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## **The use of a Delphi survey to examine maternity high dependency care (MHDC) in obstetric units remote from tertiary referral centres**

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### *Abstract*

*Background.* Up to 5 % of women in the UK will receive maternity high dependency care (MHDC), although there are varying opinions as to the defining features of this concept. This paper describes the rationale for, and design of, a modified three- round Delphi survey examining MHDC.

*Objectives.* To obtain a consensus on the definition and defining features of MHDC in obstetric units (OUs) remote from a tertiary referral centre. To examine if the definition for, and defining features of, MHDC are the same for OUs remote from tertiary referral centres with differing annual birth rates. To investigate if the definition for, and defining features of MHDC are the same for the professional groups of doctors and midwives working in OUs with similar annual birth rates.

*Method.* The Delphi participants comprised midwives, obstetricians, and anaesthetists employed in seven OUs. Round one (qualitative) involved completion of a self-report questionnaire. During rounds two and three (quantitative), respondents rated their level of agreement or disagreement against five-point Likert items for a series of statements (n=106). The level of consensus for the combined percentage of strongly agree and agree statements was set at 80% for the second and third rounds. The round two statistical findings were not fed back to the respondents but, they were given the opportunity to provide additional qualitative comments throughout the second and third rounds.

Ethical approval was granted by the local research ethics committee and the relevant NHS research and development departments.

*Conclusion.* Where modifications are made to traditional Delphi surveys, the researcher must carefully justify the methodological decisions that have been taken.

*Key words:* Maternity/obstetric high dependency care, maternal critical care, levels of critical care for adults, Delphi survey, modified Delphi study, consensus methods, evidence-based midwifery

## Introduction

Maternity high dependency care (MHDC) is a complex entity and although the Intensive Care Society (ICS) Levels of Critical Care for Adults (ICS, 2009) classification system has been introduced to provide operational definitions of 'high dependency' and 'intensive care', it is unknown how widely this system has been adopted in UK obstetric units (OUs). The literature suggests there are likely to be variations between OUs, regarding MHDC provision, including the facilities offered, the availability of professional expertise, and the complexity of the monitoring and treatments provided (Maternal Critical Care Working Group, 2011). The provision of safe high- quality maternity care is paramount and further research exploring the ways in which MHDC is conceptualised and defined may assist with service planning.

## Background

Increasing numbers of women are classified as having complex pregnancies due to co-morbidity and/or obstetric complications and technological/medical advances (Robson and Waugh, 2013). While some acutely ill women will require admission to an intensive care unit (ICU) for complex treatments including organ system monitoring and support, others may receive MHDC within the OU setting (Maternal Critical Care Working Group, 2011). MHDC has been positively evaluated in terms of bringing the requisite obstetric and critical care expertise together and promoting continuity of care for women and their families (Saravanakumar et al, 2008).

The national percentage of women receiving and surviving MHDC is presently unknown. Surveys suggest that 4.2% to 5% of women require MHDC (Hussain et al, 2011; Saravanakumar et al, 2008). By contrast, a retrospective study of high dependency admissions on a Scottish labour ward with an annual birth rate of 6000, identified that over an eight-month period in 2010, the admission rate was equivalent to 1.8% of all births (Rajagopal et al, 2011).

Some acute NHS Trusts have OUs classed as regional or national centres of excellence, termed tertiary referral centres, while others are classed as district general hospitals (DGHs) (Department of Health, 2015). DGHs may be geographically near to, or remote from, a tertiary referral centre. The *Birthplace* national survey determined that of 180 OUs, 49% had one or more obstetric high dependency unit (HDU) beds (Redshaw, 2011). Rawal et al, (2008) have identified that where OUs do not have specific maternity high-dependency beds, care is either provided in a room on the labour ward (44%), a surgical HDU (34%), or in the obstetric theatre recovery area (22%).

## Defining MHDC

According to the ICS (2009) and the Maternal Critical Care Working Group (2011), level 1 care includes:

- Care of women requiring additional monitoring/ interventions (ICS, 2009)
- Step-down care from a higher level (ICS, 2009)
- Women with neuraxial analgesia, diabetes requiring insulin infusions and those with medical disorders (Maternal Critical Care Working Group, 2011).

The Maternal Critical Care Working Group (2011) provides examples of level two care (ICS, 2009) in the context of the obstetric population, and these include:

- Extended post-operative care (although this is not defined)
- Step down care from level three to level two
- Respiratory support (50% or more oxygen via a face mask to maintain oxygen saturations or Continuous Positive Airway Pressure or Bi-Level Positive Airway Pressure)
- Cardiovascular support (intravenous antihypertensives for blood pressure control in pre-eclampsia, Central Venous Pressure (CVP) line for fluid administration and monitoring to guide therapy)
- Neurological support (administration of magnesium sulphate to control seizures and intracranial pressure monitoring)
- Hepatic support (management of acute fulminant hepatic failure caused by Haemolysis, Elevated Liver enzymes and Low Platelets (HELLP) syndrome or acute fatty liver).

Examples of level three care include:

- Invasive mechanical ventilation (intubation and ventilation) and support of two or more organ systems (ICS, 2009).

Expert opinion suggests that women receiving MHDC may be classed as receiving either level one or level two care, or solely level two care (Scrutton and Gardner, 2012). In contrast, level one care has been equated with high dependency care by the Maternal Critical Care Working Group document and ICS levels two and level three described as 'maternal critical care' (Maternal Critical Care Working Group, 2011). Kuukasjarvi and Waite's (2012) retrospective audit of case notes in a UK teaching hospital over a one- week period in 2010 categorised the level of care each woman received. In total, 66 women admitted to the labour ward had their care 'mapped' against the ICS levels of care - 26% of women (n=17) required level zero care, 71% (n=47) required level one care and, 3% (n=2) required level two care. Given the inconsistencies regarding the definition of MHDC, further clarification is required which is based on robust evidence (James et al, 2011).

## Indications for MHDC

A contemporary UK retrospective survey of MHDC provision in a tertiary referral unit conducted over a

two-year period, using data from electronic records, found that 50% of women were admitted for obstetric haemorrhage, 16% for hypertensive disorders, and 10% for cardiac disorders (Whitworth et al, 2016). The researchers acknowledge the findings may not be generalisable to OUs that do not provide tertiary level care, because it is suggested there may be a higher prevalence of MHDC in tertiary referral centres (Whitworth et al, 2016). Overall, there are indications that more women receive MHDC for obstetric reasons than comorbidities alone (Whitworth et al, 2016; Saravanakumar et al, 2008). However, these studies comprise low-level evidence and have the highest chance of bias (Joanna Briggs Institute, 2016).

#### *Characteristics of MHDC*

High dependency care is characterised by higher levels of staff to patient ratios (typically either one staff to one or two patient(s) ratio), than the allocation on general hospital wards (Association of Anaesthetists of Great Britain and Ireland and the Obstetric Anaesthetists' Association, 2013; Garfield et al, 2000). The 'Birthrate Plus' tool, used for calculating midwifery staffing levels, uses a five-point classification system (I-V), where V represents the work involved caring for women, such as those requiring high dependency care (Ball et al, 2013). Women falling into category V require a ratio of 1.4 whole time equivalent midwives per woman whilst on the labour ward (Ball et al, 2013). Although the Birthrate Plus tool provides a comprehensive and pragmatic approach to calculating staffing levels, its impact on clinical outcomes requires additional investigation (NICE, 2015). Consequently, further research calculating definitive midwife to woman ratios for those requiring MHDC is required.

In terms of the physiological monitoring characterising MHDC, a retrospective audit of MHDC provision in a UK obstetric tertiary referral centre conducted over a 23-year period identified that, 22% (n=303) of women required invasive monitoring with an arterial line, 1% (n=14) received central venous pressure (CVP) monitoring, and 7% (n=96) required both (Saravanakumar et al, 2008). A more recent audit of women requiring MHDC over a four-week period identified that of 42 women receiving MHDC, 33% (n=14) required monitoring with arterial lines (James and Barclay, 2012). This is a higher percentage than earlier reports suggest, but may in part, reflect the higher numbers of women receiving MHDC in tertiary referral centres (Whitworth et al, 2016).

#### *Delphi study context*

Limited evidence suggests that tertiary referral centres are more likely to provide MHDC than DGHs (Whitworth et al, 2016; Saravanakumar et al, 2008). Smaller DGHs may not have the necessary resources or clinical expertise to provide MHDC on the labour ward and so transfer women to the ICU, or a tertiary

referral centre if feasible (Simpson and Barker, 2008). The highest transfer rate of acutely ill women to ICU in a dated survey by Cordingley and Rubin (1997) was noted for OUs with annual birth rates of 1000-1999 (median 1.84 per 1000 deliveries, range 0-5.52), and transfer rates gradually fell as the annual birth rate increased (2000- 2999, median 1.45; 3000-3999 median 1.1.7; 4000-4999 1.00) (Cordingley and Rubin, 1997: 158). Similar findings have been reported more recently in the Netherlands (Zwart et al, 2010). Consequently, there may be local variations in the characteristics of, and definition for, MHDC. To date, there is limited published research examining healthcare professionals' understanding of the concept of MHDC in DGHs with varying annual birth rates (Cordingley and Rubin, 1997), and is an aspect of service provision requiring further investigation. There is no research investigating if midwives and doctors who work in OUs with similar annual birth rates, share the same views regarding the defining features of MHDC. This is an important consideration given that cohesive multidisciplinary team (MDT) working is a vital factor in promoting safe MHDC provision and some midwives may feel inadequately prepared to provide this type of care (Cockerill et al, 2011; Bench, 2007).

#### *Study aims and research questions*

The overarching aim of this research was to 'determine what constitutes high dependency care in OUs remote from tertiary referral centres'. The research aim was addressed through the following objectives:

- To achieve a consensus on the definition for, and defining features of MHDC
- To examine whether the definition for, and defining features of MHDC are the same for OUs that have different annual birth rates and are remote from a tertiary referral centre
- To investigate if the definition for MHDC and its defining features are the same for the professional groups of doctors and midwives, who work in OUs with similar annual birth rates that are remote from a tertiary referral centre.

#### *Method*

The Delphi method, a survey approach described by Linstone and Turoff (1975) was utilised to obtain data from experts currently involved directly or indirectly in the provision of MHDC. Key features of the Delphi method include the formation of an expert or 'informed' panel, anonymity of participants, iteration, controlled feedback, and statistical aggregation of group response (Linstone and Turoff, 1975; Sackman, 1975). Delphi studies are undertaken in a series of rounds, and the data gathered may either be quantitative, qualitative, or a combination of both (Bramwell and Hykawy, 1999; Linstone and Turoff,

1975; Sackman, 1975).

The Delphi method is suited to examining complex issues in health and social care where agreement is sought, and its main purpose is to gain consensus about an issue where there is contention (Keeney et al, 2011 ). The MHDC Delphi survey consisted of three rounds in total, and a modified technique was utilised whereby the statistical results obtained during the second round (R2) were not fed back to the respondents in round three (R3) (Endacott et al, 1999). There are differing opinions as to the number of rounds that should be conducted in Delphi surveys ranging from two to five (Mullen, 2000). In this instance, it was decided to conduct a three round survey, as described by other researchers (e.g. Endacott et al, 1999; Green et al, 1999).

### Study setting

Seven OUs situated in Southern England (see Table 1) were accessed to provide a source of relevant experts for the Delphi survey. The OUs were chosen as they were representative of DGHs within the same region, but had lower annual birth rates than the tertiary referral unit situated a significant geographical distance away from the seven OUs. OUs E-G were situated in relatively rural locations, while OUs A-D were situated in more densely populated areas, but served both urban and rural populaces. None of the OUs had a designated team of midwives responsible for providing MHDC. The Delphi method was a convenient means of gaining data due to the large geographical distances between the participants (Adler and Ziglio, 1996).

Table 1. Characteristics of OUs where participants worked

Obstetric Unit	Type of Unit	Approximate number of births per annum, at time of survey commencing	Number of MHDC beds
A	Obstetric Unit / Alongside Midwifery Led Unit	3300	Not specified
B	Obstetric Unit / Freestanding Midwifery Led Unit	3300	1
C	Obstetric Unit including midwifery led care.	4000	1
D	Obstetric Unit including midwifery led care.	4500	2
E	Obstetric Unit including midwifery led care.	1700	0
F	Obstetric Unit including midwifery led care.	2200	0
G	Obstetric Unit including midwifery led care.	1500	0

### Sample size and recruitment

Multidisciplinary team working is a crucial aspect of MHDC (Centre for Maternal and Child Enquiries (CMACE), 2011) and 14 professional titles comprised the multidisciplinary team of obstetricians, anaesthetists and midwives who made up the expert group, see Table 2 online at [rcm.org.uk/ebm](http://rcm.org.uk/ebm).

For every OU (n=7), one or two experts (where possible), were asked to represent each of the 14 professional titles comprising the expert group. This provided a maximum sample size of n=140 for the first wave of professionals who were asked to participate. The names of potential participants were obtained from the HoMs/clinical directors and where more than two names were provided for a professional title (for example, Band 6 midwives), a random sampling procedure was used to determine which professionals would be approached. Random sampling ensured that all potential participants had an equal chance of being selected, thereby reducing researcher bias (Polit and Hungler, 1995). The participants were sent a covering letter, participant information sheet, the R1 Delphi questionnaire, a biographical data sheet and a stamped return envelope.

If an expert did not return the completed self-report questionnaire within two weeks, or declined to participate, another expert with the same professional title was (where possible), randomly selected and asked to participate (Hung et al, 2008). This process was used to enhance the R1 return rates (Asch et al, 1997), and meant another 53 experts were invited to participate. In total, 193 experts were asked to participate in R1 of the Delphi survey.

The accepted sample size for a Delphi survey has been debated, with sample sizes ranging from approximately 15 (Bramwell and Hykawy, 1999) to multiples of a hundred (Scapolo and Miles, 2006). The sample size for this study was based on previous Delphi surveys (Scapolo and Miles, 2006) and the recognition that not all the expert titles stated could be represented by large numbers of staff. However, it was also acknowledged that where there is heterogeneity in the characteristics of the experts, larger sample sizes are required (Skulmoski et al, 2007).

### Ethical considerations

Ethical approval was granted by the local Research Ethics Committee and the relevant NHS research and development departments. It was highlighted that participants would be able to contact the researcher for further information and clarification throughout the research as required, reflecting the need for a dynamic process of informed consent (Munhall, 1988). All study participants were identified by numbers which ensured subject anonymity. No names were used on written records and confidentiality was assured.

*Round one data collection and analyses*

The R1 self-report questionnaire consisted of the open-ended question; ‘What constitutes high dependency care in the maternity unit setting?’ Participants were given instructions that included answering the research question as comprehensively as possible. They were informed they could use single words, phrases, statements, and paragraphs, and were asked to include all aspects of MHDC they felt to be relevant. Biographical data sheets were also completed.

Questionnaire data were transcribed verbatim by the researcher. The qualitative data analyses were underpinned by a generic approach (Cooper and Endacott, 2007). This was chosen as it is important in Delphi surveys to ensure that the qualitative R1 findings remain true to the respondents’ initial thoughts and opinions, with low levels of abstraction, so respondents may easily recognise their R1 data in the R2 questionnaire (Keeney et al, 2011). The analytical method chosen was qualitative description (Neergaard et al, 2009). This is used to produce a ‘rich, straight description’ of an issue with a low level of conceptualisation (Neergaard et al, 2009: 2). Overarching themes emerged from the linking of the codes and categories derived from the data. The analysed data were reviewed and no major revisions to the categories and themes arising were required, demonstrating interpretive reliability (Burns and Grove, 2003).

*Round two data collection and analyses*

The statements comprising the R2 questionnaire were developed using all of the codes that had been formulated from the R1 data (Keeney et al, 2011). The research team did not differentiate which codes were more or less relevant when formulating the statements. Every code generated a statement and the researcher did not add or remove any statements. It was important for the R2 questionnaire to accurately reflect the respondents’ first round opinions and not those of the researcher (Keeney et al, 2011). The ‘defining of questionnaire content’ by the respondents themselves, is viewed as a factor that enhances the internal validity of Delphi studies (Endacott et al, 1999).

The codes comprising the R1 theme of ‘service delivery’ were not included in the R2 questionnaire but this theme informed a second research phase. It was considered inappropriate to seek consensus on factors such as the environment where MHDC was provided, as these were largely beyond the control of staff in the individual OUs.

During R2 the participants were asked to rate their level of agreement or disagreement on a five-point Likert scale for a series of statements (n=106) based on the R1 codes. The opportunity for additional qualitative comments was also provided. A final

question was included to determine the respondents’ familiarity with the ICS’s (2009) ‘Levels of critical care for adult patients’ classification system as some, but not all respondents had referred to this system during R1. The questionnaire was piloted with six maternity care professionals not participating in the Delphi study. The R2 questionnaire was distributed to the 85 participants who returned the R1 questionnaire. A reminder pack was sent to the non-responders after approximately two weeks.

The R2 quantitative data were entered into SPSS 17.0 (SPSS Inc, 2008) and each statement was analysed individually using descriptive statistics. The median scores and interquartile ranges were calculated for each statement (1=strongly disagree (SD), 2=disagree (D), 3=neither agree nor disagree (NAND), 4=agree (A) and 5=strongly agree (SA)). The median scores informed the process of reducing the number of statements to be included in the third round, while providing a broad overview of the data. The combined percentage of SA and agree A scores and percentage of SD and D were also calculated for every statement. The level of consensus for the combined percentages of SA/A or SD/D statements was set at >80% (Raine, 2006; Green et al, 1999) . This level was chosen as it had been used successfully in previous studies (Raine, 2006). Also, it was necessary to make a pragmatic decision and set a level of consensus that would be attainable when seeking the opinions of different professional groups, working in different OUs, while being credible in clinical practice.

The respondents’ data were grouped and analysed in the following sequence: For all seven OUs combined; by OUs with similar annual birth rates (see Figure 1); by professional title (doctor/midwife) working in the OU groups.

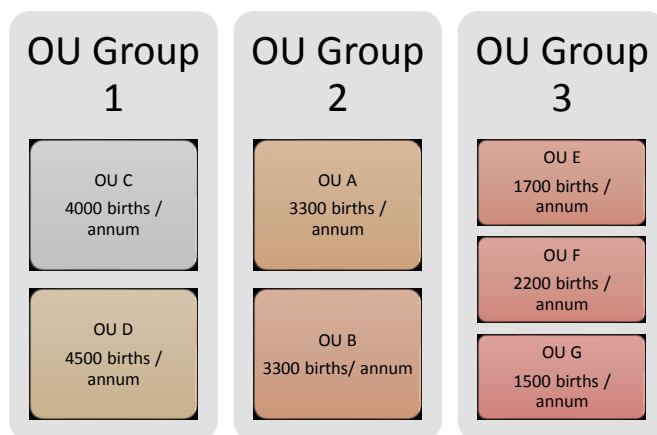


Figure 1. Birth rates for the OUs forming the OU groups

### *Round three data collection and analyses*

The R3 questionnaire derived from the R2 results. A reductionist approach (Green et al, 1999) was used to develop the questionnaire and reduce the number of statements returned to the respondents during the third round. The R2 statements with median scores of four and a level of consensus of 80% or more were removed from the R3 questionnaire, unless respondent comments suggested further exploration in the final round was necessary.

Those statements with median scores of one (strongly disagree), two (disagree) and five (strongly agree) were also excluded from the R3 questionnaire, unless comments provided by the respondents indicated the need for further exploration or rewording. Removal of some statements reduced the number of statements from 106 in R2 to 47 in R3. The screening and removal of certain questions by the research team allowed respondents to concentrate on important aspects (for example, questions where consensus was not achieved, or had been reworded in response to the respondents' R2 comments) (Martino, 1993).

Adopting a modified approach, the R2 statistical results were not fed back to the respondents during R3, alternatively, the respondents were given the opportunity to provide written comments during R2 and R3. This strategy was implemented to offset a criticism that respondents are unable to discuss or clarify their opinions during Delphi surveys and to reduce the chance of them forming a specious or manipulated consensus (Keeney et al, 2011; Sackman, 1975).

The first section of the R3 questionnaire asked respondents to decide whether a list of conditions and interventions (n=15) warranted intensive care as opposed to MHDC. These questions were developed in response to respondents commenting that intensive care would be more appropriate than MHDC for some of the R2 statements. The second part of the R3 questionnaire asked participants to rate their level of agreement or disagreement for a series of statements (n=32) relating to MHDC, using Likert type items as in the second round.

The R3 quantitative data were entered into SPSS 17.0 and analysed using descriptive statistics as for R2. Part one of the questionnaire calculated the percentage of 'yes' and 'no' responses provided by the respondents. For part two of the questionnaire the frequency of SA/A and SD/D agree statements were calculated, and the qualitative comments were

tabulated. During R3 the level of consensus for the combined percentages of SA/A statements remained at >80% (Raine, 2006). The respondents' data were grouped and analysed using the same sequence as for R2.

### *Strengths and limitations*

To obtain a true reflection of MHDC, this modified Delphi survey included professionals with clinical, managerial, strategic, educational and governance roles. In total, these professionals reflect the 'real world' views of the OU team who provide MHDC (either directly in terms of 'hands-on care' or indirectly).

The decision not to feedback the statistical findings to the respondents during R3 may be identified as a study limitation by proponents of the traditional Delphi survey (Sackman, 1975). However, the inclusion of the respondents' qualitative comments during R2 and R3 enabled them to clarify their responses, adding greater depth and clarity of meaning to the descriptive statistics. The respondents' R2 comments also influenced the content of the R3 questionnaire, thereby enhancing both its content and face validity.

Delphi studies are lengthy and labour intensive (Mullen, 2000).

History (events that may alter respondents' opinions between rounds), threatens the internal validity of Delphi surveys, and the longer a survey takes to complete, the greater this threat becomes (Keeney et al, 2011 ). The MHDC Delphi study took over a year to complete and is thus identified as a study limitation.

### *Conclusion*

A modified Delphi survey was conducted to seek consensus on the definition and defining features of MHDC, as the limited published literature identifies differing opinions regarding the concept. Delphi surveys are appropriate for examining complex aspects of clinical practice where consensus is sought. When modified approaches are undertaken, the researcher must carefully justify the methodological decisions that are made. Moreover, the somewhat lengthy nature of Delphi surveys and the possible impact on internal validity must be acknowledged. The findings of this modified Delphi survey will be reported in the next issue of *Evidence Based Midwifery*

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