The Stirling eDelphi Platform.

About Delphi Studies.

Originally developed by the RAND Corporation in the 1950's , the Delphi method has since been used extensively in healthcare research [1-12], amongst other fields. Since its inception, many Delphi studies have varied slightly from the original RAND Corporation method, and it is therefore common to find studies described as modified Delphi studies, or using a Delphi approach [13]. Delphi studies use a form of consensus methodology to develop a reliable consensus of a group of experts on a specific topic. The Delphi method involves a series of questionnaires, or 'rounds' (typically 3), on a specific topic being completed by subject experts. These rounds are interspersed by controlled feedback which includes the participant's own judgment and the overall group judgment for comparison. Participants are then given the opportunity to revise their judgment in the following rounds if they so desire. Participants' individual responses are unknown to the group [14].

Challenges of Delphi Studies.

Delphi studies have several challenges. These can be separated into two broad categories: methodological and managerial. Methodologically the challenges relate to ensuring the rigour of the method so as to ensure trustworthiness of the findings. Transparency about selection criteria of expert participants; method of identification of study items for round one, and choice of level of consensus 'cut off' are all essential and challenging.

Notwithstanding the above methodological challenges, Delphi studies are also managerially challenging – primarily in the inter round analysis and development of individualised questionnaire responses for large numbers of participants. This results in studies requiring considerable periods of time between rounds to conduct analysis and prepare individualised responses for each participant. This in turn increases the length of time and cost required to conduct a Delphi study. Current commercial platforms such as Survey Monkey and Qualtrics do not have the functional ability to enable the automatic development of individualised participant responses that a Delphi study requires if it is to be managed efficiently.

The Stirling eDelphi Platform©.

The eDelphi Platform was designed to improve the efficiency of Delphi study management, and to enhance participant interpretation of inter-round responses, and data evaluation. It has been successfully used on three previous occasions [12, 15, 16] and is a planned component of an ongoing HTA funded study [17].

The Stirling eDelphi Platform manages the whole eDelphi process: from participant invitation to reporting of the final analysis. Data is collected using a purposively designed study website, with an Administration page that controls the whole process (Figure 1).

Figure 1: Screen-shot of the Stirling eDelphi Platform: Administration page.

The eDelphi platform is accessed through an on-line web browser. Individuals are required to register to take part in the study using a study password and unique identifier; these are sent to them by the research team, via the eDelphi platform. Once they have registered on the platform, individuals are asked a series of study consent questions (these are standard ethics consent questions, but can be tailored for each study).

Having consented participants are asked to complete the first round of data collection. The website includes the usual features you would expect from such a service. Having logged in, users are presented with the Delphi questionnaire and, if they have already started it, the values they have already entered are saved and re-presented. A completion bar indicates the percentage of that round's questions that have already been completed.

Participants respond to each question by clicking the mouse in the appropriate scaling response to each item. Guidance to understand the Delphi scale is provided (Figure 2). A help button provides

Figure 2: Screen-shot of the Stirling eDelphi Platform: Scale guidance and help function.
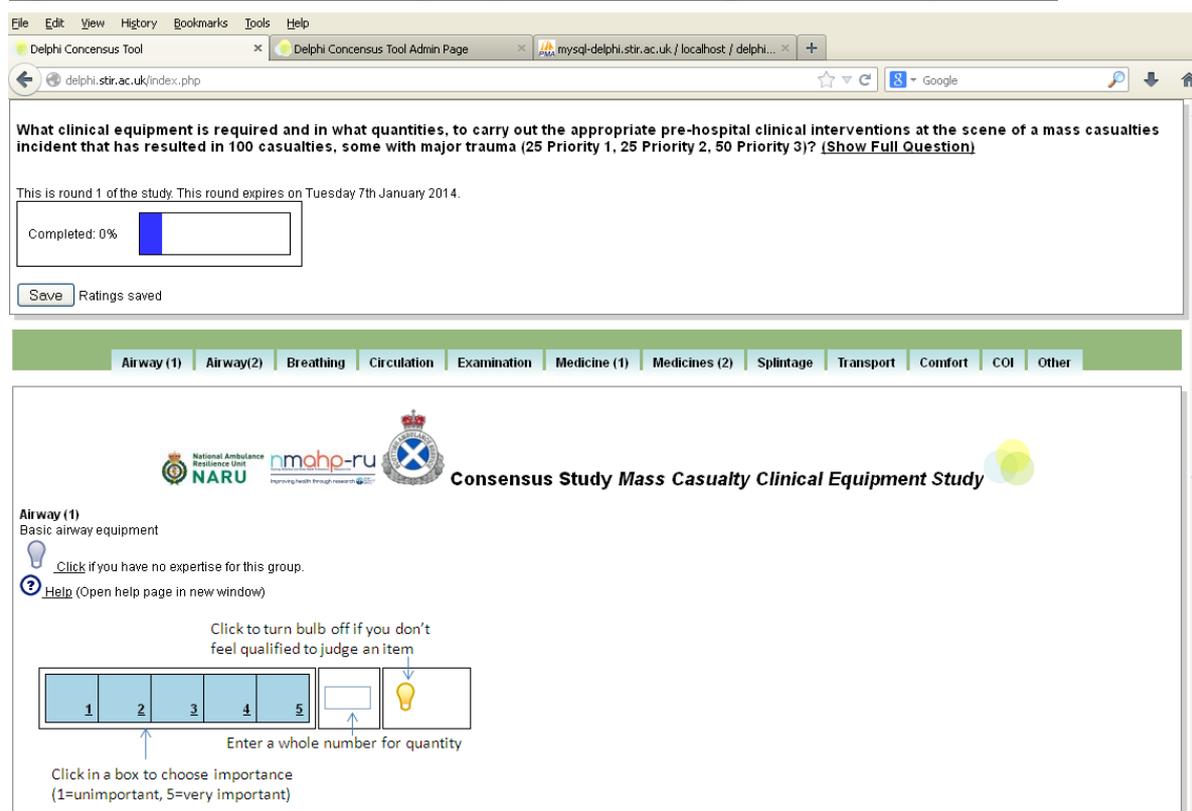
the opportunity for participants to get more information if required.

When participants click on a scale response, a green disk appears to indicate their selection (Figure 3). Participants are prompted to save their responses as they progress through the study and whenever they log out of the website. This allows participants to return to the site and complete the questionnaire in more than one sitting. Electronic reminders are sent automatically two weeks after the commencement of each round, and also in the final stages to those individuals who have not yet completed the round. These reminders state the final date by which the current round must be completed. The data of reminders and the end date for each round can also be set manually, if it is required to extend data collection for any reason.

Figure 3: Screen-shot of the Stirling eDelphi Platform: Participant responses to Round 1.
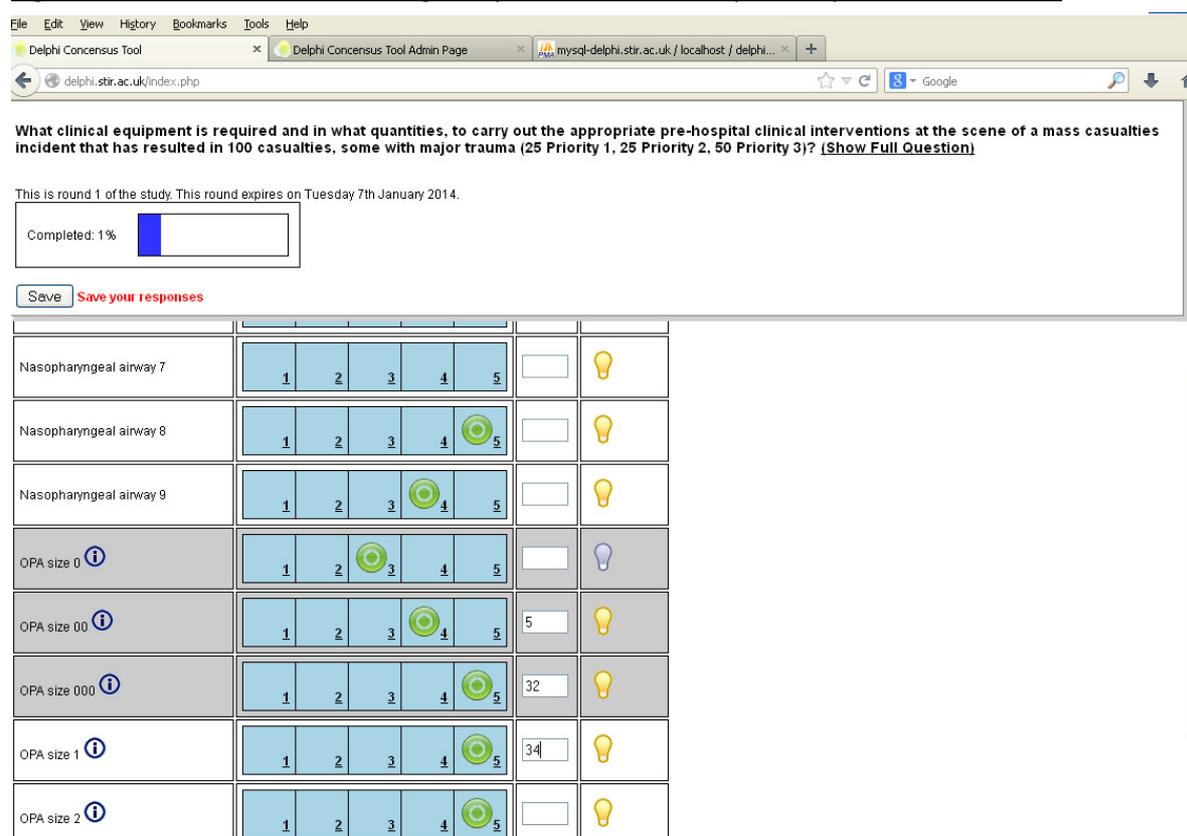
Inter-round data analysis is completed automatically at the end of each round and participants are immediately sent their bespoke questionnaires for the successive round. These show the group response to each item, as well as the participant's previous personal response. Participants are then asked if they would like to change their rating based on other participants' responses, or to keep it as it was. The automatic analysis and resending of bespoke questionnaires to potentially high numbers of participants significantly reduces the administration, and consequently researcher time, that is normally required to be undertaken between rounds of a Delphi study.

Data handling.

Delphi studies vary considerably in how they handle and analyse their data [14]. The Stirling eDelphi Platform allows the data to be presented to participants in a novel and more meaningful way than traditional Delphi studies have done. Data from rounds two and three are presented to participants as a colour histogram (or heat map) where the depth of colour indicated the frequency with which respondents in the previous round had chosen each rating. Figure 4 shows the frequency with which each of the five responses had been chosen in the previous round (dark being many, light being few). The grey circle shows the choice that the current participant made on the previous round and the green circle shows the choice that they have made on the current round, (in round one each box was white as no previous selection had been made). In this way, participants can easily see how their responses compared to the consensus in the previous round and either confirm or update their response accordingly.

Figure 4. An example from the website of a colour histogram of previous responses.

Stirling eDelphi analysis.

Frequently in Delphi studies the mean value and standard deviation of ratings are presented. However, these are likely to be sub-optimal measures as it is more likely that the responses will form a skewed distribution. For example, if half the respondents in our study chose a score of 1, and half chose 5, then reporting a mean of 3 would fail to illustrate that the data had a bi-modal distribution. Therefore we proposed use of non-parametric approaches in the data analyses.

The Stirling eDelphi platform undertakes a descriptive analysis of the total number of items that reached consensus of being important. Consensus levels can be set by the research team. As a standard we use 80%. The significant difference in consensus of item importance between rounds are tested by Wilcoxon Rank Sum Test for independent events.

Further information please contact:

Dr Edward Duncan
Senior Research Fellow
Nursing Midwifery and Allied Health Professions Research Unit, University of Stirling
Stirling, FK15 4NF, Scotland, UK.
Email: edward.duncan@stir.ac.uk
Telephone: 01786 46 6286

References.

1. Mead D., Mosely L.: **The use of Delphi as a research approach**. *Nurse Resercher* 2001, **8**:4–37.

2. Duncan EAS, Nicol MM, Ager A: **Factors That Constitute a Good Cognitive Behavioural Treatment Manual: a Delphi Study**. *Behavioural and Cognitive Psychotherapy* 2004, **32**:199–213.

3. Dwyer M: **A Delphi survey of research priorities and identified areas for collaborative research in health sector library and information services UK.** *Health libraries review* 1999, **16**:174–91.

4. Aron D, Pogach L: **Quality indicators for diabetes mellitus in the ambulatory setting : using the Delphi method to inform performance measurement development**. *Quality and Safety in Health Care* :315–318.

5. Ager A, Stark L, Akesson B, Boothby N: **Defining best practice in care and protection of children in crisis-affected settings: a Delphi study.** *Child development* 2010, **81**:1271–86.

6. Woollard M: **Emergency calls not requiring an urgent ambulance response: expert consensus.** *Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors* 2003, **7**:384–91.

7. Crawford AWF, MAckway-JOnes K, Russell DR CS: **incidents**. *Emergency medical journal* 2004, **21**:24–29.

8. Carley S., Mackway-Jones K, Donnan S: **Delphi studyinto planning for care of children in major incidents**. *Archives of Disease in Childhood* 1999, **80**:406–409.

9. Beattie E, K M-J: **A Delphi study to identify performance indicators for emergency medicine**. *Emergency Medicine Journal* 2004, **21**:47–50.

10. Jensen J., Croskerry P, Travers A.: **Paramedic clincial decision making during high acuity emergency calls: design and mthodology of a Delphi study**. *BMC Emergency Medicine* 2009, **9**.

11. Jensen J, Croskerry P, Travers A.: **Consensus on paramedic clinical decisions during high-acuity emergency calls: results of a Canadian Delphi study.** *Canadian Journal of Emergency Medicine* 2011, **13**:310–318.

12. Duncan, EAS, et al. **Consensus on items and quantities of clinical equipment required to deal with a mass casualties big bang incident: a national Delphi study**. *BMC emergency medicine* 2014, 5.

13. Mead D., Mosely L.: **The use of Delphi as a research approach**. *Nurse Resercher* 2001, **8**:4–37.

14. Powell C: **The Delphi technique: myths and realities.** *Journal of advanced nursing* 2003, **41**:376–82.

15. Hibberd C, Torrens C, Sutherland B, Strachan H, Duncan EAS **Developing a Neuro-Rehabilitation Outcomes Management System (NROMS) – Identifying what is important to measure, a consultation approach.** Report for the Scottish Government, 2015

16. France E, Ring N, Noyes J, Maxwell M, Duncan EAS, Jepson R, Turley R Developing meta - ethnography reporting guidelines and standards for research (eMERGE). HS&DR Project:13/114/60 Developing meta-ethnography reporting guidelines and standards for research (eMERGE) Protocol version 2. Accessed at http://www.nets.nihr.ac.uk/__data/assets/pdf_file/0003/141429/PRO-13-114-60.pdf

17. O'Cathain A, Turner K, Croot L, Hoddinott P, Duncan EAS, Yardley L Identifying and assessing different approaches to developing complex interventions (INDEX study). (£380,463) MRC Methodology Panel. 2016-2018. Accessed at http://gtr.rcuk.ac.uk/projects?ref=MR%2FN015339%2F1