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Data Article

A knowledge elicitation study to inform the development of a consequence model for Arctic ship evacuations: Qualitative and quantitative data



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ABSTRACT

Expert knowledge was elicited to develop a life-safety consequence severity model for Arctic ship evacuations (Browne et al., 2021). This paper presents the associated experimental design and data. Through semi-structured interviews, participants identified factors that influence consequence severity. Through a survey, participants evaluated consequence severity of different ship evacuation scenarios. The methodology represents a two-phased mixed methods design. Life-safety consequence severity is measured as the expected number of fatalities resulting from an evacuation. Participants of the study were experts in various fields of the Arctic maritime industry. Sixteen experts participated in the interviews and the survey (sample size: $n = 16$). Sample size for the interviews was based on thematic data saturation. Predominantly the same group of experts participated in the survey. Interviews were analysed using thematic analysis. Interview data informed the development of evacuation scenarios defined in the survey. The interview guide and survey questions are presented. Data tables present the codes that

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emerged through thematic analysis, including code reference counts and code intersection counts. Data tables present the raw data of participant responses to the survey. This data can support further investigation of factors that influence consequence severity, definition of a broader range of evacuation scenarios, and establishment of associated consequence severities. This data has value to Arctic maritime policy-makers, researchers, and other stakeholders engaged in maritime operational risk management.

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Specifications Table

| | |
|--------------------------------|--|
| Subject | Ocean and Maritime Engineering |
| Specific subject area | Consequence modelling of Arctic ship evacuations (expert-based assessment) |
| Type of data | Tables |
| How the data were acquired | Semi-structured interviews, followed by a survey. Sixteen experts participated in the interviews and survey (sample size: $n = 16$). Semi-structured interviews were conducted and recorded using Cisco Webex video-conferencing software. QSR Nvivo 1.3 software was used for transcription and thematic analysis of the interview data. Surveys were administered and results collecting using Qualtrics online survey software. |
| Data format | Processed data: processed data from the semi-structured interviews is provided, including thematic codes and descriptions, code reference counts, and code intersection counts. Raw data: survey data |
| Description of data collection | Through semi-structured interviews, participants identified factors that influence life-safety consequence severity of Arctic ship evacuations. Interviews were held and recorded using Cisco Webex video-conference software. Interviews were transcribed verbatim and analysed through thematic analysis using QSR Nvivo qualitative analysis software. Interview data informed the development of a survey, in which participants evaluated life-safety consequence severity of different evacuation scenarios. Surveys were administered using Qualtrics online survey software. |
| Data source location | <ul style="list-style-type: none">• Institution: Memorial University of Newfoundland, Ocean Engineering Research Centre• City/Town/Region: St. John's, Newfoundland & Labrador• Country: Canada |
| Data accessibility | Repository name: Mendeley Data identification number: https://doi.org/10.17632/f4jrwm2tnf.1 Direct URL to data: https://data.mendeley.com/datasets/f4jrwm2tnf/1 |
| Related research article | [1] T. Browne, B. Veitch, R. Taylor, J. Smith, D. Smith, F. Khan; Consequence modelling for Arctic ship evacuations using expert knowledge, Marine Policy, 130 (2021) 104,582. https://doi.org/10.1016/j.marpol.2021.104582 . |

Value of the Data

- These data are important because they provide transparency on established consequence severities for Arctic ship evacuations.
- These data provide a novel contribution to Arctic maritime operational risk management, addressing the lack of ship accident data for Arctic regions which prevents the use of conventional statistical approaches to assess life-safety risk.

- Maritime policy-makers, researchers, ship operators, and other stakeholders engaged in Arctic maritime operational risk management can benefit from these data.
- This data can support further investigation of factors that influence consequence severity, definition of a broader range of evacuation scenarios, and establishment of associated consequence severities for Arctic shipping.

1. Data Description

The data for this study is contained in a Microsoft Excel Workbook stored in a Mendeley Data repository (<https://doi.org/10.17632/f4jrwm2tnf.1>). The Workbook contains twenty-seven separate Worksheets. A description of the data contained in each Worksheet is provided in Table 1.

Table 1

Description of the data contained in the Microsoft excel workbook.

| Worksheet titles | Data format | Descriptions |
|-----------------------------|-------------|---|
| 1. Code descriptions | Processed | Codes established through thematic analysis of the interview data. Codes are used to categorize segments of text, capturing the meaning of what was said by the participant |
| 2. Code reference count | Processed | The number of times each code was referenced across all interview data. |
| 3. Code intersection matrix | Processed | The number of times each combination of code intersections occurred across all interview data. The same segment of text can fit multiple codes and is referred to as a code intersection. |
| 4. Survey, A1.a – | Raw | Participant responses to Block A survey questions. |
| 8. Survey, A4 | Raw | Participant responses to Block A survey questions. |
| 9. Survey, B1 – | Raw | Participant responses to Block B survey questions. |
| 27. Survey, B19 | Raw | Participant responses to Block B survey questions. |

Acronyms used in the Microsoft Excel Workbook and in this article are defined in Table 2.

Table 2

Definition of acronyms.

| Acronym | Descriptions |
|---------|--|
| AIRSS | Arctic Ice Regime Shipping System |
| CCG | Canadian Coast Guard |
| IRB | Inshore Rescue Boat |
| NORDREG | Northern Canada Vessel Traffic Services Zone Regulations |
| NWP | Northwest Passage |
| POB | Personnel On-board |
| POLARIS | Polar Operational Limit Assessment Risk Indexing System |
| SAR | Search and Rescue |
| SARex | Search and Rescue Exercise |
| PPE | Personal Protective Equipment |
| VOO | Vessel of Opportunity |

Table 3 provides the interview guide used for the semi-structured interviews.

Table 4 provides the defined Likert scale for level of influence used in the survey.

Table 5 provides the defined Likert scale for likelihood used in the survey.

Table 6 provides the factors and associated levels used to define evacuation scenarios in the survey.

Table 7 provides the ship types and associated numbers of personnel on-board (POB) evaluated for each evacuation scenario in the survey.

Table 8 provides the definitions and indices for life-safety consequence severity used in the survey.

Table 9 provides the Block B evacuation scenarios of the survey.

The Appendix provides the complete survey questionnaire.

2. Experimental Design, Materials and Methods

Expert knowledge was elicited through a two-phased mixed methods design [1]. In the first phase, through semi-structured interviews, participants identified factors that influence life-safety consequence severity of Arctic ship evacuations. In the second phase, through a survey, participants evaluated life-safety consequence severity of different evacuation scenarios and the level of influence and likelihood of different factors as they pertain to Arctic ship evacuations and consequence severity. Life-safety consequence severity is measured as the expected number of fatalities resulting from an evacuation [1,2].

Sixteen experts participated in the interviews and survey (sample size: $n = 16$). Sample size for the interviews was based a thematic data saturation [3]. Thematic data saturation is achieved when additional interviews produce no new insights. Thematic data saturation was achieved after thirteen interviews, however a total of sixteen interviews were conducted and included in the data presented here. The process to test for thematic data saturation is described by Browne et al. [1]. Predominantly the same group of experts completed the survey, however three participants left the study after the interviews and three new participants joined for the survey. Details on recruitment and participant backgrounds for both the interviews and survey are provided by Browne et al. [1].

2.1. Semi-structured interviews

Through semi-structured interviews, participants identified factors that influence life-safety consequence severity of Arctic ship evacuations. Interviews were conducted and recorded using Cisco Webex video-conference software. Interviews were transcribed verbatim. The semi-structured interview guide is presented in Table 3.

Table 3
Interview guide (originally presented by Browne et al. [1]).

| | |
|--|--|
| 1. Introduction | |
| 1.1 | What are some of the challenges of a ship evacuation in Arctic waters, in comparison to non-Arctic waters? |
| 2. Perceived severity and influencing factors | |
| 2.1 | What factors contribute to the potential for loss of life during the evacuation and rescue of a ship in Arctic waters? |
| 2.2 | Do certain ship types pose a greater potential for loss of life should evacuation and rescue occur in Arctic waters? |
| 2.3 | Does the operational profile of a ship influence the potential for loss of life should evacuation and rescue occur in Arctic waters? |
| 2.4 | Are there Arctic regions that pose a greater potential for loss of life should evacuation and rescue occur in Arctic waters? |
| 3. Closing | |
| 3.1 | Considering life-safety for Arctic shipping, what are your biggest concerns? |
| 3.2 | Is there anything else you would like to add regarding life-safety for Arctic ships? |

QSR Nvivo 1.3 qualitative analysis software was used to conduct thematic analysis of the interview data. The interview data was coded and the most frequently referenced codes and

code intersections informed the development of themes. A detailed description of the thematic analysis process is provided by Browne et al. [1].

2.2. Survey

The analysed interview data was used to develop the survey. The survey was organized in two blocks, Block A and Block B. The survey was administered using Qualtrix online survey software. The complete survey questionnaire is provided in the Appendix.

2.2.1. Block A description

The level of influence that factors have on response time, evacuee survivability, and the potential for loss of life following an evacuation was evaluated. A five-point Likert scale was used to evaluate level of influence (Table 4). The likelihood of loss of life to occur should an evacuation take place onboard different ship types was evaluated. A five-point Likert scale was used to evaluate likelihood (Table 5).

Table 4

Likert scale for level of influence (originally presented by Browne et al. [1]).

| 1. Extreme influence | 2. Major influence | 3. Moderate influence | 4. Slight influence | 5. No influence | 6. Prefer not to answer |
|----------------------|--------------------|-----------------------|---------------------|-----------------|-------------------------|
|----------------------|--------------------|-----------------------|---------------------|-----------------|-------------------------|

Table 5

Likert scale for likelihood.

| 1. Extremely likely | 2. Very likely | 3. Moderately likely | 4. Slightly likely | 5. Not likely at all | 6. Prefer not to answer |
|---------------------|----------------|----------------------|--------------------|----------------------|-------------------------|
|---------------------|----------------|----------------------|--------------------|----------------------|-------------------------|

2.2.2. Block B description

Participants rated evacuation scenarios for life-safety consequence severity. Factors and ship types used to define evacuation scenarios are presented in Table 6 and Table 7, respectively. Life-safety consequence severity is measured as an expected number of fatalities. The five-point severity scale used to evaluate consequence severity is presented in Table 8. Evacuation scenarios are presented in Table 9.

Table 6

Factors used to define evacuation scenarios (originally presented by Browne et al. [1]).

| Factors | Levels | |
|----------------|------------|---------------|
| Season | Summer | Winter |
| Ice conditions | Sea ice | Open water |
| Wind/sea state | Calm | Severe |
| Evacuation | Controlled | Uncontrolled |
| Response time | 12 h 24 h | 2 days 5 days |

Table 7
Ship types and POB numbers evaluated for evacuation scenarios (originally presented by Browne et al. [1]).

| Ship type | POB |
|--|------|
| Passenger vessel (e.g. expedition cruise ship) | 250 |
| Passenger vessel (e.g. standard cruise ship) | 1000 |
| Cargo vessel | 25 |
| Fishing vessel | 10 |
| Pleasure craft | 10 |

Table 8
Life-safety consequence severity definitions (originally presented by Browne et al. [1]; modified from the International Maritime Organization Formal Safety Assessment guidelines [4]).

| Severity index | Severity | Effects on human safety | Equivalent fatalities |
|----------------|--------------|---|-----------------------|
| 1 | Minor | Single or minor injuries | 0.01 |
| 2 | Severe | Multiple or severe injuries | 0.1 |
| 3 | Significant | Single fatality or multiple severe injuries | 1 |
| 4 | Catastrophic | Multiple fatalities | 10 |
| 5 | Disastrous | Large number of fatalities | 100 |

Table 9
Evacuation scenarios (originally presented by Browne et al. [1]).

| Scenario | Factors | | | | |
|---------------|---------------|-------------------|------------------|---------------------------|---------------|
| | Season | Ice conditions | Wind & sea state | Evacuation | Response time |
| B1 (Baseline) | Summer | Sea ice present | Calm | Controlled | 12 h |
| B2 | Summer | Sea ice present | Calm | Controlled | 24 h |
| B3 | Summer | Sea ice present | Calm | Controlled | 2 days |
| B4 | Summer | Sea ice present | Calm | Controlled | 5 days |
| B5 | Summer | Open water | Calm | Controlled | 12 h |
| B6 | Summer | Sea ice present | Severe | Controlled | 12 h |
| B7 | Summer | Sea ice present | Calm | Rapid/Uncontrolled | 12 h |
| B8 | Summer | Open water | Severe | Controlled | 12 h |
| B9 | Summer | Open water | Calm | Rapid/Uncontrolled | 12 h |
| B10 | Summer | Sea ice present | Severe | Rapid/Uncontrolled | 12 h |
| B11 | Summer | Open water | Severe | Rapid/Uncontrolled | 12 h |
| B12 | Winter | Sea ice present | Calm | Controlled | 12 h |
| B13 | Winter | Open water | Calm | Controlled | 12 h |
| B14 | Winter | Sea ice present | Severe | Controlled | 12 h |
| B15 | Winter | Sea ice present | Calm | Rapid/Uncontrolled | 12 h |
| B16 | Winter | Open water | Severe | Controlled | 12 h |
| B17 | Winter | Open water | Calm | Rapid/Uncontrolled | 12 h |
| B18 | Winter | Sea ice present | Severe | Rapid/Uncontrolled | 12 h |
| B19 | Winter | Open water | Severe | Rapid/Uncontrolled | 12 h |

Ethics Statements

The experimental design and participant recruitment strategy for this study received ethics review and approval by the Memorial University Interdisciplinary Committee on Ethics in Human Research (ICEHR) and is in compliance with the guidelines of the Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans (ICEHR number 20210767-EN) [1].

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRedit Author Statement

Thomas Browne: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing; **Brian Veitch:** Funding acquisition, Project administration, Supervision, Methodology, Writing – review & editing; **Rocky Taylor:** Conceptualization, Supervision, Writing – review & editing; **Jennifer Smith:** Formal analysis, Methodology, Writing – review & editing; **Doug Smith:** Supervision, Writing – review & editing; **Faisal Khan:** Funding acquisition, Supervision, Writing – review & editing.

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Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:[10.1016/j.dib.2021.107612](https://doi.org/10.1016/j.dib.2021.107612).

References

- [1] T. Browne, B. Veitch, R. Taylor, J. Smith, D. Smith, F. Khan, Consequence modelling for Arctic ship evacuations using expert knowledge, *Mar. Policy* 130 (2021) 104582.
- [2] IMO. 2018. Revised Guidelines for Formal Safety Assessment (FSA) for Use in the IMO Rule-Making Process. MSC-MEPC.2/Circ.12/Rev.2. International Maritime Organization (IMO), London, UK, 9 April 2018.
- [3] B. Glaser, A. Strauss, *The Discovery of Grounded theory: Strategies for Qualitative Research*, Aldine Publishing, Chicago, USA, 1967.