are difficult to understand was coded as a dummy variable: yes = 1, no = 0.
- Besides these explanatory variables, a selection of socio-demographic factors were included. These are defined in section 4.0: Profile of Respondents.

The dependent variable for the stage one analysis was respondents' reported levels of worry before the Storm and was measured on a 5-point ordinal scale from not at all worried to worried a great deal. Table 68 sets out the results of the analysis for stage one. The results are obtained from a generalised ordered probit model, estimated using the gologit function in STATA with a probit link function (Williams 2006). The coefficients on independent variables which violated the parallel regressions assumption were permitted to vary, which results in four coefficients reported in the tables below for

those variables. In all other cases, one coefficient is reported. Robust standard errors were computed, and marginal effects are reported to more fully explain the results.

Table 68: Worry Before The Storm – Stage One

	Coef.	Robust Std. Err.	Marginal effects (dy/dx)				
			Not at all	A little	A moderate amount	A lot	A great deal
Female	0.188***	0.054	-0.042***	-0.032***	0.039***	0.023***	0.011***
Age	0.032**	0.012	-0.007**	-0.006**	0.007**	0.004**	0.002**
Age^2	0*	0	0*	0*	0*	0*	0*
Owns Home	0.057	0.069	-0.012	-0.01	0.012	0.007	0.004
Years at Home	0.003	0.003	-0.001	0	0.001	0	0
Live in a House	0.075	0.094	-0.016	-0.013	0.015	0.009	0.005
No. of Children (at household)	0.032	0.023	-0.007	-0.006	0.006	0.004	0.002
No. of Adults (at household)	-0.03	0.023	0.006	0.005	-0.006	-0.004	-0.002
Works fulltime	0.288***	0.066	-0.066***	-0.046***	0.06***	0.035***	0.017***
Race (White)	-0.044	0.169	0.009	0.008	-0.009	-0.006	-0.003
Income 30,000-70,000	0.112	0.106	-0.024	0.064‡	0.015	-0.031	-0.024*
	-0.101	0.094					
	-0.279*	0.113					
	-0.394*	0.165					
Income Over 70,000	0.031	0.112	-0.007	0.059‡	0.02	-0.04*	-0.033***
	-0.135	0.1					
	-0.398***	0.121					
	-0.628***	0.172					
A Farmer	0.115	0.159	-0.023	-0.023	0.022	0.016	0.008
Expert	0.122	0.092	-0.025	-0.07**	0.036	0.012	0.047***
	0.238***	0.069					
	0.271***	0.08					
	0.565***	0.118					
Lives in a village	-0.251**	0.08	0.05**	0.05***	-0.047**	-0.034***	-0.019***
Lives in a town	-0.255***	0.069	0.051***	0.05***	-0.048***	-0.035***	-0.019***
Lives in a suburb/outskirt of a city	-0.207**	0.067	0.04**	0.042**	-0.038**	-0.029**	-0.016**
Lives in a city	-0.374***	0.091	0.08***	0.067***	-0.074***	-0.048***	-0.025***
Takes action first on Red	0.215‡	0.123	-0.056	-0.024*	0.049**	0.023‡	0.009*
Takes action first on Orange	0.568***	0.138	-0.123***	-0.103***	0.166***	0.052**	0.008

	0.583***	0.125					
	0.337*	0.134					
	0.166	0.155					
Takes action first on Yellow	0.193	0.199	-0.05	-0.211***	0.118*	0.1*	0.043**
	0.674***	0.18					
	0.665***	0.193					
	0.585**	0.228					
Satisfied with weather warnings	0.09**	0.032	-0.019**	0.022*	0.005	-0.006	-0.002
	-0.008	0.028					
	-0.04	0.037					
	-0.039	0.05					
Weather Warnings Too Frequent	-0.135**	0.051	0.029**	0.024**	-0.027**	-0.017**	-0.009**
Weather Warnings Difficult to Understand	0.268*	0.109	-0.05**	0.029	-0.04	0.034	0.027*
	0.053	0.085					
	0.276**	0.103					
	0.349*	0.139					
/cut1	0.133	0.322					
/cut2	1.391	0.324					
/cut3	2.448	0.328					
/cut4	3.153	0.329					
χ2 (Chi-squared) (df = 23)	227.32***						
No. Obs	2,076						

Notes ‡p<0.1, *p<0.05, **p<0.01, ***p<0.001

The regression model results show that those who stated they take action in response to weather warnings (status yellow, orange or red) were more likely to worry about the Storm than those who state they do not act on any warning. If we consider stated actions as reflecting risk aversion levels, the more risk averse are more likely to report higher levels or worry.

The magnitude of the impact on worry was lower for those who state they only act on a red weather warning, than for those who take action in response to orange or yellow warnings, and weakly statistically significant.

Examining the marginal effects, it can be seen that, compared to those who state they would not act in response to any warning, the probability of worrying "a great deal" about the Storm estimated as

0.9 percentage points higher for those who would only act on a red warning, whereas it is 4.8 percentage points for those who state they would act on a yellow warning.

Taking action on an orange warning has a stronger impact on worry levels at the lower end of the worry scale, with the effect petering out at the upper end. This is reflected in the highly significant marginal impacts on lower and mid-levels of worry. We see a reduction in the probability of stating low worry levels and increases in the probability of mid-range worry levels, compared to those who do not act on warnings. For example, the probability of stating 'Not at all' worried about the storm is estimated to be 12.3pp lower and the probability of stating "a moderate amount" of worry is estimated as 16.6pp higher for individuals who first act on orange warnings compared to those who do not react to any warning.

The impact of action on a yellow warning is larger and statistically significant for higher levels of worry. This is reflected in the significant marginal impacts on worry in the mid- and upper levels. Taking action on a yellow warning, compared to not reacting to any warning, leads to an estimated decrease of 21.1pp in the probability that a respondent stated he "worried a little" about the Storm before its arrival and increases of 11.8pp, 10pp and 4.3pp respectively in the probabilities a respondent stated he worried "a moderate amount", "a lot" and "a great deal".

Satisfaction with the weather warnings had a significant impact on worry only at lower levels of the scale. The marginal effects show that a one-point increase in the satisfaction scale reduced the probability that respondents stated they were not at all worried by an estimated 1.9pp and increased the probability they were a little worried about The Storm by 2.2pp. There is no significant impact on higher levels of worry.

The results also showed that respondents who stated weather warnings were issued too frequently were less likely to be worried about this Storm. For example, the probability that respondents worried "a lot" about the Storm increased by 1.7pp if the respondents had suggested the weather warnings were issued too frequently.

Those who suggested that weather warnings are difficult to understand were more likely to worry about the Storm. For example, controlling for all other variables at their mean values, the probability that a respondent stated they were "not at all" worried about the Storm is estimated to be 5pp lower for those who reported that weather warnings are difficult to understand.

Summarising the impacts of socio-demographics: females, older respondents, those working full time, those with lower incomes, and those living in rural areas (compared with all other settlement types) were all more likely to report higher levels of worry about the Storm.

8.3 Determinants of Preparedness Actions Before the Storm Arrived (Stage Two)

Inspired by PMT (Figure 2), the next stage of analysis focused on the relationship between levels of worry and preparedness actions before the Storm. Given that Maddux and Rogers (1983) emphasised that fear appeals change attitudes and behaviours. Having provided insight into the direction and magnitude of the effect of weather warnings on respondents' levels of worry before the Storm. We expected as the warnings should increase worry, this would then increase probability of preparedness action before the Strom, Figure 75.
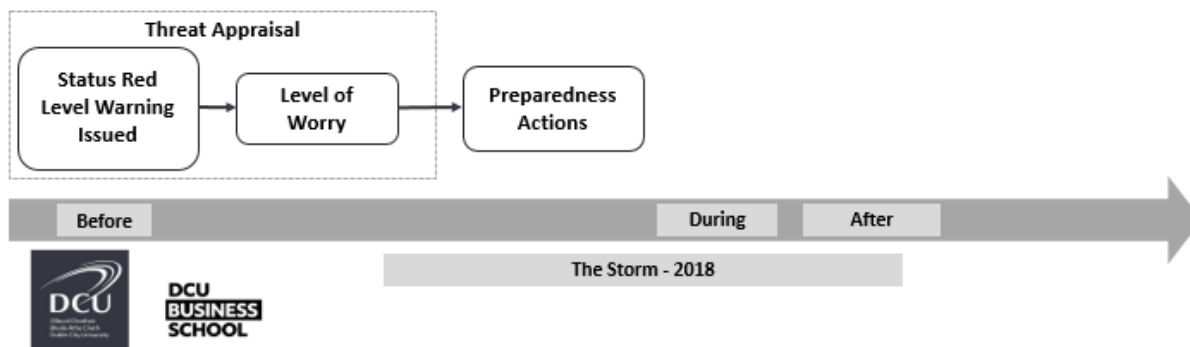
Figure 75: Stage Two of the PMT based theoretical framework

Stage Two: $Actions\ (Before) = f[socio-demographics, level\ of\ worry\ (before)]$

Overview of the independent variables for stage two:

- Levels of worry (before the Storm) were measured on a 5-point ordinal scale from "not at all worried" to "a great deal worried". The level of worry was included as a set of four dummy variables: "Worry Before - Little" to "Worry Before – A great deal". The base category to which all others is compared is "not at all worried".
- The same selection of socio-demographic factors as used previously was included, defined in 4.0: Profile of Respondents.

The dependent variable for the stage two analysis was the number of reported preparedness actions respondents took before the Storm arrived. These were measured on a 5-point ordinal scale from zero actions completed (0) to four actions completed (4). The four indicators were: in response to the weather warnings, 1) had households sought any further information about how to prepare for the approaching Storm; 2) had they made plans for the possible loss of water; 3) had they made plans for the possible loss of power; 4) did they purchase additional food supplies to prepare for The Storm. Each was measured using a nominal scale (yes = 1, no= 0) and added to create the score from zero actions to four actions.

Table 69 sets out the results of the stage two analysis, which again used a generalised ordered profit regression. As before, the coefficients on the independent variables which violate the parallel lines assumption were permitted to vary across classifications of the dependent variable, resulting in four coefficients reported in the table below. For independent variables that adhere to the parallel lines assumption, the single coefficient is reported. Robust standard errors were computed, and marginal effects reported to enhance intuitive understanding of these results.

Table 69: Actions Before The Storm – Stage Two

	Coef.	Robust Std. Err.	Marginal effects (dy/dx)				
			0 – Actions	1 – Actions	2 – Actions	3 – Actions	4 – Actions
Female	0.202***	0.044	-0.033***	-0.036***	-0.01***	0.033***	0.047***
Age	0.048**	0.016	-0.007**	-0.009**	-0.003**	0.007**	0.012**
Age^2	-0.001**	0	0**	0**	0**	0**	0**
Owns Home	-0.044	0.061	0.007	0.008	0.003	-0.007	-0.011
Years at Home	0.003	0.002	0	0	0	0	0.001
Live in a House	0.265**	0.101	-0.047*	0.042‡	0.065*	0.048	-0.107***
	0.017	0.092					
	-0.149	0.092					
	-0.383***	0.104					
No. of Children (at household)	0.045*	0.018	-0.007*	-0.008*	-0.003*	0.007*	0.011*
No. of Adults (at household)	-0.006	0.019	0.001	0.001	0	-0.001	-0.002
Works fulltime	-0.034‡	0.055	0.005	0.006	0.002	-0.005	-0.008
Race (White)	0.188	0.128	-0.033	-0.033	-0.008**	0.032	0.042
Income 30,000-70,000	0.212***	0.063	-0.033***	-0.038***	-0.013***	0.033***	0.051***
Income Over 70,000	0.323***	0.067	-0.047***	-0.057***	-0.024***	0.046***	0.082***
A Farmer	-0.228*	0.103	0.041‡	0.04*	0.008***	-0.039*	-0.049*
Expert	-0.131‡	0.077	0.021	-0.031‡	-0.038*	0.025	0.023
	0.028	0.06					
	0.119*	0.055					
	0.091	0.062					
Lives in a village	-0.091	0.062	0.013	0.016	0.007	-0.013	-0.023
Lives in a town	-0.122*	0.053	0.018*	0.022*	0.009*	-0.018*	-0.031*
Lives in a suburb/outskirt of a city	-0.149**	0.055	0.022**	0.027**	0.01**	-0.022**	-0.037**
Lives in a city	-0.164*	0.068	0.025*	0.029*	0.011**	-0.025*	-0.04*
Worry Before - Little	0.464***	0.061	-0.067***	-0.082***	-0.034***	0.065***	0.118***
Worry Before - Moderate	0.756***	0.063	-0.099***	-0.129***	-0.067***	0.089***	0.206***
Worry Before – A Lot	0.891***	0.08	-0.084***	-0.14***	-0.111***	0.052***	0.283***

Worry Before – A Great Deal	1.02***	0.113	-0.081***	-0.149***	-0.138***	0.025‡	0.343***
/cut1	0.627	0.309					
/cut2	1.406	0.310					
/cut3	2.124	0.311					
/cut4	3.006	0.313					
χ2 (Chi-squared) (df = 22)	422.3 ***						
No. Obs	3,228						

Notes ‡p<0.1, *p<0.05, **p<0.01, ***p<0.001

The results of the regression showed that, controlling for the set of socio-demographic factors, a statistically significant positive relationship exists between worry about the Storm and the number of actions taken action before the Storm. This is evident in the increasing magnitude of the regression coefficients corresponding to higher worry levels.

The marginal effect values reflect this. For example, the probability that a respondent stated they completed all four preparedness actions is estimated to be 11.8pp higher if they worried a little before the Storm arrived, compared to those who did not worry at all. This figure increases to 34.3pp for those who worried a great deal about the Storm. These results support the contention that, while high levels of worry are not always associated with protective action for every household, worry can act as a strong motivator to undertake preparedness action.

Being female, having a larger number of children in the household, and having a higher household income (of over 30,000) increases the likelihood of taking actions before The Storm. For example, the marginal effect suggested that the probability that a respondent stated they completed all four actions increases by 4.7pp if they were female compared to male. The impact of age on actions taken is quadratic, showing an inverted u-shape relation.

Working full-time, being a farmer, an expert, and living in a town, suburbs, or city decreased the likelihood of taking actions before The Storm. For example, living in a city translates into a decrease of 4pp in the probability that a respondent says they had completed all four actions.

The effect of living in a house, as opposed to an apartment or other, is to reduce the probabilities of extremes in terms of action, either taking no action or completing all four, and increasing the probability of the mid-range number of actions.

8.4 Determinants of the Reflective Coping Appraisal (Stage Three)

Rogers and Prentice-Dunn (1997) highlighted that the Coping Appraisal of PMT has rich meaning and can be conceptualised in various ways. As noted before, we examined the concept of a reflective post-event Coping Appraisal as part of our PMT framework. However, Mileti (1995) emphasised that people

do not wait passively for the arrival of more information about the warnings; "most people actively seek out additional information (Mileti 1995, p.3), which Mileti refers to as the confirmation phase. Given that we theorised the level of worry attributed to the Storm would be influenced by people's attitudes towards the weather warnings – e.g., understanding and belief (stage one of the analysis) we posited that this confirmation phase might influence the trajectory of worry. Given this assumption, we sought to test whether a change in the trajectory of worry and preparedness actions may influence the reflective post-event Coping Appraisal. This is visualised in both Figure 76 and the general form for this "Stage Three" regression below.
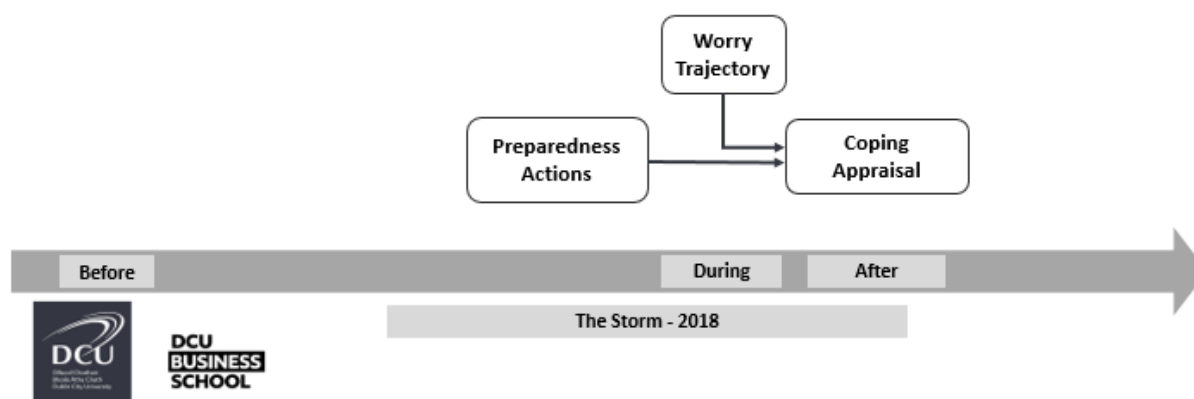
Figure 76: Stage Three of the PMT based theoretical framework

Stage Three: $\boldsymbol{Coping\ Appraisal = f[socio-demographics, change\ in\ worry, Preparedness\ Actions\ (before)]}$

Overview of the independent variables for stage three:

- As noted above, preparedness actions were measured on a 5-point scale from zero actions completed (0) to four actions completed (4). Four dummy variables, defined for those taking one to four actions, are included as independent variables. Those who took no action were used as the reference category.
- Worry trajectory was coded into three dummy variables: worry decreased, worry increased, and worry stayed the same. The third was used as the reference category.
- The selection of socio-demographic variables was also included; outlined in 4.0: Profile of Respondents.

The dependent variable for stage three of the analysis was the 11-point reflective post-event coping appraisal scale. Notably, this scale ranges from 0% to 100% at intervals of 10%, see Figure 33, where 0 indicated not at all prepared, and 100 represented being totally prepared. Table 70 sets out the results of this analysis, using an OLS regression with robust standard errors.

Table 70: Coping Appraisal – Stage Three

	Coef.	Robust Std. Err	95% Conf. Interval	
Female	-3.734***	0.899	-5.496	-1.972
Age	0.762**	0.244	0.284	1.24
Age^2	-0.006**	0.003	-0.011	0
Owns Home	-0.577	1.256	-3.039	1.886
Years at Home	-0.058	0.045	-0.148	0.031
Live in a House	-4.04*	1.645	-7.265	-0.816
No. of Children (at household)	0.136	0.364	-0.579	0.85
No. of Adults (at household)	-0.694	0.417	-1.511	0.123
Works fulltime	-4.136***	1.075	-6.244	-2.028
Race (White)	5.075	3.047	-0.9	11.049
Income 30,000-70,000	1.472	1.465	-1.401	4.344
Income Over 70,000	3.295*	1.535	0.287	6.304
A farmer	0.935	2.449	-3.867	5.737
Expert	-3.382***	0.954	-5.253	-1.51
Lives in a village	-1.04	1.267	-3.525	1.444
Lives in a town	-0.658	1.091	-2.798	1.482
Lives in a suburb/outskirt of a city	-1.208	1.123	-3.41	0.995
Lives in a city	-1.498	1.433	-4.307	1.311
Worry Decreased	5.448***	1.012	3.463	7.433
Worry Increased	-13.24***	0.896	-14.997	-11.483
Actions Before – 1	4.317*	1.798	0.791	7.843
Actions Before – 2	7.278***	1.711	3.922	10.633
Actions Before – 3	12.282***	1.687	8.974	15.589
Actions Before – 4	14.137***	1.762	10.682	17.592
Constant	43.757***	5.925	32.139	55.375
Adjusted R^2	0.174			
F	30.87***			
No. Obs	3,164			

Notes *p<0.05, **p<0.01, ***p<0.001

The OLS results suggest that the number of actions taken before the Storm arrived had a strong positive relationship with reported post-event coping appraisal, as the reported coefficients on "Actions Before" variables increase in magnitude from β=4.317 (for one action completed) up to β=14.137 (for four actions completed). That is, the more actions completed, the higher post-event coping appraisal is predicted to be. For instance, the coefficient for respondents who completed all four actions before the Storm suggests that having four actions completed is estimated to change the coping appraisal by β=14.137 compared to someone who had taken no actions. The differences between consecutive

coefficients indicate the marginal increases in coping appraisal for each extra action taken, and the results show the largest marginal impact is for action 3 undertaken.

Unsurprisingly, a change in post-event coping appraisal was also significantly related to the respondent's trajectory of worry during the storm. An increase in worry over the course of the Storm was found to have a highly significant negative association with reflective coping appraisal, while a decrease in worry during the course of the Storm was associated with statistically significant higher post-event coping appraisal levels. Compared to a respondent who reported no change in worry, the results predict coping appraisal to be 13.24 points lower for those who state their worry increased, and 5.45 points higher for those who state worry decreased.

The estimation predicts reflective coping appraisal to be lower for females, those living in a house, those working full-time and experts. Coping appraisal is estimated to increase with higher income. There is a quadratic relationship between age and reflective coping appraisal, with coping appraisal increasing in age up to approximately 63 years, after which it declines.

8.5 Determinants of After-Actions (Stage Four)

Finally, in line with our PMT inspired framework, we tested the influence of post-event coping appraisal on undertaking preparedness actions (after-action) in the immediate weeks following the Storm. This is visualised in both Figure 77 and the general form for this regression titled "Stage Four" below. In short, we expected that high levels of the reflective, post-event coping appraisal, would reduce the likelihood that households undertake preparedness actions immediately following the Storm.
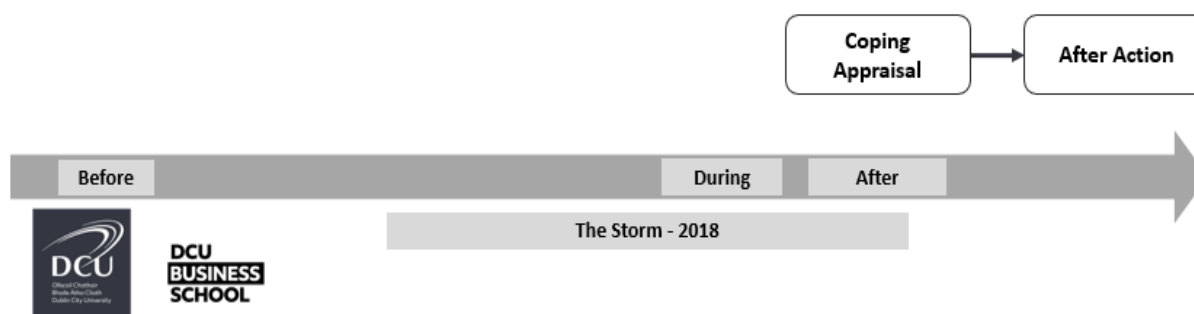

Figure 77: Stage Four of the PMT based theoretical framework

Stage Four: $After\ Action = f[socio - demographics, impacted\ by\ the\ Storm, coping\ appraisal]$

An overview of the independent variables for stage four:

- As noted in stage three, the 11-point reflective post-event coping appraisal scale ranges from 0% to 100% at intervals of 10%. This is included as a continuous variable.

- "Impacted by the Storm" is a dummy variable set equal to 1 if the respondent reports being adversely impacted by the Storm, 0 otherwise.
- The same selection of socio-demographic factors was also included. As before these are defined in section 4.0: Profile of Respondents.

The dependent variable, After-Action, is a binary variable indicating whether respondents undertook any further actions in the 8-weeks following The Storm. Of the 3685 applicable respondents, 12.9% (474n) had undertaken subsequent protective actions and were coded as Yes (1); the remainder were coded as No (0).

After-Action was modelled using probit regression with robust standard errors. Results are in Table 71, where profit regression coefficients and marginal effects are reported. The latter show the change in the predicted probability of having taken action after the storm, resulting from a one-unit change in the explanatory variable, setting all other explanatory variables to their mean values.

Table 71: After-Actions

	Coef.	Robust Std. Err.	Marginal effects (dy/dx)
Female	-0.087	0.067	-0.017
Age	0.01	0.020	0.002
Age^2	0	0.000	0
Owns Home	0.334***	0.098	0.06***
Years at Home	0.002	0.003	0
Live in a House	0.066	0.124	0.012
No. of Children (at household)	-0.025	0.028	-0.005
No. of Adults (at household)	-0.04	0.031	-0.008
Works fulltime	0.112	0.086	0.021
Race (White)	-0.364*	0.184	-0.086^
Income 30,000-70,000	-0.282**	0.099	-0.055**
Income Over 70,000	-0.351***	0.108	-0.065***
A Farmer	-0.013	0.169	-0.002
Expert	0.226***	0.068	0.048**
Lives in a village	0.029	0.095	0.006
Lives in a town	-0.041	0.081	-0.008
Lives in a suburb/outskirt of a city	-0.176*	0.087	-0.033*
Lives in a city	-0.144	0.109	-0.028
Coping Appraisal	-0.004***	0.001	-0.001***
Impacted by the Storm	0.22	0.148	0.038^
Constant	-0.986	0.445	
Chi-squared (df = 20)	90.86***		
Log Likelihood	-1148.57		
Correctly classified	87.48%		
No. Obs	3,164		

Notes *p<0.05, **p<0.01, ***p<0.001

The analysis shows a highly significant negative relationship existed between the reflective coping appraisal and the tendency to take protective actions after the Storm. The estimated marginal effect shows for every one-point decrease in the post-event coping appraisal, the probability of taking action after the Storm increases by 0.001 (0.1pp). Thus, the worse a household felt they had coped with the Storm, the more likely they were to undertake further preparedness actions immediately following this Storm.

Owning their home, and identifying as an Emergency Management Expert, significantly increased the likelihood respondents took actions to prepare the home in the weeks following the Storm. For example, owning the home led to a 6pp rise in the probability a respondent stated they undertook after-actions.

Being white, having a household income of over 30,000 and living in the suburbs/ outskirt of a city compared with a rural area significantly reduced the likelihood of taking actions after the Storm. For example, the marginal effects revealed that the probability a respondent stated they had undertaken after-actions decreased by 3.3pp if they lived in the suburbs. All other socio-demographic characteristics were non-significant.

9.0 Conclusion: Through a PMT Lens

The Storm Emma case study was conducted to discover the respondents' experiences, challenges, behaviour, and perceptions immediately before, during and after the Storm.

Based on the result of the mixed-methods analysis, including descriptive statistics, exploratory content analysis and inferential statistics, this study used components of PMT to offer insights into respondents' worry levels before and during the Storm; their household preparedness before and after the Storm; respondents' opinions of the weather warnings they received about the Storm; and respondents' satisfaction with the national response.

This section of the report provides a summary of the results following each stage of the regression analysis modelled off the PMT based theoretical framework, as illustrated in Figure 78.
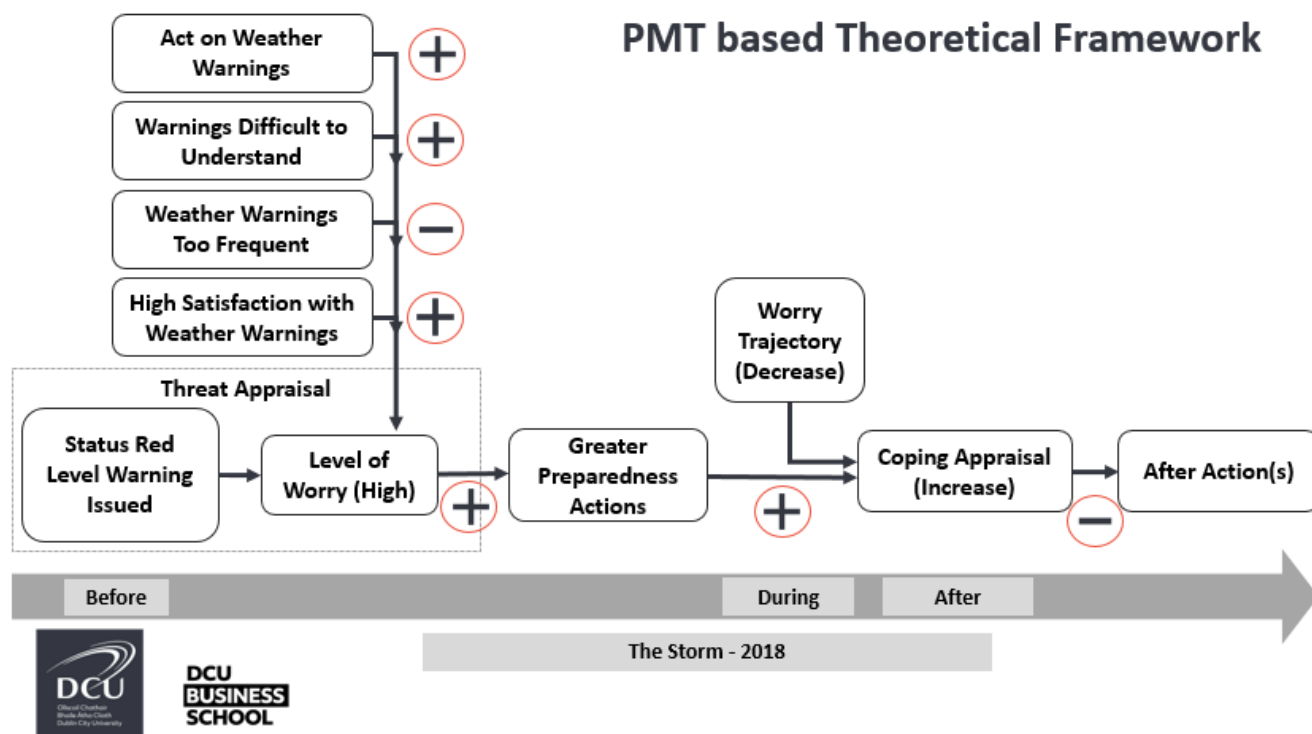
Figure 78: PMT based theoretical framework: the response process and after-action to the Storm 2018 (summary of four stages of regression results).

Stage 1: Worry Before the Storm

The large majority (88.2%, 3416n) of respondents were at least somewhat satisfied to extremely satisfied with the current Met Éireann weather warning system. However, respondents were divided on weather warning credibility. Some believed they were too frequent and not localized enough to be taken seriously, while others believed the opposite to be true.

The regression analysis results provided further insight into the direction and magnitude of the effect of the response process, understanding and believing weather warnings (Figure 72, Mileti 1995), on respondents' levels of worry before The Storm.

- Respondents who indicated that they took action on weather warnings and those who suggested that warnings were difficult to understand were more likely to report a high level of worry about the Storm.
- Respondents were less likely to worry about The Storm if they stated weather warnings were issued too frequently.
- Satisfaction with weather warnings impacted worry only at lower worry levels.

Stage 2: Actions taken before the Storm

Respondents' levels of preparedness before the Storm varied, but the action most performed was purchasing additional food supplies, 72.2% (2939n), followed by making plans for the possible loss of power 59.6% (2327n). Details of additional preparedness actions, or lack of, were provided by 2,220 respondents. However, 459 of these stated they did not make any specific preparations for The Storm. For some, this was because they did not think The Storm would not be as bad as it was, while for others, it was because they believed the nationwide red weather alert was an over-reaction. For others, not preparing was a source of regret.

The regression analysis findings suggested that a positive association existed between the level of worry before The Storm and the number of preparedness actions taken. For instance, the probability of completing all four actions before The Storm was estimated to be 11pp higher for those who worried only a little about The Storm compared to those who were not at all worried, and 34.3pp higher for those who worried a great deal about the Storm.

Worry about a natural hazard has not always been shown to inspire preparedness action. However, in this case, worry about The Storm (the threat appraisal having been informed by understanding and believing the weather warnings) prompted immediate action.

Stage 3: Reflective Coping Appraisal

The study found that worry was heightened by The Storm's severity, worries about getting to and from work, and concerns for family and friends. Worry was mitigated by geographic location, where the impact was less severe, and by keeping informed. PMT suggests that taking preparedness action may be explained by exhibiting a high threat appraisal and a high coping appraisal. To better understand the process, stage three examined how actions before The Storm impacted respondents' reflections on their coping appraisal. The regression analysis suggested that in the case of The Storm:

- The reflective post-event coping appraisal was negatively related to changes in worry during the Storm, i.e., a decrease in worry during the storm led to an increase in the post-event coping appraisal.
- Preparedness action and reflective coping appraisal were positively related. Having completed a greater number of preparedness actions beforehand increased how well people felt they had coped during this event.

These results suggest that following the national guidance and taking action before The Storm enhanced respondents coping appraisal.

Stage 4: Actions after the Storm

A total of 3685 respondents, 12.9% (474n), undertook protective actions in the weeks following The Storm. Respondents were asked if, on reflection, they should have done more to prepare for The Storm. 2,460 suggestions were made but, of these, 525 felt they did not need to make any additional preparations to cope with The Storm.

Regression analysis examined the relationship between respondents' post-event coping appraisal and taking additional preparedness actions following The Storm. A statistically significant, negative relationship was found between the reflective post-event coping appraisal and the tendency to take protective actions after The Storm. This finding indicates that the worse a household felt they coped during The Storm, the more likely they were to have undertaken further preparedness actions immediately afterwards—thus confirming the PMT model (Figure 78).

Summary

In summary, these findings make three contributions to our understanding of preparedness related to The Storm. Weather warnings are an important antecedent in forming threat appraisal and influencing worry. Such warnings are a critical driver of subsequent preparedness action as part of a PMT framework. Secondly, worry plays a vital role in affecting protection motivation before and during a

severe weather event such as The Storm. Lastly, the evidence suggests that respondents' ability to cope during The Storm significantly impacted after actions to prepare for future weather events.

The importance of the national weather warning system and how these warnings are interpreted must not be overlooked. The analysis presented within this case study suggests that these warnings play a crucial role in determining how weather information is perceived and acted upon – they are a critical element of PMT.

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Appendix One

Analytical Process	Application in NVivo	Strategic Objective	The iterative process throughout the analysis
What data are analyzed **How are they defined** **What is the population from which they are drawn? (Source)**	Phase 1: Downloading submissions and formatting demographic and other profiling information into a single table for import into a computer-aided qualitative data analysis system (NVivo)	Data Management (Open and hierarchal coding through NINVO)	Who said what?
			Why did they say it?
What are the contexts relative to which the data are analyzed? (Encoding Process)	Phase 2 – Open Coding Phase 3 – Categorization of Codes Phase 4 – Coding on Phase 5 – Data Reduction/Consolidation		
		Descriptive Accounts (Reordering, 'coding on' and annotating through NVIVO)	How did they say it?
Exploring relationships and patterns across categories (Channel, Message, Recipient)	Phase 6: Generating Analytical Memos		
			What inferences may be drawn?
Integrating data to write findings (Decoding Process)	Phase 7 – Validating analytical memos Phase 8– Synthesizing analytical memos		
		Explanatory Accounts (Extrapolating deeper meaning, drafting summary statements and analytical memos through NVIVO)	To whom did they say it
			With what effect?

Stages and processes deployed in qualitative data analysis

Adapted from Krippendorff (2004)

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