



What do women want? Valuing women's preferences and estimating demand for alternative models of maternity care using a discrete choice experiment



Christopher G. Fawsitt^{a,b,c,*}, Jane Bourke^b, Richard A. Greene^c, Brendan McElroy^b,
Nicolas Krucien^d, Rosemary Murphy^b, Jennifer E. Lutomski^e

^a Bristol Medical School, University of Bristol, United Kingdom

^b Cork University Business School, University College Cork, Cork, Ireland

^c National Perinatal Epidemiology Centre, University College Cork, Cork, Ireland

^d Health Economics Research Unit, University of Aberdeen, Institute of Applied Health Sciences, Foresterhill, Aberdeen, AB25 2QN, United Kingdom

^e Radboud Institute for Health Sciences, Radboud University Medical Center, Nijmegen, Netherlands

ARTICLE INFO

Article history:

Received 7 July 2016

Received in revised form 23 June 2017

Accepted 19 September 2017

Keywords:

Discrete choice experiment

Consultant-led care

Midwifery-led care

Willingness to pay

ABSTRACT

In many countries, there has been a considerable shift towards providing a more woman-centred maternity service, which affords greater consumer choice. Maternity service provision in Ireland is set to follow this trend with policymakers committed to improving maternal choice at hospital level. However, women's preferences for maternity care are unknown, as is the expected demand for new services. In this paper, we used a discrete choice experiment (DCE) to (1) investigate women's strengths of preference for different features of maternity care; (2) predict market uptake for consultant- and midwifery-led care, and a hybrid model of care called the Domiciliary In and Out of Hospital Care scheme; and (3) calculate the welfare change arising from the provision of these services. Women attending antenatal care across two teaching hospitals in Ireland were invited to participate in the study. Women's preferred model of care resembled the hybrid model of care, with considerably more women expected to utilise this service than either consultant- or midwifery-led care. The benefit of providing all three services proved considerably greater than the benefit of providing two or fewer services. From a priority setting perspective, pursuing all three models of care would generate a considerable welfare gain, although the cost-effectiveness of such an approach needs to be considered.

© 2017 The Author(s). Published by Elsevier Ireland Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

In many countries, there has been a considerable shift towards providing a more woman-centred maternity service, which affords greater consumer choice and involvement in decision-making [1–5]. In the UK, for example, the configuration of maternity services has developed to reflect women's varying preferences for maternity care by providing pregnant women with a range of choices on antenatal and intrapartum care [5]. In particular, women may choose between two models of care at hospital level: consultant-led care and midwifery-led care. Although some women have expressed concerns regarding the safety of care in MLUs [6], internationally, midwifery-led care has been found to be

associated with fewer interventions and comparable adverse outcomes when compared with consultant-led care [7–11]. Women also report higher satisfaction levels following care in a MLU [8], which may be due, in part, to continuity of care. Homeliness of the delivery room and involvement in decision-making, which are typically associated with midwifery-led care, also influenced women's decision-making in favour of this model of care [12]. In Ireland, there has been an increased interest among policy makers to expand midwifery-led care in order to improve maternal choice and provide a more woman-centred maternity service [13–15]. Currently, midwifery-led care is limited to two geographic regions, catering to relatively small populations [7]. Women have yet to be surveyed about their preferences for alternative models of maternity care and whether they would utilise midwifery-led care if presented with this option alongside consultant-led care.

In Ireland, as elsewhere, consultant-led care is provided in an obstetric unit, or consultant-led unit (CLU), and a team of mid-

* Corresponding author at: Bristol Medical School, University of Bristol, Canynge Hall, 39 Whatley Road, Bristol, BS8 2PS, United Kingdom.

E-mail addresses: c.fawsitt@bristol.ac.uk, c.fawsitt@gmail.com (C.G. Fawsitt).

wives and obstetric doctors are responsible for providing maternity care. In a CLU, the full range of medical services, including obstetric, anaesthetic, and neonatal care, is readily available. In contrast, midwifery-led care is delivered in an alongside midwifery-led unit (MLU), overseen by a team of midwives with no obstetric doctors or medical services on the premises. In recent times, hybrid formulations of maternity care have become available. One such example in Ireland is the Domiciliary In and Out of Hospital Care (DOMINO) scheme. Established in 2001 as a pilot service, and expanded thereafter to some of the major maternity units across the country, the DOMINO scheme provides continuity of care before, during, and after pregnancy. Under the DOMINO scheme a midwife provides antenatal care for the expectant mother in a community setting, accompanies her throughout labour in a CLU, and provides follow-up postnatal care when she returns home [16]. The scheme provides rapid postnatal discharge, with women encouraged to return home in as few as three to six hours after giving birth.

In this study, a discrete choice experiment (DCE) was employed to investigate women's preferences for different features of maternity care and examine trade-offs for these features based on willingness to pay (WTP). Potential uptake of consultant- and midwifery-led care and the DOMINO scheme was estimated and women's WTP for these packages of care was calculated.

2. Materials and methods

The DCE provides a valuable approach to investigating preferences and modelling demand, and is widely used in environmental economics, marketing research, health services research [17] and priority setting [18]. Hundley et al. [12] also found that it is a useful technique for eliciting preferences within a maternity care setting. A DCE is a survey-based measure which examines expected behaviour and can be used to model demand when a market for a particular good or service does not currently exist [19]. Respondents are presented with a set of hypothetical alternatives and asked to select their preferred scenario. The alternatives are described and compared using attributes, which are characteristics of the goods or services on offer [20,21]. The DCE is used to investigate strengths of preferences and trade-offs using marginal rates of substitution (MRS). By including a cost or price attribute, it can be used to investigate consumers' WTP for certain attributes or combinations of attributes.

2.1. Development of the DCE

The merit of a DCE hinges on the identification of appropriate attributes and levels [21,22]. This study adopts the gold standard approach and uses qualitative research [23]. Using focus groups and thematic analysis, five attributes were identified as being important to women when choosing place of delivery (see supplementary Table S1): continuity of care with the same midwife from antenatal through to intrapartum care; involvement of obstetric doctors during labour; types of pain relief immediately available; women's role in decision-making during labour; and women's preferred length of stay in hospital after delivery. The qualitative research is described in detail by Fawsitt et al. [24].

The levels for each attribute broadly described service-differences between consultant- and midwifery-led care and were defined by current practice, informed by the focus groups, or instructed by expert opinion. Two levels were identified for the attribute continuity of care with the midwife. In both a CLU and MLU, one-to-one care is provided by a midwife for the duration of antenatal and intrapartum care. In a MLU, women are typically guaranteed continuity of care with the same midwife [25]. This cannot be guaranteed in a CLU, but may occur unintentionally.

Two levels were defined for the attribute involvement of obstetric doctors during labour. In a CLU, obstetric doctors are involved in women's care in the event of a complication. Since care in a MLU is provided solely by midwives, obstetric doctors cannot be involved during intrapartum care but are available on-site in the event of a complication, requiring a short distance transfer to an alongside CLU. The attribute for pain relief had two levels which derived from current practice where the provision of epidural anaesthesia described care in a CLU and a birthing pool described care in a MLU. Evidence from the focus groups suggested that women had varying preferences about their role in the decision-making during labour. Participants identified two levels: to be kept informed and actively involved in decision-making; to be kept informed with all decision-making devolved to staff. Four levels were assigned to the length of stay attribute, and described a 6, 24, 48 and 72 h postnatal stay. In a MLU, women are encouraged to stay in hospital postnatally for up to 24 h, while in a CLU, women are permitted to stay for up to two days. In contrast, the DOMINO scheme encourages women to return home within six to 24 h.

A price proxy was also incorporated into the DCE to calculate women's marginal WTP for maternity care. Since maternity care is free in Ireland, there were no established prices to guide these levels. Price levels were available for private care, but these prices represented a superior level of care. Four levels were assigned to the attribute, informed by qualitative research and iterative pilot testing. Given women's familiarity with assigning a price level to private care, the WTP attribute was described in terms of an out-of-pocket expense. The levels were €100, €500, €1000, and €1500.

There is consensus among DCE practitioners that it is important to mimic real world scenarios in DCEs in order to best reflect real world decisions. In this study, women were presented with two generic alternatives (i.e., Maternity Care Service A and B, respectively) and an opt-out option (i.e., Neither A nor B). The opt-out option did not describe an alternative model of care such as home birth care or private care, but encompassed all other potential maternity care services. When modelling potential market uptake, a key objective of this paper, there is much consensus that a DCE should include an opt-out option [17,21,26,27].

The levels were combined together to form "maternity care services" using experimental design techniques and NGENE software [20,28]. A subset of 32 profiles, divided across 16 choice sets, was generated using an orthogonal main effects design. A sample choice set is presented in Fig. 1. Each participant was asked to answer all 16 choice tasks, allowing measurement of the effects of changes in the features of maternity services on the probability of being accepted by women. The DCE was piloted extensively, in line with best practice guidelines [21]. We assessed the appropriateness of attributes and levels, validity, experimental design, response rate and length of time taken to complete the survey, among other aspects of the survey, such as layout and presentation. Over the course of the pilot studies, the DCE was revised and a number of changes were made to the layout and presentation, language used, attributes included in the DCE, and overall research objectives. In each pilot study, we followed the same distribution technique assumed in the final survey, detailed below, and invited a random sample of 50 women by post to participate in the study. Overall, the pilot studies helped to refine the DCE and approach to survey distribution.

2.2. Distribution and survey administration

The final survey was distributed across two groups of women attending antenatal care in two teaching hospitals in Ireland: Cork University Maternity Hospital and the National Maternity Hospital, Dublin. The former is a tertiary maternity hospital that caters to 8000 deliveries per annum in the south west of Ireland [29], while the latter is located in the east of Ireland, and caters to approx-

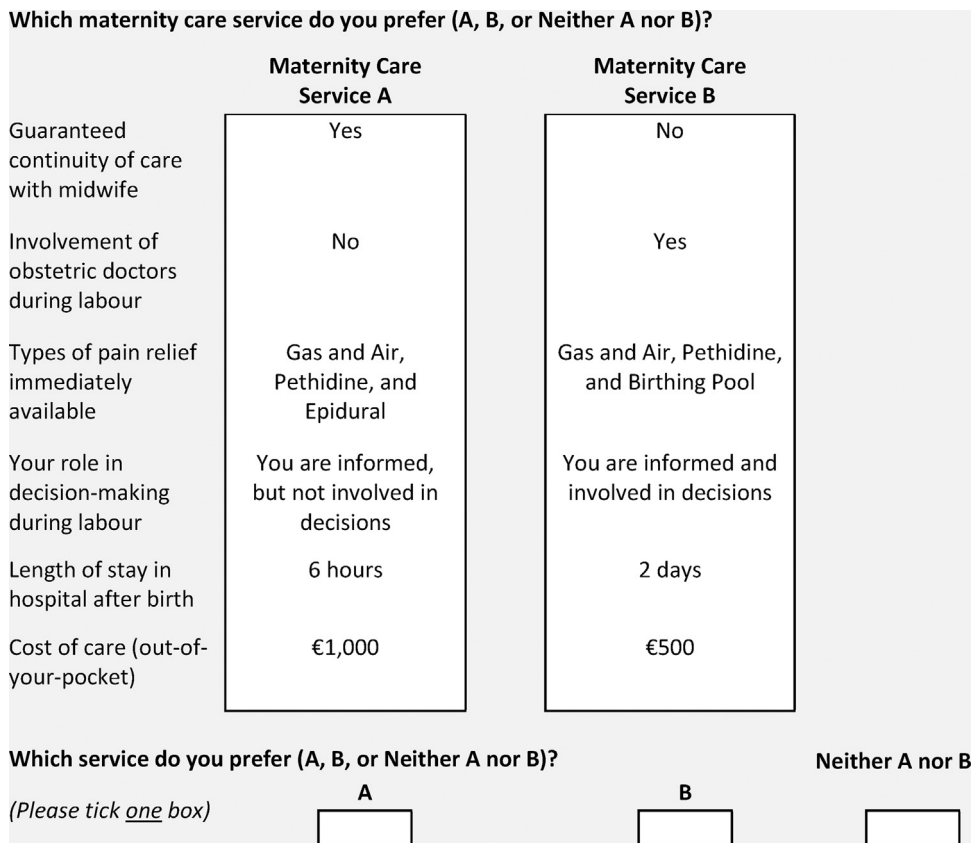


Fig. 1. Sample DCE choice set.

imately 9000 deliveries per annum [30]. To minimise the effect of experience on preferences, women were surveyed early during antenatal care. Only women who were considered to be at low risk of obstetric complications were invited to participate in the study as high risk women do not have the option of delivering in a MLU. Low risk was defined according to the National Institute for Health and Care Excellence (NICE) guidelines and included women between 18 and 39 years of age with no history of obstetric complications or Caesarean section and no contraindications of morbidities at the time of pregnancy [5].

Selecting the appropriate sample size is complex. Lancsar and Louviere [21] propose that a sample size of twenty is sufficient to reliably estimate a discrete choice model. This study invited 400 women via post to participate in the study. Three reminders were distributed to participants who neither returned the survey nor opted out of the study over the course of eight weeks. Ethical approval for the study was granted by the Clinical Research Ethics Committee, Division of Obstetrics and Gynaecology in CUMH, and the Research Ethics Committee in The NMH.

Questionnaire responses were coded and entered into Stata 12 [31] using dummy coding for the qualitative attributes (continuity of care, involvement of obstetric doctors, types of pain relief, involvement in decision-making) and continuously for the quantitative attributes (length of stay, cost).

2.3. Discrete choice analysis

Different discrete choice models were tested to analyse women’s preferences for maternity care within a random utility theory framework (RUT). The RUT framework assumes that women seek to maximise a set of innate preferences, or utilities, according to the perceived benefit associated with the different fea-

tures of maternity care. This utility is derived from the features (or attributes) of the services (e.g., continuity of care with the same midwife) rather than from the service itself. The impact of the attributes on decision making depends on women’s strengths of preferences for those attributes, or features of maternity care. A standard multinomial logit (MNL) model was used initially to analyse women’s choices within the RUT framework. However, the MNL model assumes preferences are fixed across women, or homogeneous; that is, the discrete choice model assumes that all women have the same preference for continuity of care, for example. It is unlikely that women derive the same utility from each of the attributes on offer. Heterogeneity in preferences can be investigated using a flexible model, such as the random parameters or mixed logit (MXL) model.

Within a RUT framework, for any woman *n*, the probability (*P*) of choosing maternity service *j* is:

$$P_{nj} = \frac{\exp(V_{nj})}{\sum_j \exp(V_{nj})} \tag{1}$$

and the associated (indirect) utility for woman *n* is:

$$V_{nj} = \beta_1 ASC_A + \beta_2 ASC_{NO} + \beta_{3n} CONT_j + \beta_{4n} OBDOCS_j + \beta_{5n} PAIN_j + \beta_{6n} DECMAX_j + \beta_{7n} LOS_j + \beta_{8n} COST_j \tag{2}$$

where *V_{nj}* is the utility associated with consumption bundle *j* for woman *n*, and *β_n* are individual-specific preferences for the attributes (*X_j*). Heterogeneity in women’s preferences for *β_n* is represented by a distribution of preferences over the sample. Women’s preferences for *β_n* are normally distributed, with mean (*μ*) and standard deviation (*σ*) estimated from the choice data. The *σ* parameters allow quantifying the variability in preferences among women; a *σ* parameter significantly different from 0 indicates

greater variability in preferences among women. Different specifications of the MXL model were tested before finding the best model to explain women's preferences [32]. By examining the ratio of preferences to cost, or MRS, women's marginal WTP for a specified level of each attribute was calculated using data obtained from the MXL model:

$$WTP = \beta_K / -\beta_{priceproxy} \quad (3)$$

The DCE was also used to model the probability of market uptake for three different combinations of attributes that resembled consultant-led care, midwifery-led care, and DOMINO care. Consultant-led care described discontinuity of care with the same midwife, immediate access to an obstetric doctor and epidural anaesthesia, limited involvement in decision-making, and 48 h length of stay; midwifery-led care described guaranteed continuity of care with the same midwife, limited access to obstetric doctors and epidural, greater involvement in decision-making, and 24 h length of stay; DOMINO care described continuity of care with the same midwife, immediate access to an obstetric doctor and epidural anaesthesia, limited involvement in decision-making, and 6 h length of stay. Probabilities were simulated by taking 1000 draws from the estimated distributions of the choice data and calculated as means over the total number of draws [33].

Finally, the DCE was used to measure the benefit to women, or welfare change as it's known in economics, arising from the provision of multiple maternity services (i.e., midwifery-led care alongside consultant-led care, etc.). Welfare change was calculated by weighting the utility of each maternity service by the probability of uptake. This was an important consideration as the provision of multiple services might not necessarily benefit everyone. For instance, some women may substitute to the new service, while others may remain with the existing service. Those women that stay with the existing service do not benefit from the provision of the new service; hence, it was important to capture the benefit of the new service in terms of those that actually gained from its provision [34]. Small and Rosen [35] adapted a measure for compensating variation (CV) from Hicks [36] which can be used to calculate welfare change:

$$CV = -\frac{1}{\beta_{cost}} \left[\ln \sum_{j=1}^J e^{V_j^1} - \ln \sum_{j=1}^J e^{V_j^0} \right] \quad (4)$$

where V_j^0 and V_j^1 describe the states of the world respectively before and after the new maternity service is introduced [36]. The log sum expressions, $\ln \sum_{j=1}^J e^{V_j^1}$ and $\ln \sum_{j=1}^J e^{V_j^0}$, weight the utility of each alternative by their associated probability of uptake. β_{cost} is the marginal disutility of the cost attribute [37].

Welfare change was measured in this study following the hypothetical introduction of midwifery-led care and DOMINO care alongside consultant-led care. Both measures were estimated separately first, and then jointly, relative to care in a CLU. The CV was estimated in the same way as the predicted probabilities: drawn from the mean of 1000 simulations of the estimated distributions [33].

3. Results

Of the 400 surveys distributed, 112 women returned the questionnaire, yielding a response rate of 28%. Two respondents were removed for failing to complete more than 25% of the choice sets. Fourteen further respondents were removed from the sample due to the high risk nature of their pregnancy. The final sample comprised 96 women (1536 observations) with participants from

CUMH accounting for two-thirds of this group (64). Eighty-five per cent of women (82) completed all 16 choice sets. On 449 occasions, or across 29.9% of the choice sets, respondents chose the 'Neither' option.

3.1. Sample characteristics

The mean age of participants was 30.2, with a median age of 30 (see supplementary Table S2). The average age of first-time mothers was 29.6, with a median age of 29. The youngest participant was 20, while the eldest was 39. Less than half the sample was multiparous (45), while 53.1% were nulliparous with a singleton foetus (53). Women who had given birth before had one to four other children. The mean number of births was 1.4 (SD=0.60). The majority of participants were married, accounting for 53.7%. Some 39.6% reported having private health insurance.

3.2. Women's preferences for maternity services

The MXL model performed considerably better at estimating women's preferences than the standard MNL model. The estimation of preferences was further improved by increasing the number of random attributes, suggesting that preferences varied across respondents. The model that best described women's preferences included five random attributes and three fixed attributes. The three fixed attributes were the ASC for alternative A and the opt-out option, and cost. This model was also considerably better than a MXL model which specified all attributes as random.

The results of the MNL model and MXL model are presented in Table 1. Focusing on the MXL model, the two ASC parameters were not significant, suggesting that women's choices were not influenced by factors other than the attributes of the maternity services. Each attribute was significant, confirming that all 6 features were important to women when evaluating maternity care. The negative coefficient on cost implies a disutility associated with having to pay for maternity care, with women willing to give up less. The positive coefficient on each of the other attributes indicates that women derived utility from being guaranteed continuity of care with the same midwife; having immediate access to medical services, including obstetric doctors and epidural anaesthesia; experiencing extended periods of stay in hospital; and being actively involved in the decision-making. There was considerable heterogeneity in preferences, as indicated by the large standard deviation for each attribute. The attribute with the greatest utility was involvement of obstetric doctors during labour. The greatest heterogeneity in preferences surrounded the attributes for pain relief and continuity of care.

3.3. Women's willingness to pay for improvements in maternity services

Using preference data from the MXL model, women's marginal WTP for the different attributes were calculated (Table 1). The relative importance of attributes varied considerably. Women were willing to give up €921.43 (95% CI €577.513, €1313.03) to ensure they had an obstetric doctor involved in their care. The second most valued attribute was having an active role in the decision-making during labour. Women were willing to pay €787.18 (95% CI €432.86, €1,275.61) for this outcome. To ensure continuity of care with the same midwife throughout the antenatal and intrapartum period, women were willing to pay €743.20 (95% CI €358.34, €1,217.85). For epidural anaesthesia, instead of a birthing pool, women were willing to pay €334.43 (95% CI €9.31, €740.37). Finally, for an additional hour in hospital postnatally, women were willing to pay €17.27 (95% CI €11.28, €23.42).

Table 1
Mixed logit model reflecting women's preferences and willingness to pay (WTP)

	MNL Model Coefficient (SE)	MXL Model Coefficient (SE) ^a	SD (SE)	WTP, € (95% CI)
ASCA	−0.012 (0.071)	−0.021 (0.115)		
ASCN	−0.005 (0.100)	0.186 (0.340)		
Continuity of care	0.558 (0.092) ^{***}	1.028 (0.240) ^{***}	2.133 (0.242) ^{***}	743.20 (358.34, 1217.85)
Involvement of obstetric doctors	0.569 (0.081) ^{***}	1.275 (0.214) ^{***}	1.409 (0.159) ^{***}	921.43 (577.51, 1313.03)
Pain relief	0.351 (0.092) ^{***}	0.463 (0.237) ^{**}	2.220 (0.247) ^{***}	334.43 (9.31, 740.37)
Role in decision-making	0.502 (0.094) ^{***}	1.089 (0.234) ^{***}	1.675 (0.186) ^{***}	787.18 (432.86, 1275.61)
Length of stay	0.011 (0.002) ^{***}	0.024 (0.005) ^{***}	0.033 (0.004) ^{***}	17.27 (11.28, 23.42)
Cost	− 0.001 (0.000) ^{***}	− 0.001 (0.000) ^{***}		
Log-likelihood	−1460.94	−1097.04		
Parameters	8	13		
AIC	2937.89	2220.08		
BIC	2989.20	2303.46		
Observations	1503	1503		

Notes:

Abbreviations: ASCA, alternative-specific constant for alternative A; ASCN, alternative-specific constant for opt-out; SD, standard deviation; SE, standard error, AIC, Akaike information criterion; BIC, Bayesian information criterion.

*** p < 0.01.

** p < 0.05.

^a The MXL model was estimated using 500 Halton draws.**Table 2**
Predicting market uptake for different models of care.

Model of care	Probability	95% CI	
		0.025 quantile	0.975 quantile
MLU alongside CLU			
CLU	0.491	0.467	0.516
MLU	0.509	0.485	0.533
DOMINO alongside CLU			
CLU	0.412	0.387	0.437
DOMINO	0.588	0.563	0.613
MLU & DOMINO alongside CLU			
CLU	0.272	0.251	0.293
MLU	0.288	0.266	0.309
DOMINO	0.440	0.415	0.465

Notes:

Abbreviations: CLU consultant-led unit; MLU midwifery-led unit; DOMINO domiciliary in and out of hospital care; WTP willingness to pay; CI confidence intervals.

Care in a CLU describes discontinuity of care with a midwife, immediate access to an obstetric doctor and epidural anaesthesia, limited involvement in decision-making, and 48 h length of stay; care in a MLU describes guaranteed continuity of care with a midwife, limited access to obstetric doctors and epidural, greater involvement in decision-making, and 24 h length of stay; DOMINO care describes continuity of care with a midwife, immediate access to an obstetric doctor and epidural anaesthesia, limited involvement in decision-making, and 6 h length of stay.

3.4. Modelling market uptake

The potential uptake for three combinations of attributes was modelled. It was assumed that the initial probability of uptake for care in a CLU was 1.00 since we were interested in modelling market outcomes in regions where the only model of care initially on offer (at hospital level) was care in a CLU. The introduction of a MLU would affect the utilisation of consultant-led care (Table 2). A large proportion of women would substitute to the new service; the probability of uptake for care in a MLU was estimated at 0.509 (95% CI 0.485, 0.533). Just under half of women would remain with the existing service, with 0.491 (95% CI 0.467, 0.516) expected to utilise consultant-led care. If DOMINO care was introduced alongside consultant-led care, a greater number of women would utilise the new service also with the probability of uptake estimated at 0.588 (95% CI 0.563, 0.613) compared with 0.412 (95% CI 0.387, 0.437) for care in a CLU. If both experimental alternatives were introduced alongside consultant-led care, the probability of uptake across the three models of care was estimated at 0.272 (95% CI 0.251, 0.293) for care in a CLU, 0.288 (95% CI 0.266, 0.309) for care in a MLU, and 0.440 (95% CI 0.415, 0.465) for DOMINO care.

Table 3
Calculation of welfare change following introduction of a MLU and DOMINO care alongside a CLU.

	Mean WTP	95% CI	
		0.025 quantile	0.975 quantile
Compensating variation			
MLU alongside CLU	€1,270.52	€1,168.73	€1,372.32
DOMINO alongside CLU	€1,793.72	€1,665.52	€1,921.91
MLU & DOMINO alongside CLU	€2,329.81	€2,198.20	€2,461.43

Notes:

Abbreviations: CLU, consultant-led unit; MLU, midwifery-led unit; DOMINO, domiciliary in and out of hospital care; WTP, willingness to pay; CI, confidence intervals; CV, compensating variation.

3.5. Impact of new maternity services on women's welfare

Finally, the welfare change arising from the introduction of midwifery-led care and DOMINO care alongside consultant-led care was calculated. When care in a MLU was introduced, where the probability of uptake was 0.509, the welfare gain arising from the policy change was estimated at €1,270.52 (95% CI €1,168.73, €1,372.32) (Table 3). Following the introduction of the DOMINO scheme alongside consultant-led care, a welfare gain of €1,793.72 (95% CI €1,665.52, €1,921.91) was estimated. Finally, following the introduction of midwifery-led care and DOMINO care alongside consultant-led care, the welfare gain was calculated at €2,329.81 (95% CI €2,198.20, €2,461.43).

4. Discussion

The results show that women preferred being guaranteed continuity of care with the same midwife from antenatal through to intrapartum care; having immediate access to obstetric doctors and epidural anaesthesia during labour; being actively involved in the decision-making around their labour; and enjoying extended periods of stay in hospital after the birth of their baby. MRS against the cost attribute show that the most important attribute to women was involvement of obstetric doctors during labour; women were willing to give up €921.43 to ensure this outcome. When the utility scores for each attribute were combined to reflect consultant- and midwifery-led care and the DOMINO scheme, the results suggest that women's ideal maternity care package closely resembled the DOMINO scheme. In other words, women desired continuity of care with the same midwife, immediate access to an obstetric doctor and

epidural anaesthesia, limited involvement in decision-making, and 6 h length of stay. When modelled against the other alternatives, the DOMINO scheme consistently attracted the greatest proportion of women. For instance, if the DOMINO scheme was introduced alongside consultant-led care, the expected uptake for this package of care among the low risk obstetric population was 58.8%, compared with 41.2% for consultant-led care. Midwifery-led care also attracted a greater proportion of women. When introduced alongside consultant-led care, 50.9% of the obstetric population were expected to utilise this service against 49.1% who remained with the existing consultant-led service. In terms of calculating welfare change, the results presented here suggest that the welfare gain associated with the alongside provision of all three packages of care was €2,329.81.

This is the first study to examine maternal preferences for alternative models of maternity care in an Irish setting using a DCE. Reassuringly, the findings mirror other international studies. In Scotland, Hundley and Ryan [38] found similar preferences for maternity care: the authors conducted a DCE and found women preferred maternity units that provided continuity of carer throughout labour and delivery, more methods of pain relief, involvement of medical staff, and greater involvement for the women in decision-making. In two other studies in Scotland, similar preferences were obtained. Pitchforth et al. [6] found that type of provider and pain relief were important attributes to women during labour, while Longworth et al. [39] found that access to epidural anaesthesia was important during intrapartum care.

There are certain limitations associated with this research. The obtained sample size was smaller than anticipated, which may have biased estimated preferences. However, the degree and magnitude of this bias could not be discerned in the context of this study. Further, it is difficult to generalise the findings to the low risk obstetric population since this analysis was based on a convenience sample rather than a random sample of women. It is difficult to compare the sample with the low risk obstetric population also. While the National Perinatal Reporting System (NPRS) in Ireland publishes nationally representative data on the obstetric population on an annual basis, it cannot distinguish between low and high risk women [40]. However, the results correspond to findings obtained during the qualitative research, which also found that women's ideal maternity care package resembled the DOMINO scheme [24].

The objective of this research was to determine women's preferences for publicly provided hospital-based care, namely consultant- and midwifery-led care, and model potential uptake of these services. To best reflect the real-world decisions faced by pregnant women when choosing between these models of care and other maternity care services, including private care, home birth care, community care, among other variations on these major models of care, we included an opt-out option in the DCE, consistent with best practice guidelines [21] and the overall objective to model market participation. As the opt-out option did not describe a specific model of care, it was difficult to discern the way in which respondents treated the 'Neither' option in the choice sets. The utility of the opt-out option may have varied across women, affecting the values of the estimated parameters. However, we found that women were not influenced by the opt-out option, but instead made choices based on the relative attractiveness of, or lack thereof, the available alternatives. Given the high frequency with which women selected this option, it is likely that women considered the opt-out option as 'Not Acceptable', rather than another maternity care service, meaning the utility of the opt-out option was likely comparable across respondents. Another potential limitation of this description was that women could systematically opt-out of the DCE if the proposed alternatives did not perfectly match their preferences, resulting in a loss of information. While the opt-out

alternative improved the realism of the task and was important in the context of the research objectives, information on the relative attractiveness of each attribute was lost when this option was selected. Lastly, this study was unable to compare costs and benefits. While this study demonstrated the usefulness of the approach to measure welfare change, as documented elsewhere [34,37,41], these data do not correspond to cost inputs, which is a requirement of the approach to directly compare costs and benefits [41].

The strengths of this study lie in the range of phenomena that could be explored using the DCE approach. The DCE elicited preferences, investigated trade-offs, modelled market uptake, and calculated welfare change. Each technique provides important information on the relative attractiveness of the different models of care at a timely juncture in Irish policy formulation. A major strength of the DCE to measure maternal preferences rests on the qualitative research. Rather than developing *ad hoc* attributes to elicit maternal preferences in the DCE, focus groups were undertaken to identify the features of maternity care that were important to women when choosing place of delivery. Qualitative research is regarded as the most reliable method for attribute development [23]. The significance of the attributes in the DCE supports the use of qualitative research, and reinforces the findings obtained during qualitative research. Another key strength of the DCE also lies in the use of a flexible model to estimate preferences. The MXL model shows that women's preferences were not fixed, but rather varied across attributes. Finally, the method employed here to investigate welfare change provides important information on the benefits associated with providing multiple alternatives. Ideally, these benefits should be compared against the combined cost of providing these services; research which is forthcoming by these authors.

Given the government's commitment to reform maternity service provision in Ireland by expanding midwifery-led care throughout the country, this research provides timely, evidence-based data on the demand for alternative models of maternity care. We find demand for midwifery-led care would be relatively weak compared with the DOMINO scheme. Pursuing all three models of care generates a considerable welfare gain, although the cost-effectiveness of such an approach needs to be considered. In order to efficiently organise maternity care, there needs to be an increased focus on priority setting where the allocation of resources reflects demand and value for money.

Disclosure of interests

All authors have nothing to declare.

Details of ethical approval

This study was granted ethical approval from University College Cork Clinical Research Ethics Committee review (ECM4 06/03/12); the Division of Obstetrics and Gynaecology, Cork University Maternity Hospital; the Research Ethics Committee in The National Maternity Hospital, Dublin.

Funding

This research was supported by the National Perinatal Epidemiology Centre of Ireland.

Acknowledgements

We thank the participants of the study for taking the time to share their preferences with us. We also thank Ms. Yvonne Freyne, Cork University Maternity Hospital, and Ms. Rachel Conaty,

National Maternity Hospital Dublin, for facilitating the acquisition of patient contact details.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.healthpol.2017.09.013>.

References

- [1] Department of Health. Changing childbirth. Part 1. Report of the Expert Maternity Group. Department of Health: Her Majesty's Stationary Office; 1993.
- [2] The National Health Committee. Review of Maternity Services in New Zealand; 1995. Wellington, New Zealand.
- [3] National Health and Medical Research Council (Australia) Expert Panel on Options for Effective Care in Childbirth. Options for Effective Care in Childbirth, ed. N.H.a.R.C. (Australia). 1996, Canberra, Australia.
- [4] DOH. Press Release: Varadkar launches public consultation on National Maternity Strategy. Dublin: Department of Health; 2015.
- [5] NICE. Intrapartum care for healthy women and babies. London: National Institute for Health and Clinical Excellence; 2014.
- [6] Pitchforth E, et al. Models of intrapartum care and women's trade-offs in remote and rural Scotland: a mixed-methods study. *BJOG: An International Journal of Obstetrics & Gynaecology* 2008;115(5):560–9.
- [7] Begley C, et al. Comparison of midwife-led and consultant-led care of healthy women at low risk of childbirth complications in the Republic of Ireland: a randomised trial. *BMC Pregnancy and Childbirth* 2011;11(1):85.
- [8] Hatem M, et al. Midwife-led versus other models of care for childbearing women. *Cochrane Database of Systematic Reviews* 2008;4:CD004667.
- [9] Rooks JP, Weatherby NL, Ernst EKM. The national birth centre study. part II. Intrapartum and immediate postpartum and neonatal care. *Journal of Nurse-Midwifery* 1992;37(5):310–30.
- [10] Waldenstrom U, et al. Team midwife care: maternal and infant outcomes. *Australian and New Zealand Journal of Obstetrics and Gynaecology* 2001;41(3):257–64.
- [11] Waldenstrom U, Nilsson CA, Windbladh B. A Randomized controlled study of birth centre care versus standard maternity care: effects on women's health. *Birth* 1997;24(1):17–26.
- [12] Hundley V, Ryan M, Graham W. Assessing women's preferences for intrapartum care. *Birth* 2001;28(4):254–63.
- [13] DOH. Creating a Better Future Together: National Maternity Strategy 2016–2026. Dublin: Department of Health; 2016.
- [14] KPMG. Independent Review of Maternity and Gynaecology Services in the Greater Dublin Area. Dublin: KPMG; 2008.
- [15] RCPI. The Future of Maternity and Gynaecology Services in Ireland 2006–2016. Dublin: The Institute of Obstetricians and Gynaecologists; 2006.
- [16] HSE. Report to the Chief Executive Officers of the Health Boards/Domiciliary Births Group. Dublin: Health Service Executive; 2004.
- [17] De Bekker-Grob EW, Ryan M, Gerard K. Discrete choice experiments in health economics: a review of the literature. *Health Economics* 2012:145–72.
- [18] Green C, Gerard K. Exploring the social value of health-care interventions: a stated preference discrete choice experiment. *Health Economics* 2009;18(8):951–76.
- [19] Louviere J, Hensher D, Swait JD. Stated choice methods: analysis and applications. Cambridge: Cambridge University Press; 2000.
- [20] Amaya-Amaya M, Gerard K, Ryan M. Discrete choice experiments in a nutshell. In: Ryan M, Gerard K, Amaya-Amaya M, editors. *Using Discrete Choice Experiments to Value Health and Health Care*. Dordrecht: Springer; 2008.
- [21] Lancsar E, Louviere J. Conducting discrete choice experiments to inform health-care decision making: a user's guide. *Pharmacoeconomics* 2008;26(8):661–77.
- [22] Ryan M. Using Consumer Preferences in Health Care Decision Making. *The Application of Conjoint Analysis*. London: Office of Health Economics; 1996.
- [23] Coast J, et al. Using Qualitative Methods for Attribute Development for Discrete Choice Experiments: Issues and Recommendation; 2011.
- [24] Fawsitt CG, et al. What women want: exploring pregnant women's preferences for alternative models of maternity care. *Health Policy* 2017;121(1):66–74.
- [25] MidU. An evaluation of midwifery-led care in the Health Service Executive North Eastern area. Dublin: Trinity College Dublin; 2009.
- [26] Ryan M, Farrar S. Using conjoint analysis to elicit preferences for health care. *BMJ* 2000;320(7248):1530–3.
- [27] Ryan M, Gerard K, Amaya-Amaya M, editors. *Using Discrete Choice Experiments to Value Health and Health Care*. ed. I.J. Bateman, vol. 11. Dordrecht: Springer; 2008.
- [28] ChoiceMetrics. Ngene 1.1.1 Software; 2012. Australia.
- [29] CUMH. Annual Report 2012. Cork: Cork University Maternity Hospital; 2013.
- [30] NMH. Annual Report 2012. Dublin: National Maternity Hospital, Dublin; 2013.
- [31] StataCorps. Stata Statistical Software: Release 12. College Station: TX: Stata Press; 2012.
- [32] Ryan M, Watson V, Gerard K. Practical issues in conducting a discrete choice experiment. In: Ryan M, Gerard K, Amaya-Amaya M, editors. *Using Discrete Choice Experiments to Value Health and Health Care*. Dordrecht: Springer; 2008.
- [33] Train K. *Discrete Choice Methods with Simulation*. New York: Cambridge University Press; 2002.
- [34] Ryan M. Deriving welfare measures in discrete choice experiments: a comment to Lancsar and Savage (1). *Health Economics* 2004;13(9):909–12.
- [35] Small KA, Rosen HS. Applied welfare economics with discrete choice models. *Econometrica* 1981;49(1):105–30.
- [36] Hicks JR. *Value and Capital*. Oxford: Clarendon Press; 1939.
- [37] Lancsar E, Savage E. Deriving welfare measures from discrete choice experiments: inconsistency between current methods and random utility and welfare theory. *Health Economics* 2004;13(9):901–7.
- [38] Hundley V, Ryan M. Are women's expectations and preferences for intrapartum care affected by the model of care on offer. *BJOG: An International Journal of Obstetrics and Gynaecology* 2004;111:550–60.
- [39] Longworth L, Ratcliffe J, Boulton M. Investigating women's preferences for intrapartum care: home versus hospital births. *Health and Social Care in the Community* 2001;9(6):404–13.
- [40] NPRS. *Perinatal Statistics Report 2012*. Dublin: Economic Social Research Institute; 2013.
- [41] McIntosh E. Using discrete choice experiments within a cost-Benefit analysis framework. *Pharmacoeconomics* 2006;24(9):855–68.