



# **Hospital choice in times of restructuring the hospital sector**

PhD dissertation

Nasrin Tayyari Dehbarez

Aarhus University  
Department of Public Health

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## **Supervisors**

Professor Rikke Søgaard, MSc, MPH, PhD

Department of Public Health, Aarhus University- Bartholins Alle 2, 8000 Aarhus C, Denmark

Department of Clinical Medicine, Aarhus University, Denmark

Professor Dorte Gyrd-Hansen, MSc, PhD

Department of Public Health and Danish Centre for Health Economics (DaCHE), University of Southern Denmark- Campusvej 55, 5230 Odense M, Denmark

Professor Niels Ulbjerg, MD, PhD

Department of Obstetrics & Gynecology, Aarhus University Hospital- Palle Juul-Jensens Boulevard 99, 8200 Aarhus N, Denmark

## **Evaluation committee**

Professor Karsten Vrangbæk, MSc, PhD

Department of Public Health, Copenhagen University, Denmark

Senior Lecturer Seda Erdem, MSc., PhD

Economics Division, University of Stirling, United Kingdom

Professor Cecilia Ramlau-Hansen, MSc., PhD

Department of public health, epidemiology, Aarhus University, Denmark

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## List of original papers

### Study 1

Tayyari Dehbaraz, N. Gyrd-Hansen, D., Uldbjerg, N., Søgaard, R., Does free choice of hospital conflict with equity of access to highly specialized hospitals? A case study from the Danish health care system. Health Policy. <https://doi.org/10.1016/j.healthpol.2018.04.006>.

### Study 2

Tayyari Dehbaraz N., Lou S., Uldbjerg N., Møller A., Gyrd-Hansen D., Søgaard R. “Pregnant women’s choice of birthing hospital: a qualitative study on individuals' preferences”. Women and birth. 2017. <https://doi.org/10.1016/j.wombi.2017.11.006>.

### Study 3

Tayyari Dehbaraz, N. Raun Mørkbak, M., Gyrd-Hansen, D., Uldbjerg, N., Søgaard, R., Women's Preferences for Birthing Hospital in Denmark: A Discrete Choice Experiment. The Patient- Patient Centered Outcome Research. <https://doi.org/10.1007/s40271-018-0313-9>.

## **Abbreviation list**

ASC	Alternative Specific Constants
ALNA	Attribute-Level Non-Attendance
ANA	Attribute Non-Attendance
CVM	Contingent Valuation Methods
DCE	Discrete Choice Experiment
DRG	Diagnostic Related Groups
EUT	Expected Utility Theory
GP	General Practitioner
HLQ	Health Literacy Questionnaire
ICD	International Classification of Diseases
IIA	Independent of Irrelevant Alternatives
IID	Identically Independently Distributed
ISPOR	International Society for Pharmacoeconomics and Outcomes Research
LCM	Latent Class Model
LL	Log Likelihood
LPCP	London Patient Choice Project
MNL	Multi-Nomial Logistic
MXL	Mixed Logit
MRS	Marginal Rate of Substitution
NHS	National Health Service
NICU	Neonatal Intensive Care Unit
NPM	New Public Management
OR	Odds Ratio
PTT	Person Trade-Off
RP	Revealed Preferences
RPL	Random Parameter Logit model
RRM	Random Regret Minimization
SEGs	Socio-Economic Groups

SES	Socio-Economic Status
SG	Standard Gamble
SLL	Simulated Log Likelihood
SP	Stated Preferences
TTO	Time Trade-Off
VIF	Variance Inflation Factor
WTT	Willingness to Travel

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## **English summary**

Hospital choice policy has been introduced in Northern European health care system as part of New Public Management tool to create a market-like situation, where patients' signals and the threat of exit make the hospitals more sensitive to patient's preferences. The initial aims of the policy were to increase efficiency through competition for waiting time and quality, enhance providers' responsiveness to consider patients' preferences and to give patients more power over their journey to receive treatment.

The policy was introduced in Denmark at the beginning of the 1990s and it was initially known as 'free hospital choice'. Over time, there has been introduced some changes to the policy with regard to improvement in the availability of information regarding waiting times and introduction of payments based on DRG rates. 'Extended choice' which was introduced in 2002, gave patients opportunity to choose between a number of private hospitals and hospitals abroad if the home county could not offer treatment in a public hospital within two months. The the guaranteed waiting time had reduced to one month by 2007.

Denmark is also passing a restructuring phase for hospital sector by merging small hospitals and building larger specialized hospitals. This means that more citizens will have access to the same high quality services; however, it also means that the distance to the hospital in some area of the country will be longer.

This project focused on pregnant women choice of hospital because women demonstrated that they take the opportunity to choose among birthing hospitals. Women also have more time to seek information and make an informed decision. We specifically focused on uncomplicated pregnancies because of the homogeneity in terms of need to hospital services.

Applying a health economics perspective, this PhD project investigated uptake of choice and the consequences of hospital choice policy on equity. The project investigated women's decision-making in relation to choice of birthing hospital, information seeking process and priorities regarding hospital characteristics. Furthermore, the utility of hospital attributes were quantified and trade-offs of hospital attributes were estimated.

To study uptake of choice and the effect of choice on equity of access with regard to socioeconomic status, several Danish data registries were used. The study was a retrospective cohort of 134,049 women who were living near a non-highly specialized hospital and the bypassing of nearest hospital to reach a highly-specialized hospital was assessed using multivariate logistic regression.

To study women's decision-making strategies and priorities regarding birthing hospital, thirteen women who were offered real choice of birthing hospitals at the first prenatal visit to the GP, were interviewed using a semi-structured interview guide and data were analyzed using a thematic analysis.

Moreover, to quantify women's preferences for hospital attributes, a discrete choice experiment with 12 choice scenarios was used. 517 women who were members of an online panel responded to choice sets by choosing

between three unlabeled alternatives characterized by five attributes. A random parameter logit model was used to estimate the utility and marginal willingness to travel for improvements in other hospital attributes.

The results showed that 12% of women bypassed the nearest non-highly specialized hospital to reach a highly-specialized hospital. Notably, high education level was significantly associated with up-specialization, which indicates that the hospital choice policy exacerbates inequity of access to hospitals.

The qualitative study informed us that women make decision independently and trust their own or peers' experiences when making decision. In addition, specialized services and qualified staff, continuity of midwifery care, hospital service offered and travel time were identified as the most important attributes of birthing hospital.

The results of discrete choice experiment showed that the key driver of choice of birthing hospital is availability of an neonatal intensive care unit; the study also revealed the relative importance of the hospital attributes. Substantial heterogeneity was observed due to prior experience with giving birth and with regard to risk attitude and health literacy.

This dissertation concludes that women's high demand for highly-specialized hospitals may reduce accessibility for those in need of specialized care and thereby threaten both equity and efficiency. In addition, women's demand for hospital services is mainly steered by previous birth experience and women's risk attitude. Therefore, there appears to be room for more information to be provided about the women's risk profile and service attributes as an instrument for making an informed decision.

At the time of patient-centered care, where patients' preferences are to be valued, hospital choice policy needs to accommodate individuals' preferences into its components. This PhD project provides some evidence of women's preferences to be considered in policy and it is also suggested to elicit preferences of other groups of hospital users to contribute to evidence-based policy.

## **Danish summary**

Frit sygehusvalg er indført i de nordeuropæiske sundhedsvæsenet som et led i New Public Management for at skabe en markedslignende situation, hvor risiko for patienters fravalg af et specifikt tilbud øger hospitalernes opmærksomhed på patienternes ønsker. De primære mål med politikken var at øge effektiviteten gennem konkurrence i forhold til ventetid og kvalitet, at forbedre udbydernes lydhørhed over for patienternes præferencer og at give patienterne mere selvbestemmelse over egen behandling.

Politikken blev indført i Danmark i begyndelsen af 1990'erne, og den blev oprindeligt kendt som 'Det frie sygehusvalg'. Over tid er der indført nogle ændringer i politikken med hensyn til at forbedre adgangen til information vedrørende ventetider samt indførelse af DRG-takster som basis for afregning mellem hospitaler i forbindelse med patienternes frie valg. Udvidet frit valg, som blev introduceret i 2002, gav patienterne mulighed for at vælge mellem en række private sygehuse og sygehuse i udlandet, hvis hjemregionen ikke kunne tilbyde behandling på et offentligt sygehus inden for to måneder. I 2007 blev den garanterede ventetid reduceret til en måned.

Danmark befinder sig tillige i en omstrukturingsfase for hospitalssektoren med etablering af større specialiserede hospitaler og samtidig nedlæggelse/sammenlægning af de små hospitaler. Det betyder, at flere borgere får adgang til de samme tilbud af høj kvalitet. Det betyder dog også, at afstanden til hospitalet i nogle områder af landet bliver større.

Dette projekt fokuserer på frit valg blandt gravide kvinder, fordi det har vist sig, at kvinderne ofte benytter sig af muligheden for frit at vælge fødested. De gravide kvinder har mere tid til at søge information og træffe beslutning på et velinformeret grundlag. Vi fokuserer specifikt på ukomplicerede graviditeter på grund af homogeniteten, hvad angår behovet for hospitalsydelser.

Ved anvendelse af et sundhedsøkonomisk perspektiv undersøger dette ph.d.-projekt frit valg og konsekvenserne af det frie sygehusvalg med hensyn til lighed. Projektet undersøger kvinders beslutningstagning i forhold til valg af fødested, informationssøgningsproces og prioriteringer vedrørende udvalgte egenskaber ved de valgte hospitaler. Endvidere bliver brugen af hospitalsattributter kvantificeret, og afvejninger af attributterne bliver estimeret.

For at undersøge valg og effekten af valg på lighed i adgang med hensyn til socioøkonomisk status blev der anvendt flere danske dataregistre. Undersøgelsen er en retrospektiv kohorteundersøgelse af 134.049 kvinder, der boede tæt på et ikke-højt specialiseret hospital. Fravalg af nærmeste hospital med henblik på at føde på et højt specialiseret hospital blev vurderet ved hjælp af multivariat logistisk regression.

For at undersøge kvinders beslutningsstrategier og prioriteringer vedrørende valg af fødested blev 13 kvinder, der blev tilbudt reelt valg af fødested ved den første graviditetsundersøgelse hos den praktiserende læge, interviewet med afsæt i en semistruktureret interviewguide, og data blev analyseret ved hjælp af en tematisk analyse.

For at kvantificere kvindernes præferencer for hospitalsattributter blev der desuden anvendt "discrete choice experiment" med 12 valgscenarier. 517 kvinder, der var medlemmer af et online-panel, reagerede på valgmuligheder ved at vælge mellem tre umærkede alternativer med fem egenskaber. En "random parameter logit model" blev brugt til at estimere nytteværdien og den marginale vilje til at vælge et andet hospital med henblik på at skabe forbedringer i andre sygehusattributter.

Resultaterne viste, at 12 % af kvinderne fravalgte det nærmeste ikke-højt specialiserede sygehus for at komme til et højt specialiseret sygehus. Højt uddannelsesniveau var signifikant forbundet med ønsket om høj specialisering, hvilket tyder på, at fritvalgspolitikken forværrer uligheden i adgang til hospitalet.

Det kvalitative studie viste, at kvinder selvstændigt træffer beslutninger og stoler på deres egne eller ligestilledes erfaringer, når de træffer beslutning. Derudover blev specialiserede ydelser og kvalificeret personale, kontinuitet i jordemoderkontakten, det tilbudte sygehus og rejsetid identificeret som de vigtigste egenskaber ved valg af fødested.

Resultaterne af "discrete choice eksperimentet" viste, at det væsentligste incitament ved valg af fødested er tilstedeværelse af en neonatalafdeling; undersøgelsen afslørede også den relative betydning af hospitalsattributter. Anselig variation blev observeret på baggrund af kvindernes tidligere erfaring med fødsel, holdning til risiko og besiddelse af sundhedskompetencer.

Denne afhandling konkluderer, at kvinders store efterspørgsel efter fødsel på højt specialiserede hospitaler kan reducere tilgængeligheden for personer med behov for specialiseret tilbud og derved true både lighed og efficiens. Desuden styres kvinders efterspørgsel efter sygehusydelser primært af tidligere fødselserfaringer og kvindernes indstilling til risiko. For at kvalificere beslutningstagning synes der derfor at være behov for at frembringe yderligere information om kvinders risikoprofil og ønsker om hospitalsattributter.

I en tid med fokus på patientcentreret pleje, hvor patienternes præferencer værdsættes, skal de individuelle præferencer i forhold til hospitalernes tilbud tilpasses fritvalgspolitikken. Dette ph.d.-projekt giver nogle bud på kvinders præferencer, som kan anvendes i videre policy-making på fødselsområdet. Det foreslås ligeledes at anvende præferencer fra andre patientgrupper med henblik på at bidrage til evidensbaseret beslutningstagning i sundhedsvæsenet.

## 1 Introduction

When considering publicly funded services, such as healthcare, most people simply want a ‘good’ service, which according to Le Grand can be defined by five basic attributes: high quality, efficient management, responsiveness to user needs, simultaneous accountability to taxpayers, and equitable delivery<sup>1</sup>. For management of such public systems, four alternative models had been introduced: trust, command and control, voice, and choice<sup>1</sup>. In the trust model, professionals and managers are trusted to know what is best for their users and to deliver quality services in an efficient, responsive, accountable and equitable fashion. In command and control, professionals are part of a management hierarchy, whereby central management sets targets for providers and follows up their performance<sup>1</sup>. In voice model, users can express their dissatisfaction directly to the providers and it gives important information to providers about the quality of services they are providing<sup>1,2</sup>.

According to Le Grand, these models had a central problem that made it difficult to rely upon as a sole or even principal basis for delivering good services: the absence of the right incentives for providers<sup>1</sup>. Trust can fail because, despite the presence of many genuine providers, those delivering public services cannot always be trusted to deliver high quality services or to be responsive to their customers<sup>1,3</sup>. Command and control can also fail because the setting of endless targets results in the well-known problems of gaming and may undermine the public service ethos, and voice has no guaranteed impact on service delivery and tends to favor the middle classes<sup>1,3</sup>. It is therefore choice, which is inspired by the new public management (NPM) approach<sup>4</sup>, that is instrumental in achieving the desired outcomes because it creates incentives for providers to deliver what users want in an efficient, equitable and responsive manner<sup>1,3,5,6</sup>.

Choice has been introduced in various public service areas, including education<sup>7</sup>, public employment services<sup>8</sup>, and social services<sup>9</sup>, as well as in the healthcare sector. There are two fundamental arguments for the introduction of choice in healthcare<sup>10,11</sup>. The ideological viewpoint which states that choice will enhance individual autonomy and empower patients by giving them a more active role in their healthcare<sup>12-14</sup>, hence increasing their use of the healthcare system<sup>15</sup>. From the instrumental viewpoint, giving choice to patients will encourage providers to compete to deliver quality services, which is seen as the best way to ensure the sustainability of healthcare systems<sup>10,16,17</sup>.

The choice concept in healthcare covers a wide range of choice of treatment type (what), provider (by whom), time (when), and location when receiving the treatment (where). The focus of this thesis is on the choice of hospital, which is explained in the following section.

## 1.1 Hospital choice

In northern European healthcare systems, the right to choose between hospitals has been introduced as part of the NPM reforms of the public sector<sup>10</sup>. The right to choose was introduced in Denmark and Sweden at the beginning of the 1990s and in Norway in 2001 and patients in England have had the opportunity to choose from a range of hospitals since 2006<sup>10,15,17-21</sup>. Enhancing choice is based on the premise that public organizations, particularly those dominated by professional groups, tend to be relatively unresponsive to user needs<sup>27</sup>. The remedy for this is to create a market-like situation, where ‘consumer signals’ and the threat of ‘exit’ theoretically make the organizations more sensitive to user preferences<sup>2,27</sup>. In principle, the introduction of choice adjusts the balance of power between patients and healthcare providers, and allows dissatisfied patients to select an alternative provider<sup>22</sup>.

Several empirical studies have dealt with the uptake of choice by different groups of patients and how patients have reacted after being given a choice of where to be treated. Examples of these studies are patient’s reactions to hospital choice in Norway, Denmark and Sweden<sup>20</sup>. This study was mainly based on secondary data from various other studies undertaken in the three countries. The results indicated the reasons why variations in choice patterns should be expected based on both intrinsic patient-related factors and external institutional factors; few patients chose a hospital outside of their local region, which was mostly owing to their limited knowledge regarding their right to choose, insufficient support from GPs, and limited information about outcome measures<sup>20</sup>. One study in Denmark showed that only 60% of hip and knee patients facing a long waiting time in Denmark chose to receive treatment in a hospital farther away with a shorter waiting time, while previous experience, a short distance to travel, and a short waiting time were the most important reasons to choose the nearest hospital<sup>23</sup>. In another study in Denmark, only 53% of patients used their right to choose an outpatient clinic<sup>24</sup>. The short distance to travel, GP recommendations, short waiting time, and the patient’s previous experience with the hospital were the most important factors in patient choices<sup>24</sup>. In a study of patients needing cataract surgery in Sweden, only 4% were treated by a provider outside their home county<sup>25</sup>. In this study, the potential to change provider has probably been important in tackling the long waiting times for treatment in some counties<sup>25</sup>. Norwegian somatic patients who bypassed their local hospital waited on average 11 weeks less than those who had neither individually chosen a hospital nor bypassed the local hospital for other reasons<sup>26</sup>. A program enabling cardiac patient choice in the UK has been popular and uptake has been high, with half of the patients opting for treatment at an alternative hospital<sup>27</sup>. The results indicate that uptake of choice may be increased by the provision of information, travel arrangements, and aftercare<sup>27</sup>. A questionnaire survey in the UK investigated patient experience of choice and booking appointments with regard to time, date, and place of appointment<sup>28</sup>. More than half of the patients reported that they were not given a choice in terms of appointment date and time and that they were not able to choose among four hospitals, with 32% reporting not being given any choice<sup>28</sup>.

#### Box 1 Search strategy for studies about hospital choice

In writing up the introduction of free hospital choice policy, I mainly focused on policy-relevant literature about introduction of choice in Scandinavian health care systems and the UK.

Moreover, the following literature review have been used in addition to hand search of additional references.

- ✓ Patient Mobility for Elective Secondary Health Care Services in Response to Patient Choice Policies: A Systematic review (2017)
- ✓ Understanding patients' decision-making strategies in hospital choice: Literature review and a call for experimental research (2015)
- ✓ Determinants of patient choice of healthcare providers: a scoping review (2012)
- ✓ What benefits will choice bring to patients? Literature review and assessment of implications (2008)

In the London Patient Choice Project (LPCP), two-thirds of patients who were offered the opportunity to go to an alternative hospital chose to do so; uptake was influenced by the level of pain experienced while on the waiting list and the patients' opinions of the reputations of their home hospitals<sup>29</sup>. A review of the literature regarding patient mobility in response to patient choice policies concluded that mobility is positively associated with shorter waiting times, indicators of better service quality, and access to advanced technology and negatively associated with advanced age or lower socioeconomic backgrounds<sup>30</sup>.

It is obvious from these examples that patients value choice and the uptake of choice of hospital varies among different groups of patients and in different settings.

#### 1.1.1 Potential benefits of hospital choice

The potential benefits of hospital choice include efficiency, responsiveness, and patient's rights and empowerment<sup>31</sup>. Efficiency is a measure of whether healthcare resources are being used to obtain the best value for money<sup>32,33</sup>. Economists argue that obtaining greater efficiency from scarce resources should be a major criterion for priority setting in healthcare systems<sup>33</sup>. Choice can affect efficiency by promoting competition among hospitals. The logic behind hospital competition is that hospitals would have a financial incentive to change their behavior and ultimately deliver improved financial, operational, and clinical performance<sup>34</sup>. Competition ensures that consumers receive high-quality care and informs consumers about the costs and benefits of selecting a particular provider or treatment<sup>35</sup>.

The competition policy for healthcare provision in some European countries (France, Germany, Netherlands, Norway, and Portugal) is explained in the literature<sup>36-41</sup>. In these countries, hospitals are increasingly being paid via fixed prices, enabling them to compete for quality, although prices are set in different ways among different countries<sup>36-41</sup>. The effect of competition can be assessed through the use of performance indicators, such as quality, waiting time, and cost efficiency<sup>36</sup>. The theoretical literature regarding quality competition

in healthcare markets with fixed prices has concluded that there is a positive relationship between competition and quality<sup>42,43</sup>; however, empirical studies show positive<sup>44</sup>, negative<sup>45</sup>, mixed<sup>46</sup>, or no effects of competition on quality<sup>47</sup>.

Waiting times are a major health policy concern in many OECD countries<sup>48</sup>. Policymakers often argue that more competition and patient choice can reduce waiting times by encouraging hospitals to compete for patients and revenue<sup>48-50</sup>. However, there is little empirical evidence regarding the effect of patient choice on hospital waiting times. Brekke et al. developed a model of hospital competition, where hospitals differ in terms of their location and waiting times<sup>48</sup>. Their results demonstrated that hospital competition reduces waiting times only if the competitive demand segment is sufficiently small, otherwise, if free choice is relevant for a sufficiently large share of the total patient mass, then competition increases waiting times<sup>48</sup>. Therefore, policies that encourage choice and competition in healthcare markets may not be as successful as policymakers might expect<sup>48</sup>. An empirical study conducted by Siciliani and Martin concluded that within the catchment area of up to five hospitals, more choice was significantly associated with shorter waiting times. However, an increase in the number of hospitals (to 11 or more hospitals) could improve waiting times when the degree of choice was very high<sup>51</sup>. Dawson et al. investigated the impact of the LPCP on ophthalmology waiting times. They showed that giving a patient more choice of provider led to a modest reduction in waiting time and a convergence in waiting times among London hospitals<sup>52</sup>.

The policy intention is that patient choice works as a mechanism for creating competition between hospitals, which in turn will lead to improvements in quality of hospital care<sup>53</sup>. Several studies have investigated the impact of different dimensions of quality on patient choice. The dimensions vary among a range of crude quality measures, such as mortality and readmission rates, measures of the health gain from specific treatments, consumer perceptions of unobserved attributes, procedure-specific clinical quality, waiting time, etc.<sup>53-57</sup>. These studies reveal a common message: patients take quality into account when making their choice of hospital and providers can attract more patients by improving their quality, which is fundamental to the success of the policy of patient choice<sup>53-57</sup>.

Another potential benefit of introducing hospital choice is patient empowerment. From a user perspective, by giving patients the opportunity to choose among hospitals, the relationship between the individual citizen and the healthcare system changes, in the sense that patients become more empowered when they can choose their hospital<sup>15</sup>.

Patient empowerment offers opportunities for patients to identify their needs, take action, and increase their autonomy and involvement in their care and treatment<sup>58,59</sup>. The European Patients Forum supports patient empowerment, aiming to 'promote the development and implementation of policies, strategies and healthcare services that empower patients to be involved in the decision-making and management of their

condition’<sup>60</sup>. The empowerment process within the healthcare system is facilitated by means of a wide range of empowerment tools, such as patient education, doctor–patient communication, patient information leaflets, health promotion leaflets, support groups, and on-line information<sup>61,62</sup>.

Among the possible empowerment tools, previous studies have mainly focused on the role of the GP<sup>63–65</sup> as well as several information sources such as the details of the quality of care<sup>54,66</sup>, own or family/friends experiences<sup>66,67</sup>, public reporting<sup>67,68</sup>, information based on patient surveys<sup>69</sup>, comparative performance information<sup>70,71</sup>, and healthcare performance information<sup>67,72</sup>. The available literature concludes that patients’ experience with a provider is the most valuable source of information in choice of healthcare providers<sup>73</sup>.

Equity in access to healthcare is a key goal among countries with publicly funded healthcare systems; however, it has not been one of the primary arguments for choice in most countries that have introduced patient choice, except for the UK<sup>10</sup>. In the UK, it has been argued that choice would lead to greater equity by giving all patients some ability to choose<sup>31</sup>.

A substantial body of literature has provided empirical evidence regarding equity in the access or use of healthcare services, with some ongoing debate regarding the impact of patient choices on equity in recent years. In a review of literature using PubMed and Embase (Table 1), I have found six theoretical and five empirical studies about association between choice and equity (Figure 1).

Table 1 Search strategy for literature about choice and equity association	
Inclusion criteria	- Studies published after 1990 - Written in English
Post-hoc exclusion criteria	- Not focused on choice-equity association
search string in PubMed	(patient[TIAB] OR patients[TIAB]) AND(choice[TIAB] OR free choice[TIAB]) AND (hospital[TIAB] OR hospitals[TIAB] OR provider[TIAB] OR providers[TIAB]) AND (equity[TIAB] OR equality[TIAB])

Arguments for and against greater choice can be explicitly related to the tension between collectivism and individualism<sup>74</sup>. Choice is associated with individualism and autonomy; conversely, equity is associated with collectivism and justice<sup>75</sup>. The idea of choice derives from economic liberalism and is concerned primarily with property rights, individual autonomy, and personal responsibility. These principles are manifested in a strong reliance on the private provision of public health services, competition, and individual

responsibility, and are in opposition to the collectivist values of equity and the supremacy of community-defined needs <sup>76</sup>.

In the UK, the architects of the policy outlined three routes through which choice would improve equity <sup>77</sup>. First, by enabling all patients to avoid poorly performing providers, it would extend choice beyond private payers and the well-informed, affluent middle classes who already pushed their GPs to refer them to an alternative. Second, competition for patients would motivate poorly performing providers to improve and benefit patients from deprived areas, where poor performance was concentrated. Finally, there is a more general argument that choice will increase social solidarity and the support for a publicly funded healthcare system by preventing middle-class patients from deserting the system for the private sector <sup>77</sup>.

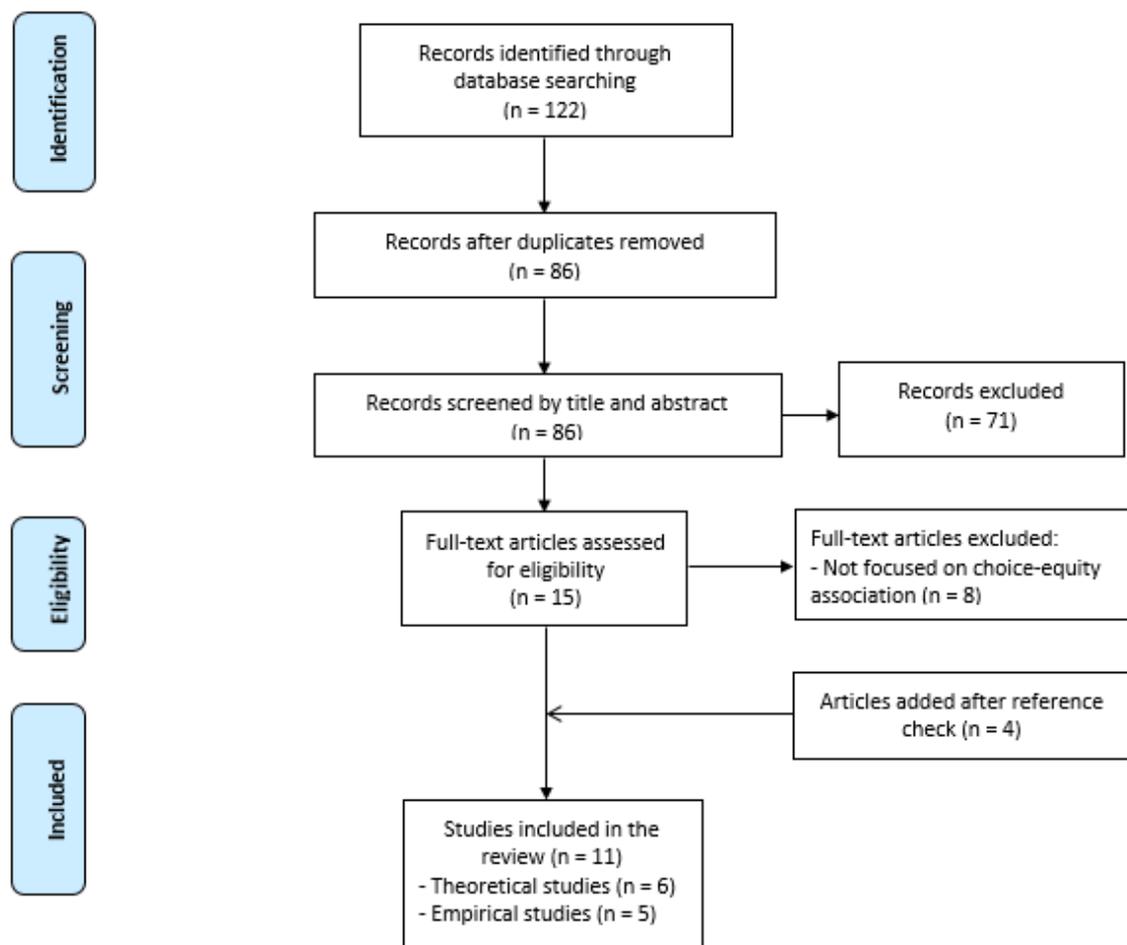


Figure 1 PRISMA flow diagram (choice and equity)

Proponents of patient choice contend that by giving poorer groups the power of ‘exit’ and by diminishing the role of the ‘voice’ of higher socio-economic groups (SEGs) in determining resource allocation, greater choice at the point of referral may reduce the inequities in the use of services that arise from differences in capability<sup>3,78</sup>.

Conversely, it has been argued that choice is inconsistent with a collectivist healthcare system, because the opportunity costs of extending choice to one person reduce the resources available to other persons, to the detriment of the overall social good<sup>79</sup>. Opponents argue that the greater the freedom to choose among providers, the wider the gaps between social groups will become in terms of access and use of healthcare services. This runs the risk of defeating the aims of healthcare policy to the detriment of those with greater needs<sup>74,76,80</sup>.

Here, I will only review studies that have been conducted in the post-reform period in different settings. In a review of three large-scale national studies in the UK by Cookson et al. about the effects of the National Health Service (NHS) reform on equity in healthcare, they found that the hospital choice reform had little effect on socioeconomic equity in healthcare<sup>81</sup>. Another study conducted in the UK, the contribution of patients’ choice behavior to waiting time inequality was estimated for treatment of patients with coronary heart disease<sup>82</sup>. In this study, one key economic factor explaining differences in waiting times by socioeconomic status (SES) considered to be patient heterogeneity with respect to choice of hospital<sup>82</sup>. Researchers allowed for self-selection due to patient choice which identified how much of the socioeconomic gradient is explained by choice or self-selection and found that patients with higher SES are more likely to exercise choice by bypassing the local hospital, but that patients’ choices account for only up to 12% of waiting time inequalities<sup>82</sup>.

A study in England, the distribution of changes in waiting time between socioeconomic groups as an indicator of equity was assessed<sup>83</sup>. The study concluded that between 1997 and 2007 waiting times for patients having elective hip replacement, knee replacement, and cataract repair went down and the variation in waiting times for those procedures across socioeconomic groups was reduced. The rise in funding, the rigid government targets, and increased choice and competition are all likely to have played a role in shortening patients’ waiting time<sup>83</sup>. A number of other studies have shown that better educated populations make greater use of information and are more likely to exercise choice in healthcare<sup>31,84,85</sup>. Fredriksson et al. critically analyzed Swedish policymakers’ arguments when introducing legislated choice of primary care provider and argued that because inequalities in healthcare constitute one of the main challenges for public health today, the impact of healthcare reforms on equity should receive more attention in policymaking<sup>86</sup>.

## 1.2 Hospital choice in Denmark

The hospital choice policy in Denmark was initially known as ‘free choice’ because the idea was linked to general concepts of choice and competition in public administration <sup>15,21</sup>. On January 1, 1993, freedom of choice was introduced by law, allowing patients to choose between public hospitals at the lowest sufficient level of specialization if the receiving hospital was willing to accept them. Choice was presented as a solution for patient complaints about the rigid administration of requests for access to hospitals in neighboring counties <sup>20</sup>. However, a number of restrictions and safeguards were built into the policy. In particular, it was decided that:

- Payments across county lines for ‘extended choice’ patients should be kept at a low level (a flat rate based on the estimated average marginal cost) to reduce economic incentives for counties to build up capacity to compete for patients from other counties.
- Counties could decide if they wanted to keep the payment for incoming patients at the county level or create incentives for hospitals and departments by letting payment follow patients to the hospital level.
- Hospitals were allowed to refuse access to ‘extended choice’ patients, but only in times of heavy workloads.
- Patients should pay travel costs for non-acute treatment in other counties.
- Choice was limited to the same level of specialization, and private treatment facilities were excluded from the scheme.
- The national government emphasized that counties would not receive additional funding for the implementation of the system.

Important changes were made to improve the availability of information regarding waiting times and to introduce payments based on Diagnostic Related Groups (DRG) rates in 2000 <sup>15,21,87</sup>.

From July 2002, ‘extended choice’ was introduced in which patients were free to choose between several private hospitals and hospitals abroad if their home county could not offer treatment in a public hospital within two months, thereby placing additional pressure on the counties to secure short waiting times. In October 2007, the national government stated that the limit on the waiting time would be reduced to one month <sup>15,20</sup>.

The hospital sector is under re-structure in Denmark; over the last two decades, hospitals have become larger because of the merging of small hospitals, which should lead to an increase in quality. The vision for the future is that more citizens will have access to the same high-quality services across the country and the same high-quality acute treatment every day of the year (24/7/365); however, this also means that the distance to a hospital in some areas of the country will be longer. The vision will be realized through a

stronger pre-hospital effort, fewer but larger hospitals, stronger collaboration with the GPs and municipalities, and by considering the patient as the central point of focus. By the end of 2019, Denmark will have 21 acute somatic hospitals and 12 specialized hospitals without emergency provision<sup>88,89</sup>. Hospital reform is an ongoing process, especially with regard to how hospitals should be managed in the future.

### **1.3 Motivation for the project**

Free hospital choice at the time of restructuring the hospital sector highlights the topics related to impact of choice policy on equity and efficiency and raises the issue of public preferences with regard to larger but higher quality hospitals, waiting time, distance to the hospital and capacity of hospitals.

Because choice of hospital is procedure specific, this Ph.D. project focused on women's choice of birthing hospital. Among all groups of hospital users, pregnant women are known to be able and willing to choose which hospital they attend<sup>20</sup>. In addition, uncomplicated pregnancy presents a homogenous group with equal need to hospital services and the lack of complication is identifiable due to existence of detailed national registries<sup>90</sup>. Finally, because pregnancy is a planned procedure, women have more time than other patients to obtain information and make an informed decision by considering different aspects of individual and hospital characteristics in their decision-making.

In the context of the Danish healthcare system, pregnant women were among those patients who took the opportunity to make a choice of hospital, and their choice behavior resulted in capacity issues for highly specialized hospitals in the Capital Region of Denmark and the Central Denmark Region. Hence, the Capital region of Denmark defined catchment area in order to restrict access for highly specialized hospitals in 2010 with an extension in 2014, and the Central Denmark region defined a similar access restriction in 2013.

In this project, we only focused on uncomplicated pregnancies because they do not require specialized services, and many aspects of their choice behavior can be investigated due to homogeneity in need for healthcare services. In the case of complicated pregnancies, women are routinely referred to highly specialized hospitals.

### **1.4 Problem definition and research questions**

Based on an overview of the current scientific literature and 25 years after the introduction of the hospital choice policy in Denmark, we still lack knowledge about many aspects of the choices made by patients.

These include the uptake of choice by different groups of patients, the source of information for patient choice and individual preferences for hospital attributes.

The overall aim of this dissertation was to inform policymakers and health care decision makers about the consequences of the hospital choice policy on equity and efficiency based on the case of an uncomplicated pregnancy.

The specific aim of study one was to assess the extent of uptake of ‘free choice/extended choice’ and, whether the policy conflicts with equal access to highly specialized hospitals. And the research questions relevant to this aim were:

- ✓ What is the proportion of women that traveled beyond their nearest hospital?
- ✓ What are the implications of women choice behavior on equity and efficiency objectives?

Study two aimed at investigating the factors that pregnant women consider when deciding where to give birth and, the source of information they use in their decision-making. Under this aim, the following questions were answered:

- ✓ What are the key decision criteria for the selection of a birthing hospital from women’s perspective?
- ✓ How do women obtain information to make decision about selecting a birthing hospital?

And the aim of study three was to assess the weight women place on each hospital attribute when making their decision and the trade-offs that women make between travel time and other hospital attributes, and if there are any systematic differences between sub-groups of women. Under this aim, I specifically answered these questions:

- ✓ How do women weight these different hospital attributes when selecting the optimal hospital?
- ✓ Are there differences in weighting of the relevant hospital attributes for different groups of women?

## **1.5 Hypothesis**

It has been reported in the literature that socioeconomic status (SES) is associated with access to healthcare<sup>29,31</sup>; therefore, in study one, we tested the hypothesis that there is a socioeconomic gradient in the uptake of hospital choice. We also investigated if being willing to travel a longer distance to reach a highly specialized hospital was associated with being risk averse.

The second study, which was qualitative, was an explanatory study of the priorities for birthing hospital, and the process of seeking information and making decisions, which was not based on any hypothesis. This study determined some of the possible attributes that should be considered in the DCE study and therefore generated hypotheses for next study.

In the final study, we hypothesized that the attributes related to availability of a neonatal intensive care unit (NICU) and specialization level of a hospital in handling rare and serious events are of highest value for women. In addition, we wanted to test preference heterogeneity among participants with regard to pregnancy-related factors and risk and regret attitude.

## 2 Materials and methods

There are two approaches for understanding and measuring preferences, i.e., the revealed preferences (RP) and stated preferences (SP) methods<sup>91</sup>. RPs are an indirect form of preference measurement because they rely on observational data and individuals are not interviewed directly<sup>92</sup>. RP methods are scarce in healthcare owing to specific features of this field, such as agency relationship, public/private insurance, and the existence of interventions that are not yet available in the market, resulting in a lack of data for these interventions<sup>93</sup>. As a result, SP methods have been commonly used, providing information about individual preferences from surveys<sup>94</sup>. It is beyond the scope of this study to go into further detail regarding RP methods.

SP methods can be based on qualitative approaches, such as individual or focus group interviews or can be quantitative, such as standard gamble (SG), time trade-off (TTO), person trade-off (PTT), and contingent valuation methods (CVM)<sup>93</sup>. One approach adopted by and further developed in health economics over the past decade is a discrete choice experiment (DCE)<sup>93,95-97</sup>. In the following text, some recent studies that used SP methods will be considered, focusing on studies conducted in settings that introduced a hospital choice reform program and on choice of birthing hospital.

Ryan and colleagues conducted an SP study among patients on the Isle of Wight, UK, that focused specifically on the trade-offs patients would be willing to make between waiting time and travel distance. They concluded that patients would forgo their preferred location if waiting times were reduced by at least 3.9 months<sup>98</sup>. The LPCP was established to offer NHS patients more choice over where and when they received treatment and to reduce waiting times. The attributes of hospitals in the LPCP included waiting time for the current hospital, waiting time for alternative hospitals, location of alternative hospitals, travel costs, reputation of alternative hospitals, and follow-up care. All of the attributes and levels significantly influenced a patient's likelihood of opting for an alternative provider<sup>99</sup>. A study in Germany investigated the preferences of the general public toward location and other attributes of surgical treatment. Responders were asked to choose their preferred provider of surgical care in a series of pairwise choices defined by five attributes. Patients based their choice between providers mainly on the characteristics of care delivery and not location of care. 'Specialization and experience of provider' was the single most important attribute, with subjects prepared to trade a four-week waiting time to obtain surgery at a highly specialized institution<sup>100</sup>. The preferences for an alternative to the local hospital were analyzed using a DCE, with six hypothetical choice sets, among patients in four areas of England. The study found that a lack of internet access had the strongest relationship with the decision to stay with the local provider. In contrast, patients that wanted more information regarding choice of a hospital, those with bad or mixed past experience of their local hospital, and those who had heard about the performance of hospitals in their area from the local media were most likely to choose an alternative hospital<sup>77</sup>. A labeled DCE was administered in New Zealand to determine

patient preferences for public and private hospitals. Patients preferred private hospitals to public ones; furthermore, the cost of surgery, waiting time for surgery, option to select the surgeon, and the condition of the hospital were other significant determinants of hospital choice for patients <sup>101</sup>.

Table 2 Search strategy for literature about choice of birthplace	
Inclusion criteria	<ul style="list-style-type: none"> <li>- Studies published after 1990</li> <li>- Written in English</li> <li>- Studies conducted in countries with universal health care system</li> </ul>
Post-hoc exclusion criteria	<ul style="list-style-type: none"> <li>- Reports</li> <li>- Mixed-method studies</li> <li>- Focus not on choice of birthplaces</li> <li>- Review articles *</li> </ul>
search string in PubMed	(women[TIAB] OR pregnant women[TIAB]) AND (birthplace[TIAB] OR intrapartum care[TIAB] OR home birth[TIAB] OR hospital birth[TIAB] OR midwifery unit[TIAB]) AND (Preferences[TIAB] OR choice[TIAB] OR decisions[TIAB])
* Reference list of the review articles are checked.	

A couple of studies have focused on women’s choice of birthplace or models of intrapartum care (table 2). In a study comparing birthing at home versus hospital for low-risk women, a conjoint analysis was used to estimate the relative importance of the attributes of intrapartum care. Women who chose a home birth valued the continuity of carer, a homely environment, and the ability to make their own decisions about what happens during labor and delivery. For the women selecting a hospital birth, an epidural for pain relief and the lack of a requirement to be transferred to another location during labor if a problem arose were the preferred attributes <sup>102</sup>. A study in the Netherlands was conducted to assess the relative importance of women’s preferences for various aspects of intrapartum care, with regard to their decision about place of birth, using a DCE method. A total of 562 low-risk, nulliparous women at 16 weeks of gestation responded to the questionnaire. All women showed a desire for involvement in decision-making, pain-relief treatment during birth, and no co-payment for childbirth. A home-like birth setting and assistance for transport during birth in case of complications were important aspects of care for women that desired a home birth <sup>103</sup>. In the Netherlands, low-risk pregnant women are free to choose to give birth at home or hospital. A study investigated preferences for various attributes of care with a focus on the influence of socio-economic characteristics and attitudes on a woman’s choice. As expected, Dutch women showed a preference for a home birth unless absence of medical pain relief incentivizes women to choose hospital birth. However, for those who opted for a hospital birth, the availability of a medical pain-relief treatment was a key attribute. Among socio-demographic factor, education and gestation age had significant effect on women’s choice <sup>104</sup>. A study in Scotland explored women’s preferences for key attributes of intrapartum care models. Attributes included the staff involved, pain-relief availability, and travel time to the delivery unit. The DCE results revealed that women preferred delivery in a specialist unit to home birth.

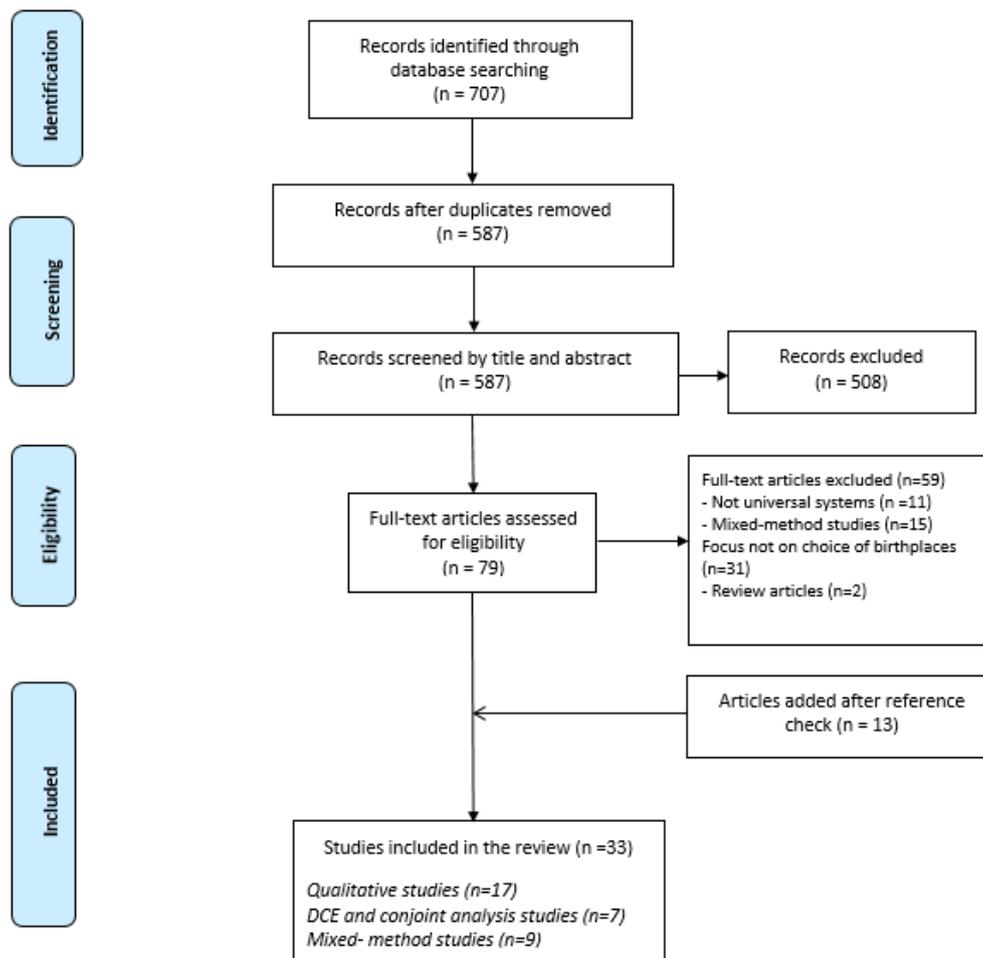


Figure 2 PRISMA flow diagram (choice of birthplace)

In addition, consultant-led care was preferred to midwife-managed care. Women were willing to travel approximately two hours to reach their preferred hospital <sup>105</sup>.

Hundley et al. conducted a study to explore the feasibility of using a DCE to assess the importance of different aspects of intrapartum care to women. The study found that women with low obstetric risk prefer maternity units that offer greater continuity of caregiver, more methods for pain relief, continuous fetal heart rate monitoring, a homely appearance, routine involvement of medical staff, and greater involvement for the woman in the decision-making process <sup>106</sup>. Hundley and Ryan investigated whether women who have access to systems of care that offer greater continuity of carer value this attribute more than women for whom the attribute is not a realistic option. They found that women in the area with least continuity rated this aspect of care significantly lower than women in other areas and suggested that the care in which is offered in systems do influence women's preferences for aspects of intrapartum care <sup>107</sup>. A study in Ireland that investigated women's preferences for alternative maternity care using a DCE showed that women prefer continuity of

midwifery care, immediate access to doctors and anesthesia during labor, being actively involved in decision-making about labor, and enjoying their time at hospital <sup>108</sup>.

As is shown in the above-mentioned literature, all birthplace studies included home birth or midwifery-led centers as an attribute in the design of the DCE. These results may be of little value for systems in which hospitals are the default birthplace, e.g., Denmark. The empirical work in this Ph.D. project, therefore, fills this gap and provides practical information regarding women’s preferences for birthing hospital.

This dissertation is based on three studies, which used different methods and different study populations. Table 3 summarizes the design and data sources used in each study.

Table 3 Study population, design, and data sources used in each study

	Study 1	Study 2	Study 3
<i>n</i>	134,049	13	517
Design	Retrospective cohort	Individual interviews	Discrete choice experiment
Data sources	Danish National Birth Register, Danish National Patient Register, National Registration of Danish	Informants sampled by general practices	Members of an online panel

The Central Denmark Region Data Approval Committee granted ethics approval for all studies (journal number 1-16-02-40-15) and the Central Denmark Region Health Research Fund, Aarhus University and the Health Foundation (Helsefonden- grant number 15-B-0122) funded the project.

## 2.1 Study 1: Uptake of choice, equity and efficiency

Equity is widely acknowledged to be an important policy objective in the healthcare sector. However, there appears to be considerable confusion over what is meant by equity in a healthcare context <sup>109</sup>. There are several definitions of equity in healthcare, with the most widely applied definitions being equal access for those in equal need, equal use for those in equal need, and equality of health.

Le Grand presented the concept of ‘equality in choice’ as the favored definition for equity <sup>110,111</sup>. He defines a distribution as equitable if it is the outcome of individuals making choices under equal constraints. In this approach, disparities in health states that arise from fully informed individuals exercising autonomous

preferences when facing the same range of choices over health are not inequitable, but disparities in health that can be related to differences in the constraints facing those individuals are inequitable. However, he acknowledges that the application of this definition of equity does raise a number of problems in relation to autonomous preferences and information concerning risk, and that these issues require further investigation and development <sup>110,111</sup>.

Culyer and Wagstaff suggest that 'equality of health' should be the dominant principle of equity <sup>109</sup>. They accept a moral philosophical definition of health, which argues that good health is essential for an individual to flourish as a human being and because healthcare is necessary for having good health, this provides an ethical justification for being concerned with the distribution of healthcare. In this sense, the demand for equity in healthcare is a derived demand from the equality of healthcare <sup>109</sup>.

Mooney argues that 'equity of access' is the superior equity criterion because equal access for equal need provides individuals with the opportunity to use the health services they require. This criterion may legitimately lead to different patterns of use for equal need, as individuals may choose to comply with treatments in various ways. This criterion is not met in the concept of 'equity of utilization' <sup>112</sup>.

The International Forum on Common Access to Health Care Services accepts equity of access as the most appropriate principle of equity for the healthcare policymaker to pursue. This concept of equity does not require that we discriminate between people who are already ill on the basis of factors that are exogenous to their health, and it respects acceptable reasons for differentials in healthcare utilization by those in equal need <sup>113</sup>. I therefore chose 'equity of access' as the definition of equity in this study. This is also the most widely used definition in the literature and government policy documents, which is defined as 'equal access for equal need' in different theoretical and empirical studies <sup>76,82,86,114,115</sup>.

### **2.1.1 Theoretical framework**

Economic models of consumer choice tend to assume that consumers will make rational decisions in pursuit of utility maximization. Economic theory initially focused on the utility associated with certain events, but later theoretical developments focused on the way consumers would maximize utility under uncertain circumstances <sup>31</sup>. The leading theory of decision-making under uncertainty is based on expected utility, which was first proposed by Daniel Bernoulli (1738) and was later reviewed by John von Neumann and Oskar Morgenstern (1947) <sup>116</sup>. Based on expected utility theory (EUT), women will choose a hospital that maximizes their utility; therefore, we used EUT as the basic theoretical approach of this study.

Among the theories of distributive justice that are relevant in the context of healthcare, the egalitarian principle of justice, which favor an equal distribution of healthcare to each of two individuals, was selected over the maximin and utilitarianism theories in this study, where all women were considered to have the same level of need. <sup>117</sup>. In comparison to a classical utilitarian allocation, the maximin principle would tend

to create practices that improve the health of the least well off and thereby make individuals more equal. However, the arguments that healthcare access should be distributed, not based on the maximin, but according to need, suggest that it would be unacceptable to rely on the maximin to justify access for the same need in cases of horizontal need <sup>118</sup>. Thus, another theoretical basis in this study is the egalitarian principle of justice.

Equity and efficiency can easily be in conflict <sup>119</sup>. When determining what will be financed from a given amount of resources, the overall objective should be to ensure that it is comprised of health interventions that will maximize the benefits to society (efficiency), whilst also accounting for the distribution of these benefits (equity)<sup>120</sup>.

Efficiency is a central theme of any sector of the economy, including health sector <sup>121</sup>. Increasing efficiency was also one of the main objective of introducing hospital choice. There are several definition of efficiency such as technical efficiency, cost efficiency, pareto efficiency and allocative efficiency <sup>117</sup>. The most widely used definitions are technical and allocative efficiency. Technical efficiency addresses the issue of using given resources to maximum health outcomes and allocative efficiency is achieved when resources are allocated so as to maximize the welfare of the community <sup>33</sup>. Under the conditions of a perfectly competitive market, allocative efficiency means satisfying consumer demand, given the distribution of tastes or relative valuation of different outputs <sup>117,121</sup>. Thus, allocative efficiency is another theoretical basis in this study.

### **2.1.2 Analytical framework**

According to EUT, an individual will choose a hospital if the expected utility they derive from that choice is greater than the expected utility associated with choosing other hospitals in their choice set. The willingness to bypass a non-specialized hospital to reach a highly specialized one was a focus of this study and is referred to as ‘up-specialization’.

It has been reported in the literature that SES is associated with access to healthcare <sup>29,31</sup>. In addition to SES, I also examined the association between up-specialization and an individual’s risk attitude, because this is an important concept within the health domain <sup>122</sup>. Smoking has previously been used as a proxy for risk attitude, where heavy smokers showed to be risk prone while ex-smokers were the most risk averse <sup>123</sup>. In addition, birth experience has been found to be a relevant proxy for risk attitude <sup>124,125</sup>. This study tested two hypotheses: 1) up-specialization is associated with a high SES, and 2) up-specialization is (holding SES constant) associated with risk aversion, proxied by smoking behavior during the first trimester and by birth experience.

### **2.1.3 Study design and population**

The study population was a retrospective cohort of women with uncomplicated pregnancies who gave birth at Danish hospitals during the period from 2005 to 2014. International Classification of Diseases (ICD)-10 codes were used to identify women with uncomplicated pregnancies. If a participant had any indication of a complicated pregnancy or if risk factors emerged during the course of their pregnancy, they were excluded from the study. Of 560,250 birth in Denmark during study period, 301,824 (54 %) were categorized as having complicated pregnancy.

### **2.1.4 Statistical analysis**

Logistic regression is a statistical technique that is used to model dichotomous response variables. To test the hypotheses in this study, I included selected variables of SES and risk aversion separately and then combined these variables in the main model.

The dependent variable was an indicator of whether women bypassed the nearest hospital to up-specialize (yes or no). Table 4 shows the different patterns of bypass behavior. It gives a broad overview of women's bypass behavior based on their nearest hospital and their selected birthing hospital. The definition of a hospital's level of specialization was based on the guideline for gynecology and obstetrics functions provided by the Danish Health and Medicines Authority ([www.sst.dk](http://www.sst.dk)). The guideline provides information about hospital functions in gynecology and obstetrics. It also introduces hospitals that offer services for different functions and divides them into regional functions and highly specialized functions.

The key to a successful logistic regression model is to choose the correct variables to enter into the model <sup>126</sup>. While it is tempting to include as many input variables as possible, this can lead to numerically unstable estimates and large standard errors with wide and imprecise confidence intervals <sup>126,127</sup>. Based on the hypotheses of this study, we decided to include SES, risk aversion, a control variable related to restrictions applied to access to hospitals, and two variables indicating travel investment as independent variables.

Access restriction was not consistent over time and this was carefully considered in data management by only considering it for the years that women had restriction in access. In addition, the structural changes in hospital sector over time are carefully considered in defining the independent variables (distance to the nearest hospital and additional distance to the nearest highly specialized hospital) and the dependent variable (specialty level of the nearest hospital).

Table 4 Definition of bypass behavior (number of individuals)

		Specialty level of the nearest hospital	
		Non-highly specialized	Highly specialized
Birthing hospital	Nearest hospital	No bypass (98,674)	No bypass (77,750)
	A hospital other than the nearest with a different level of specialization	Bypass for up-specialization (16,426)	Bypass for down-specialization (11,306)
	A hospital other than the nearest with the same level of specialization	Bypass for same-specialization (18,949)	Bypass for same-specialization (25,732)

I estimated three multivariate logistic regression models for the main analyses. Model 1 tested the association between up-specialization and high SES, model 2 tested the association between up-specialization and risk attitude, and model 3 included all of the variables (SES and risk attitude).

In addition, two alternative models were developed for sensitivity analyses. In alternative model 1, I controlled for visits to GPs, specialists, and midwives during pregnancy to test the timing and precision related to the assignment of ICD-10 diagnostic codes and the assessment of subjective need. In alternative model 2, we exchanged the access restriction with an annual fixed effect to investigate the effect of passing time on individual choices.

The analysis was performed using Stata version 14 (Stata Corp LP, College Station, TX, USA) on the Statistics Denmark server.

## 2.2 Study 2: A qualitative study of women's priorities regarding birthing hospital

Qualitative methods are extremely appropriate if the purpose of the study is to learn from the participants in a setting or to process the way they experience it, the meanings they place on it, and how they interpret what they experience. If the purpose of the study is to understand phenomena in depth and in detail, the researcher needs methods that enable the discovery of central themes and the analysis of core concerns<sup>128</sup>. Interviewing was the qualitative method that could provide us with an insight into the experiences, concerns and expectations of pregnant women regarding choice of birthing hospital.

### 2.2.1 Study design and population

To explore the priorities of women regarding hospital providers, we conducted a qualitative interview among low-risk, first-trimester pregnant women who had attended their first GP consultation. The interviews were aimed at identifying priorities for birthing hospital at the time of decision-making as well as the sources of information used to guide women's decisions. The interviews were conducted using a semi-structured interview guide, which is depicted in following Table.

Table 5 An overview of the interview guide

Warming up	<ul style="list-style-type: none"><li>• Introduction from researcher about the aim of study</li><li>• Background information from informant</li></ul>
Choice of hospital	<ul style="list-style-type: none"><li>• Arguments for choice of hospital</li><li>• Information seeking Process</li><li>• Considering other birthplace options (other hospitals or home birth)</li></ul>
Conclusion	<ul style="list-style-type: none"><li>• Advantages and disadvantages of her choice</li><li>• Asking about any other attribute that the informant did no mentioned</li></ul>

In selecting the site of clinics, different distance to hospitals as well as differences in the SES of the towns were considered. Participants had the opportunity to choose among highly specialized and different regional hospitals in the region. In spite of existence of the catchment area, we made an agreement with the highly-specialized hospital managers to admit participants of this study for giving birth. To do so, a protocol was defined to ease the process of admission. Participants were informed about the study at their initial GP visit and after giving consent to participate they were contacted to provide further information about the study and set up an interview.

The final sample included 13 pregnant women who were recruited by five GP clinics in four small towns in the Central Denmark Region. Participants were aged 23-39, with various education level, all were employed except for two who were seeking job and one who was a student. Four women were expecting their first baby, five were expecting their second and the rest were expecting their third baby. All interviews except one took place between 7 and 12 weeks of pregnancy at my workplace (DEFACTUM), the participants' home, or by phone. The first interview lasted 28–47 minutes, but for three participants a second phone interview was conducted for further clarification.

## 2.2.2 Data collection and analysis

The interviews were conducted from February to June 2016, and were audio-recorded, transcribed verbatim, and the data were entered into the NVivo software (version 10, QSR International, Melbourne, Australia). After transcribing each interview, we simply read the transcript and wrote notes and preliminary codes.

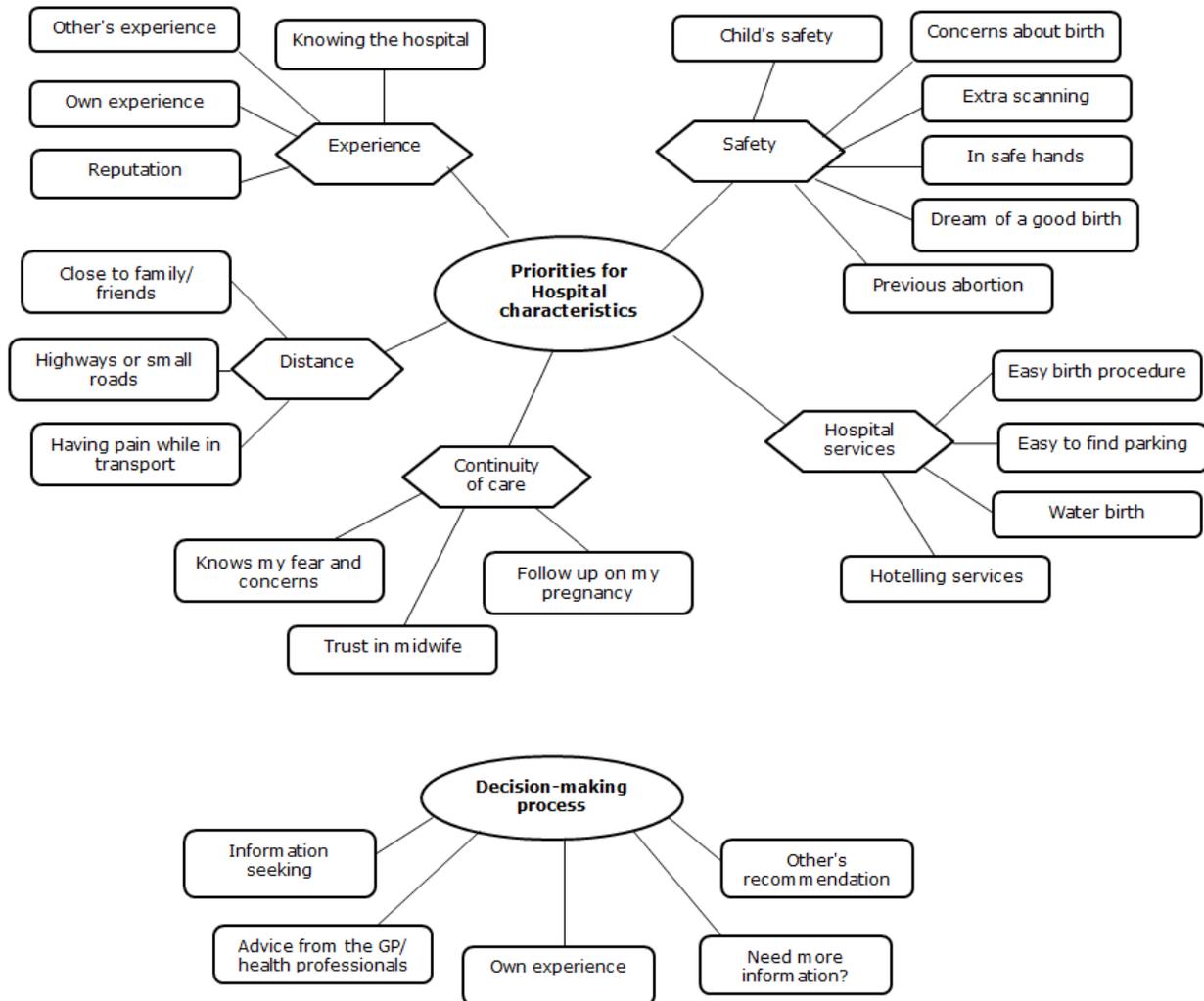


Figure 3 Thematic map

Preliminary codes were discussed between the authors (NTD, SL and AM) and the definition and content of each code was further developed and described to secure a final coding. After coding all the material, a thematic analysis was conducted for identification of the themes. This phase, which re-focuses the analysis at the broader level of themes, rather than codes, involves sorting the different codes into potential themes, and collating all the relevant coded data extracts within the identified themes<sup>129,130</sup>. We used a thematic map to

identify and illustrate the relationship between codes and between themes. Ambiguous or disconfirming data were discussed with other co-authors to clarify the issue. Within each theme, quotes illustrating different aspects of the theme were chosen and are presented in the results section.

Applying qualitative methods is not my core competency as a researcher; in addition, there was a language barrier and cultural differences to fully understand the participants. I took several steps to overcome the shortcomings of my competency in this field. First, I worked in close collaboration with a senior researcher in anthropology, who supervised my work systematically throughout the whole process. Additionally, I participated in a qualitative course, which provided me with theoretical knowledge of different qualitative methods and practical knowledge of data collection and analysis. To overcome the language and cultural barriers, an assistant helped me to conduct and transcribe the interviews and undertake the data analyses. In addition, I conducted several test interviews with my colleagues to increase my skills in doing interviews and to improve the interview guide.

### **2.3 Study 3: Discrete choice experiment**

One SP method, which has been further developed over the past decade, is the DCE, which has the advantage of estimating the utility of attributes that make up the goods or services<sup>95,131,132</sup>. DCEs have a long-standing theoretical basis in random utility theory, and are generally applied and consistent with economic demand theory<sup>133</sup>.

#### **2.3.1 Theoretical framework**

The DCE approach is grounded in characteristics demand theory<sup>134</sup> and draws its microeconomic foundations from RUT<sup>135</sup>. The characteristics demand theory states that goods or services possess characteristics or attributes, which give rise to utility. According to RUT, respondents are rational decision makers and are assumed to choose the alternative with the highest utility level. Based on RUT, the utility function has an observable component and a non-observable component. The observable part is a function of the attributes of the good or service, and the characteristics of the individual and their taste, and the random component is due to unobserved attributes or measurement errors.

Additionally, the hypothetical choice scenarios offered in DCE are constructed using experimental design theory. The appropriate design and implementation of DCEs requires consideration of the choice context, nature and composition of choice sets, and framing of choice questions and instructions. The experimental design influences the types of utility functions that can be estimated from choices<sup>93,136</sup>.

There are several guidelines for conducting a DCE study, such as the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) task force on conjoint analysis, which consists of ten items<sup>94</sup>. Ryan et al. has also provided guidance on how to conduct a DCE<sup>97</sup>. Lancsar and Louviere assembled a checklist of factors to consider when undertaking and assessing the quality of a DCE<sup>93</sup>, which I used in the execution of this study.

### **2.3.2 Defining attributes and levels**

To define the attributes, I first conducted a literature review (please see pages 16-20). The design of the DCE was guided by the qualitative study which is proven to result in a meaningful and valid design<sup>137</sup>.

The analysis of the qualitative study resulted in the identification of five categories that together determined pregnant women's priorities regarding choice of hospital:

- 1) Previous experience: women had trust in the hospital that they were already familiar with, regardless of whether they had a positive or negative experience at that hospital.
- 2) Safety: women felt safer at a hospital with more specialist services and more experienced and competent staff. They showed concern both for the safety of themselves and their newborn child.
- 3) Distance and accessibility: a close distance to their home and short travel time affected the choice of hospital; however, in some cases there was a trade-off between distance and the specialization level of services at a hospital.
- 4) Continuity of care: women agreed that continuity of midwifery care represented an ideal birth and those who did not have this opportunity expressed it as the only disadvantage of choosing a highly specialized hospital.
- 5) Hospital service attributes: women considered several aspects of the hospital services on offer to be important when making decisions about a hospital. The possibility of laboring in water and hoteling services were the most notable attributes.

On the basis of the literature and when the qualitative study was ready, we selected the attributes to be included in the DCE study and provided an understandable definition of each attribute. We chose to include a total of five attributes; four attributes were categorized as having three levels: continuity of midwifery care, availability of a neonatal intensive care unit (NICU), hospital services offered, and a hospital's level of specialization in handling rare and serious events arising from childbirth, in addition to the travel time attribute (Table 6). Danish patients pay for travel costs only if they choose a hospital

beyond their home region. For this reason, the time constraints were considered to be stronger and more realistic than budget constraints, and thus more policy relevant.

Table 6 Attributes and levels

Attribute	Level
The same midwife is responsible for the whole period of pregnancy and birth	- NO - Not sure - Yes
Availability of an NICU	- NO - Yes, but not at a highly specialized level - Yes, at a highly specialized level
Hospital services on offer (for example the possibility of a water birth, hoteling services after birth etc.)	- Not available - Depends on workload - Available
The hospital's level of specialization in handling rare and serious incidents that affect the mother's health during childbirth	- Standard at handling a normal birth - Standard at handling a complicated birth - Highly specialized at handling a complicated birth
Travel time	- 15 min - 30 min - 45 min - 60 min - 90 min - 150 min

Three levels were identified for the attribute continuity of midwifery care as women are typically guaranteed continuity of midwifery care at regional hospitals (*Yes*), however this can not be guaranteed at some hospitals due to heavy workload (*Not sure*) and in some hospitals, continuity of midwifery care is not provided (*No*). Three levels were defined for availability of an NICU. Highly specialized hospitals provide highly-specialized NICU services (*Highly specialized NICU*). Regional hospitals may or may not provide NICU services. In case regional hospitals provide NICU services, it is provided in lower level of specialization than highly-specialized hospitals. The attribute for hospital's ability to handle rare events had three levels, which mimic the real situation of highly-specialized and regional hospitals. Highly-specialized hospital provide specialized care for all types of complicated birth while regional hospitals provide standard services and they may be able to handle complicated birth or are just capable of handling normal birth. For the hospital service attribute, three levels were assigned due to diversity in service provision at different

hospitals and the workload. There are hospitals that guarantee access to desired services such as water birth (*Available*). However, at some hospitals the provision of these services depends on workload (*Depends on workload*) and some other hospitals do not provide such services (*No*). And finally six levels were assigned to travel time attribute and describe 15, 30, 45, 60, 90 and 150 minutes of travel time. To validate the included travel time, we asked ten women living in different regions and with different educational backgrounds to specify the maximum travel time they would be prepared to undertake to reach a hospital that provided their preferred level of other attributes.

Furthermore, to validate the attributes to be included, their definitions, and the assigned levels, I presented and discussed them in two focus group interviews, each with three women and two individual interviews. We also asked participants if they considered any important variables to be omitted, and if they found or considered assigned attribute levels and their definitions appropriate and relevant. Additionally, I asked ten women to specify the maximum travel time they would be prepared to undertake to reach a hospital that provided their preferred level of other attributes.

### **2.3.3 Creating experimental design**

Experimental design is a combination of attribute levels that construct choice alternatives and hypothetical scenarios. The experimental design evolved from orthogonal designs to efficient designs. The aim of determining an efficient experimental design is to generate stated choice tasks that maximize the information collected regarding individual preferences, yielding more reliable parameter estimates with an equal or lower sample size<sup>138-141</sup>. A D-efficient design was used for this study by taking a Bayesian approach. We generated a fractional factorial design to create the survey using Ngene version 1.1.2<sup>142</sup> using priors of zero for the marginal utility of attributes.

The appropriate number of choice sets is context specific and should be based on ensuring a manageable number of choice sets for respondents and a consideration of how these affect preferences<sup>143,144</sup>. From the literature, it was determined that a number of choice sets between 6 to 18 was acceptable<sup>145</sup>; however, the complexity of the tasks and the variability that we cannot observe should be considered<sup>146</sup>. We initially considered including 12 choice sets containing three alternatives of hospitals A, B, and C in a pilot study to inform the main design. The pilot surveys ensured the validity of the DCE design before the final administration. The final design consisted of 12 choice sets, each with three alternatives as the pilot design.

The chosen attributes and levels were used to design the DCE, in which women were presented with choice sets containing three alternatives (hospital A, hospital B, and hospital C). We generated a fractional factorial design to create a subset of 36 profiles, divided across 12 choice sets. A pilot study of 12 choice sets was undertaken to inform the main design. A total of 50 women who were members of the online panel completed the pilot study, and the data were analyzed using multinomial logistic (MNL) regression and

random parameters logit (RPL) model regression in Biogeme <sup>147</sup>, enabling priors to be obtained for updating the design.

#### **2.3.4 Questionnaire design and pilot tests**

The final DCE survey consisted of three sections. The first section collected information on the participants' characteristics and their health behavior. The questions about health behavior were extracted from the Danish National survey 'How Are You?'. The second section contained the 12 choice sets as well as the respondents' ratings of the difficulty of the survey and the level of assurance in their responses. The last section included questions on health literacy, regrets, and risk attitude.

The Health Literacy Questionnaire (HLQ) is a widely used measure of health literacy and was developed using a validity-driven approach including in-depth grounded consultations, psychometric analyses, and cognitive interviews <sup>148</sup>. The HLQ consists of nine scales. The translation and cultural adaption of the questions from English into Danish followed a rigorous forward-backward translation procedure and cognitive testing to ensure cross-cultural validity <sup>149</sup>. In this survey, only two of the nine scales were included: actively engage with healthcare providers (scale 6) and understanding health information well enough to know what to do (scale 9). Additionally, we have also studied the effect of risk and regret attitude on individuals' preferences. We used Dohmen's self-reported willingness to take risks in health (SOEP-H), because its cross-validity and temporal stability have been validated and proven in comparison to other available risk preferences measures <sup>150</sup>, and a regret scale developed by Schwartz et al. was used to investigate the role of regret in future decision-making <sup>151</sup>.

Only text was used to communicate the attributes and levels information to participants; however, graphics and multimedia are now commonly used to inform participants <sup>152</sup>. After finalizing the questionnaire, it was presented to fifty women who were members of an online panel as a pilot test of the design. To ensure that the pilot sample included women of pregnancy age, we chose to recruit women aged 18–40, who were distributed evenly in different regions of Denmark and had different levels of education. To minimize selection bias, respondents were not informed about the content of the DCE survey.

#### **2.3.5 Sample size**

Adequate sample sizes are crucial to obtain sufficient statistical power to test hypotheses in DCE studies <sup>153</sup>. The rule of thumb for calculating the sample size <sup>154</sup> does not address the issue of minimum sample size requirements in terms of the statistical power of hypothesis tests on the estimated coefficients. Hence, I used a step-by-step guide for the calculation of the minimum sample size requirements to ensure the correct sample

size for the study <sup>155</sup>. Following this guidance, a minimum sample size of 220 respondents was determined, with a statistical power of 0.8 and 95% certainty that all parameter estimates were different from zero. Participants were recruited by the user-needs online panel, which is used for the purpose of survey research in Denmark. The same criteria for inclusion were applied as for the pilot sample to allow the estimation of reliable models.

### 2.3.6 Data collection

The online survey was administered via an online panel. When comparing different modes of data collection in the literature, no differences were found regarding the validity of the data gathered over a range of parameters <sup>156,157</sup>. Data collection for the pilot study occurred from May to June 2017 via the user-needs online panel as the pilot study. We did not use any incentive to enhance the response rate.

### 2.3.7 Discrete choice analysis

The analysis of the choices made in the DCEs was based on RUT. Based on the RUT, the utility that individual  $n$  derives from alternative  $i$  among  $j$  alternatives, is given by the following equation:

$$U_{ni} = V_{ni} + \varepsilon_{ni} \quad (1)$$

Where  $V_{ni}$  is the observable component of the utility and  $\varepsilon_{ni}$  is the unobservable (random) component, which is identically independently distributed (iid) over alternatives. The basic model for analyzing stated preference choice data is MNL; however this model assumes homogeneous preferences for all respondents <sup>158,159</sup>. A concern raised by many researchers is the assumption of the independence of irrelevant alternatives (IIA) that is implicit in the MNL model <sup>160</sup>.

The shortcomings of MNL model have led to the development of other models such as latent class model (LCM) and random parameter logit (RPL) model. The underlying theory of the LC models posits that individuals' choice behavior and preferences can be allocated into a set of  $Q$  latent classes and preferences within each class are assumed to be homogenous, but allowed to differ across classes <sup>161</sup>. Part of the appeal of this approach is convenience of interpretation of variation across segments in the population, however it is suggested that LCMs understate the extent of heterogeneity in choice data <sup>162</sup>, especially when a small number of classes is defined and the underlying distribution of preferences is, in fact, continuous within classes <sup>163</sup>.

An alternative approach is the highly flexible RPL model that in theory can approximate any probabilistic choice model <sup>164</sup>. The RPL model allows for random taste variations, thereby accommodating unobserved

heterogeneity for observed attributes. Applications including an RPL specification can be found in healthcare, among other areas <sup>165,166</sup>.

To measure women's preferences, the choices from the experiment were analyzed using an RPL regression. If a sampled woman ( $n = \{1, 2, \dots, N\}$ ) faces a choice among  $J$  hospitals in each of  $T$  choice situations, the utility that woman  $n$  derives from choosing hospital  $j$  on choice occasion  $t$  is given by:

$$U_{njt} = \beta_n X_{njt} + \varepsilon_{njt} \quad (2)$$

Where  $\varepsilon_{njt}$  is a random term that is assumed to be an independently and identically distributed extreme value.  $X_{njt}$  is a vector of explanatory variables and  $\beta_n$  is a vector of coefficients of these variables representing women's tastes. The density for  $\beta_n$  is described as  $f(\beta_n|\theta)$ , where  $\theta$  refers to the parameters of the distribution (mean and variance). The conditional probability of woman  $n$  choosing alternative  $i$  from a total of  $J$  alternatives on choice occasion  $t$  is given by:

$$P(i_n | x_n, \beta_n) = \frac{\exp(\beta_n X_{nit})}{\sum_{j=1}^J \exp(\beta_n X_{njt})} \quad (3)$$

Consider a sequence of alternatives, one for each time period,  $\mathbf{i} = \{i_1, i_2, \dots, i_T\}$  conditional on  $\beta$  the probability that the woman makes this sequence of choices is the product of logit formulas:

$$L_{ni}(\beta) = \prod_{t=1}^T \frac{\exp(\beta_n X_{nit})}{\sum_{j=1}^J \exp(\beta_n X_{njt})} \quad (4)$$

The  $\varepsilon_{njt}$ 's are independent over time. Under the RPL, we assume that  $\beta_s$  are individual-specific and the unconditional probability of the observed sequence of choices is the expected value of the logit probability over the integral of this product over all values of  $\beta$  weighted by their density  $f(\beta|\theta)$ :

$$P_{ni} = \int L_{ni}(\beta) f(\beta|\theta) d\beta \quad (5)$$

This integral is approximated using a simulation method by taking draws from the density function  $f(\beta|\theta)$ , calculating conditional probabilities for each draw and averaging the results. This average is the simulated probability. The log likelihood (LL) for the model is given by:

$$LL_\theta = \sum_{n=1}^N \ln P_{ni}(\beta) \quad (6)$$

This equation cannot be solved analytically because the integral will not have a close form. Therefore the simulated probabilities are inserted to the LL function to give a simulated LL (SLL):

$$\text{SLL}(\theta) = \sum_{n=1}^N \ln\left\{\frac{1}{R} \sum_{r=1}^R L_{ni}(\beta_n^r)\right\} \quad (7)$$

Where  $R$  is the number of replications and  $(\beta_n^r)$  is the  $r$ th draw from  $f(\beta|\theta)$ . The maximum simulated likelihood estimator (MSLE) is the value of  $\theta$  that maximizes SLL.

To maximize the log-likelihood of equation 5, we used 800 pseudo-random draws in the final model. All parameters except for travel time were assumed to be random with a normal distribution. Travel time was kept fixed to make the computation of willingness to travel (WTT) more straight forward. The distribution of WTT takes the form of the distribution of the attribute coefficients, hence holding travel time constant is a convenient assumption which allows for easy estimation of WTT and interpretation of the results.

DCEs allow the estimation of trade-offs that respondents make between attributes, or their marginal rate of substitution (MRS) <sup>167,168</sup>. The MRS for each attribute was calculated as the WTT relative to changes in the levels of each of the other attributes. The mean WTT was estimated as the ratio of the respective attribute coefficient to the travel time coefficient, while holding other attributes at the reference level. The Delta method was used to calculate the confidence intervals of WTT measures, which avoided most of the simulations by deriving partly analytical expressions for the standard errors <sup>169</sup>.

To test the validity of the study, I analyzed the impact of excluding participants who were defined as outliers. Outliers were defined as participants who failed the rationality check, which was an assessment of whether participants consistently chose either hospital A, B, or C across all choice scenarios or did not choose a clearly superior alternative. Another group of outliers was those who responded to the survey at the mean response time  $\pm$  one standard deviation.

Respondents' previous knowledge and experience with health outcomes or services may influence their preferences; hence it is important to elicit respondent-specific health and sociodemographic information to allow for testing for systematic differences in preferences based on these characteristics (e.g., attitudinal, health history and/or status, treatment experience) <sup>94,170</sup>. To increase generalizability of the findings, it is suggested to consider respondents' health status as part of the study design as their health status may influence their preferences in a systematic way <sup>94</sup>. If respondents' preferences vary according to specific characteristics or experiences, identifying these subgroups could be valuable in tailoring programs to specific types of patients or targeting interventions to individual preferences for health outcomes <sup>94</sup>.

To account for heterogeneity in preferences with regard to the effect of pregnancy-related factors, sub-group analyses were conducted to assess prior birth experience, previous experience with abortion or pregnancy

complications, future pregnancy plans, as well as health literacy, risk, and regret attitudes on women's preferences. To test complexity of the choice tasks and certainty level of responses, we asked about these topics after choice sets.

### 3 Results

This chapter provides a brief and reflective summary of the results using state-of-the-art research methods within the subject area.

#### 3.1 Hospital choice

The Danish register databases provided us with a great opportunity to include various possible determinants of hospital choice. The most important benefit of the register data was the ability to segment women having complicated or uncomplicated pregnancies, making it straightforward to study equity of access to medical services for women with the same level of need. In addition, the availability of other relevant and important data such as smoking behavior and visits to health care providers during pregnancy enabled us to study the association between these factors and choice of hospital.

According to Table 4, 72,413 (29%) of the study population bypassed their nearest hospital for another hospital with the same, a higher, or a lower level of specialization. Of 134,049 women who were living near a non-highly specialized hospital, 16,426 (12%) chose to bypass that hospital for one with a higher level of specialization. Exercising choice of hospital has been reported for different groups of patients in different studies, and patients showed different motivations for exercising their choice. Among other reasons, shorter waiting time has been reported as a motivation for exercising the right to choose among patients who needed artificial hip or knee implantation<sup>23</sup>, cataract surgery<sup>25,171</sup>, neurosurgery<sup>172</sup>, and other types of surgery<sup>27</sup>, as well as patients with coronary heart disease<sup>29</sup>. Some studies also found that patients are motivated to choose if there are significant differences in quality of services; elective patients who needed hip surgery showed willingness to travel longer for an increase in quality of services derived from patient-reported health outcome measures<sup>173</sup>. Patients who needed angioplasty have also responded to publicly available quality ratings; however, it is argued that imperfect quality information may result in suboptimal choices and risk selection<sup>57</sup>. There have also been studies showing that patients would choose a hospital based on both waiting time and quality of services for hip replacement<sup>53,56,174</sup> and orthopedic and neurosurgery<sup>175</sup>, among others.

We cannot provide answers about women's motivations for their bypassing behavior, mostly owing to the unavailability of information. For women who bypassed their nearest hospital in favor of a highly specialized one, it seems that the specialty level of the hospital can play a part in their choice. There must be many factors, especially for those who down-specialize or choose a hospital at the same level of specialization.

The results of our study (see Table 7) confirmed the hypothesis that preferences driving hospital choice are heterogeneous for women belonging to different SES groups. Highly educated women were more willing to

travel to access a highly specialized hospital than were less educated women (OR=1.50). However, employment status and income level were not associated with up-specialization. Another Danish study found some horizontal inequity disfavoring lower income groups only in sectors with a high degree of copayment, such as dentistry <sup>176</sup>.

Table 7 Estimation results

	Up-specialization model OR (95% CI)	General bypass model OR (95% CI)
Education (years)		
<3	1	1
3-5	1.20*** (1.14-1.26)	1.03* (1.00-1.05)
≥5	1.50*** (1.40-1.60)	1.03* (1.00-1.07)
Employment		
Not active in labor market	1	1
Active in labor market	.69*** (.64-.75)	.89*** (.85-.92)
Income (quartiles)		
1st	1	1
2nd	.95 (.88-1.02)	.94*** (.91-.97)
3rd	.88** (.82-.95)	.89*** (.86-.929)
4th	.74*** (.69-.80)	.84*** (.81-.87)
Birth experience		
No	1	1
Yes	.71*** (.68-.74)	.82*** (.80-.84)
Smoker during 1st trimester		
No	1	1
Yes	.84*** (.78-.91)	.98 (.95-1.01)
Access restriction		
No	1	1
Yes	.62*** (.57-.67)	.80*** (.78;.83)
Distance to nearest hospital in km	.962*** (.960-.964)	1.006 *** (1.005-1.007)
Additional distance to a highly specialized hospital in km	.924*** (.923-.926)	.916*** (.915-.917)
Number of observations	104,519	225,971
Prob > chi2	0.000	0.000
Pseudo R <sup>2</sup>	0.3477	0.1829

OR= Odds Ratio, Significance is indicated by: \*\*\* p<0.001; \*\* p<0.01; \* p<0.05, NA= not applicable

As education is a reflection of other SES elements, one may speculate that there is probably endogeneity (in which the value of one independent variable is dependent on the value of other predictor variables <sup>177</sup>) and therefore some degree of correlation between education, employment and income. To examine this issue, I

consider using the most widely used diagnostic tool for multicollinearity, the variance inflation factor (VIF). VIF estimates how much the variance of a coefficient is inflated because of linear dependence with other predictors<sup>178</sup>. According to literature, multicollinearity can be safely ignored if the VIF is less than 2.5<sup>178</sup>, which was the case in this study. In addition, one of the solutions to multicollinearity is increasing the sample size; however, the large sample size of this study already resulted in small standard errors and narrow confidence intervals for all coefficients. Furthermore, to test the robustness of the results, I conducted the same model while including SES element separately (the results are not presented here). The results indicate a positive association between education and up-specialization and a negative association between employment and income and up-specialization.

As recommended by Angrist in *Mostly Harmless Econometrics*, education is the best determinant of SES, as it predicts other SES components in a narrow statistical sense<sup>179</sup>.

Available literature demonstrates mixed results regarding the association between SES and uptake of choice. An association between higher education and uptake of choice has been reported in studies in Norway and the UK<sup>31,84</sup>. The LPCP did not find evidence of inequalities in uptake of an alternative hospital based on social class, educational attainment, income, or ethnic group, but people in paid employment were more likely to opt for an alternative hospital than those not in paid employment<sup>29</sup>. A study in Norway found pro-reach and pro-educated inequalities in utilization of hospital outpatient services and private medical specialists; however, there was equality regarding free-of-charge services<sup>180</sup>.

In addition to SES, women's attitude to risk was a factor in their choice of birthing hospital. For some women with no need for highly specialized services, there appeared to be uncertainty about the optimal hospital, and a risk-averse attitude motivated them to bypass the nearest hospital for up-specialization. Studies using qualitative methods have found that women's understanding of risk plays a substantial part in whether they choose hospital birth over either homebirth or birth at a midwife-led center<sup>106,124,125</sup>. As it was expected, putting restriction in access to hospitals and longer distance to the nearest hospital have negative association with up-specialization (OR of 0.62 for access restriction and 0.96 for distance to the nearest hospital).

Further analysis was performed for a general model of bypassers versus non-bypassers (Table 7). I also conducted a multivariate regression for women who bypassed the nearest hospital ( $n = 72,413$ ) versus those who did not ( $n = 176,424$ ). Almost the same association was found in this model as in the up-specialization model; however, understanding the motivation for bypassing was more difficult in the general model owing to a mixture of hospital specialty levels and many other unobservable factors. This is also shown by the pseudo  $R^2$  of 0.35 for the up-specialized model versus 0.18 for the general bypass model.

For purposes of this study, only SES and risk-averse proxies were included, with adjustments for investment in travel distance and access restrictions. However, I have also used models including a number of other variables, such as age, BMI, number of hospitals in radius of 30 km and 50 km and used purposeful selection of covariates in logistic regression. Adjusting for these variables, all the analyses supported the main findings and demonstrated the robustness of the study.

### **3.2 Qualitative study of women's priorities regarding birthing hospital**

Understanding the priorities for hospital choice from a women's perspective provides valuable insight into healthcare delivery, especially at a time when government policy statements have emphasized the provision of choice for citizens. This study showed that women appreciate removing restriction in access to highly specialized hospital and they are willing to choose a highly specialized hospital for giving birth. This applies specially for those who have experience with giving birth at the highly specialized hospital.

The analysis of the interviews resulted in two overall themes being identified. First, it showed that women made independent decisions about the choice of birthing hospital, with experiences of a hospital (their own or those of relatives/friends) being the main source of information determining their choice of hospital. This was surprising because we expected women to search for information regarding their ideal hospital. However, it seemed that the study participants had already determined their priorities. This was confirmed by a study in Canada, which found that women made the decision about birthplace either before becoming pregnant or during the first trimester <sup>181</sup>. In another study, Regan and McElory showed that the majority of women knew what type of birth they wanted from an early stage in pregnancy and their choices were aligned with their understanding of risk <sup>182</sup>.

Second, the interview findings suggested that five categories were prioritized by pregnant women when choosing a hospital: previous experience, safety, distance and accessibility, continuity of care, and hospital service attributes. These findings have direct relevance for service provision, as they provide insight into how women prioritize between different hospitals attributes, and how they react to the concept of choice of hospital.

In this study, women who had previous experience with giving birth chose to give birth at the same hospital that they had previously used. This can be considered an attempt to avoid regret by choosing another hospital, with several studies showing that previous experiences shape our expectations of regret related to our decisions <sup>183,184</sup>. Choice models based on random regret minimization (RRM) have been applied in

studies of travel choice and have recently been introduced to health economics. RRM models hypothesize that individuals attempt to minimize regret rather than maximize utility when they have to choose <sup>185,186</sup>.

Risk attitude also played an important role in this study by making some women choose a hospital with skilled staff and specialized services, for the safety of both the mother and the newborn. Previous studies about the choice of birthplace or the choice of maternity care have included homebirth or maternity-led centers as alternatives to hospital birth. The results of qualitative studies mostly emphasized the role of risk/safety in giving priority to hospital birth; when women planned hospital birth, they often conceptualized birth as medically risky <sup>124,182</sup>, in addition medical model of birth and access to pain medication were other factors to choose hospital over other birth settings <sup>181,187</sup>.

### **3.3 Discrete choice experiment**

The results from the analysis of the choice data is presented in Table 8. As a point of reference, our analysis starts with the standard MNL model that assumes homogeneity of preferences in the sample. According to the MNL results, all parameter estimates are statistically significant and are in line with our expectations. In general, women prefer a hospital that provides continuity of midwifery care, has NICU department, Provides different birthing services and can handle rare events under birth. The sign of the travel time coefficient is both negative and significant, implying that respondents, *ceteris paribus*, prefer a hospital that is located within a short distance to them.

Moving from the MNL model to the RPL model shows substantial improvement in the model fit (around 370 log-likelihood units), suggesting the existence of unobserved sources of preference heterogeneity. This explains the superiority of RPL over MNL model. In both MNL and RPL models, the two alternative specific constants (ASC) parameters were significant, suggesting that women's choices were influenced by factors other than the included attributes. The results of the RPL model show similarities to the MNL results, confirming that all hospital attributes were important to women when evaluating hospitals. The availability of NICU is the key driver of women's preferences, as indicated by the significantly large impact on utility.

The estimated standard deviations showed that, there was heterogeneity for the availability of NICU and hospital's level of specialization; however, the estimated standard deviations were smaller than the estimated coefficients. The greatest heterogeneity in preferences surrounded the highest level of 'continuity of midwifery care'. This can be interpreted as women having more variations in their marginal utilities when they have continuity of midwifery care as opposed to not having midwifery care. The small and insignificant estimated standard deviation for the middle levels of 'continuity of midwifery care' and 'hospital service offer', showed that there was no heterogeneity between these levels and the reference level of the attributes.

The results of this study are not comparable with those of previous studies about birthplace choice, because the attributes included were different in sense that we only include attributes of hospital care (not other birthplace options such as home birth). The only similar attribute included in previous DCEs was continuity of care, which was found to be a significant driver of women’s choice of birthplace<sup>102,106–108</sup>.

Table 8 Estimation results

Variable	MNL	RPL	
	Coefficient (SE)	Coefficient (SE)	SD (SE)
ASC_1	0.13** (0.041)	0.14* (0.054)	0.33** (0.137)
ASC_2	0.21** (0.039)	0.20** (0.046)	0.11 (0.164)
Continuity of midwifery care			
No	Reference	Reference	Reference
Not sure	0.20** (0.023)	0.27** (0.029)	0.08 (0.064)
Yes	0.48** (0.019)	0.61** (0.043)	0.70** (0.043)
Availability of an NICU			
Not available	Reference	Reference	Reference
Yes, but not highly specialized	0.57** (0.023)	0.71** (0.037)	0.28** (0.050)
Yes, highly specialized	0.74** (0.022)	0.95** (0.048)	0.45** (0.039)
Hospital services offered			
Not available	Reference	Reference	Reference
Depends on workload	0.23** (0.023)	0.32** (0.030)	0.02 (0.031)
Available	0.37** (0.021)	0.51** (0.033)	0.24** (0.039)
The hospital's level of specialization			
Standard for normal birth	Reference	Reference	Reference
Standard for a complicated birth	0.37** (0.020)	0.43** (0.031)	0.20** (0.041)
Highly specialized for a complicated birth	0.48** (0.023)	0.62** (0.040)	0.34** (0.052)
Travel time	-0.024** (0.001)	-0.032** (0.002)	NA
SE= Standard Error; ** indicates significant at 1% level.	Log-likelihood = -4891.538 Rho-square= 0.282	Log-likelihood = - 4522.411 Rho-square= 0.336	

Using preference data from the RPL model, women’s marginal WTT for the different attributes were calculated. The relative importance of attributes varied considerably; women were willing to travel 30 minutes (95% CI 28.47–31.53) to ensure they can give birth at a hospital, which has specialized NICU department. The second most valued attribute was the hospital level of specialization. Women were willing to travel around 19.5 minutes (95% CI 18.73–20.25) to give birth at a hospital that could handle complicated births. For availability of midwifery care, women were willing to travel 19.37 (95% CI 17.89–20.85) minutes and for hospital service offer, women were willing to spend an additional 16.14 minutes (95% CI 15.37–16.90) in travel.

Subgroup analyses were conducted to determine whether there was any heterogeneity among participants with regard to pregnancy-related factors, socio-economic characteristics and individual perceptions and attitudes (here, I focus on previous experience with birth and risk attitude (Table 9)).

Women with and without prior birth experience prefer a hospital that provides continuity of midwifery care, has NICU department, Provides different birthing services and can handle rare events under birth. However there are some differences between the groups as the women who do not have birth experience, put more weight on each attribute. We observed a significantly greater WTT to access a specialized hospital and higher levels of other hospital attributes for women without birth experience e.g. women without birth experience were willing to spend an additional 11 minutes to reach a hospital with highly specialized NICU compared to women who had birth experience.

Table 9 Willingness to travel (WTT) (95% CI)

Attribute	Improvement in attribute	Prior experience with giving birth		Risk attitude	
		Yes (n = 178)	No (n = 339)	Lover (n = 174)	Averse (n = 343)
Continuity of midwifery care	Maybe available as opposed to not available	4.27 (3.68 to 4.87)	12.77 (11.15 to 14.38)	7.04 (6.08 to 8.00)	9.54 (8.33 to 10.76)
	Available as opposed to not available	6.21 (5.49 to 6.92)	30.04 (27.50 to 32.57)	19.49 (16.37 to 22.25)	19.09 (17.44 to 20.74)
Availability of an NICU	NICU available but not highly specialized as opposed to not available	18.93 (16.67 to 21.20)	27.54 (25.75 to 29.32)	18.38 (16.22 to 20.54)	25.60 (23.72 to 27.48)
	NICU available at a highly specialized level as opposed to not available	25.09 (21.96 to 28.22)	36.10 (33.90 to 38.29)	26.67 (23.46 to 29.87)	32.38 (30.22 to 34.54)
Hospital services offer	Availability is dependent on workload as opposed to not available	9.59 (9.16 to 10.02)	11.52 (10.02 to 13.01)	11.62 (10.52 to 12.73)	9.38 (8.39 to 10.37)
	Available as opposed to not available	13.41 (12.10 to 14.72)	19.20 (18.41 to 20.00)	18.09 (16.47 to 19.71)	15.21 (14.34 to 16.08)
The hospital's level of specialization	Standard for complicated births as opposed to standard for normal births	11.70 (10.55 to 12.68)	15.76 (14.93 to 16.58)	12.59 (11.10 to 14.08)	14.17 (13.56 to 14.78)
	Highly specialized for complicated births as opposed to standard for normal births	14.58 (12.97 to 16.19)	24.17 (23.20 to 25.13)	16.13 (14.98 to 17.27)	21.37 (20.34 to 22.40)

With regard to the sub-group based on risk attitude, all attributes were important for women in both groups when evaluating the hospitals. However, risk averse women put more weight on availability of an NICU and the hospital level of specialization and they were willing to travel longer for these hospital attributes. Risk-averse women for example, were willing to spend an additional time of 5 minutes to reach a hospital with highly specialized NICU compared to risk-lover group.

Additionally, analyses of the certainty level of responses to choice scenarios and the degree of complexity of the choice tasks were conducted. A 1-5 numeric scale for testing complexity of choice tasks were used as it is an important indicator about the validity of the results<sup>188</sup>, the estimated WTT of those who found the choice tasks to be easy is compared to those who found it difficult. We did not find significant difference between two groups.

Table 10 Proportion of outliers (n (%))	
Systematic choice of alternative A, B or C	38 (7.35 %)
Not choosing a superior alternative	3 (0.6 %)
Responded at mean response time $\pm$ one standard deviation.	152 (29.4%)

Table 10 demonstrate the proportion of each group of outliers. The total number of outliers were 169 (33%), which means that there was overlap among the three groups of outliers.

And Table 11 provides a comparison of outliers versus non-outliers on some selected characteristics. The Pearson chi square test showed that women in the two groups are similar to each other and the only significant difference (at 5% level) was observed for 'education' and 'having children' variables.

That 33% of the sample were categorized as outliers may be because of employing heuristics in order to simplify tasks they are presented with. Elaboration on keeping the outliers in the analysis is provided under internal validity of this study.

Table 11 comparison of outliers versus non-outliers

Variable	Outliers n=169	Non-outliers n=348
Mean age, years (SD)	30 (6.74)	30 (6.62)
Education		
Short-term	55 (33 %)	99 (29%)
Medium-term	70 (41 %)	138 (39%)
Long-term	37 (22 %)	105 (30%)
Other	7 (4 %)	6 (2%)
Has children	69 (41 %)	109 (32%)
Easy or very easy to actively engage with healthcare providers (health literacy scale 6)	40 (24 %)	107 (31%)
Easy or very easy to understand health information (health literacy scale 9)	40 (24 %)	88 (25%)

## **4 Discussion**

The three studies in this project built upon each other and were used to answer the research questions posed in the Introduction. The first study investigated uptake of choice and provided evidence of inequity of access to hospitals; this was due to individuals with higher level of education exercising their right to a choice of hospital more often. The qualitative study informed us that women make decision independently and they trust the previous experience with a hospital for their coming birth. It also informed us about the important attributes that women take into account when choosing a birthing hospital. The DCE study revealed that the availability of a specialized NICU is the most important factor of birthing hospital across all subgroups of women. In addition, the study revealed the relative importance of hospital attributes and showed substantial heterogeneity due to prior birth experience, risk attitude and health literacy.

Interestingly, most of the significant differences were found in the comparison between those with and those without prior birth experience. The differences between the preferences of women with and without birth experience was shown through the register study where women without birth experience, were more likely to bypass the nearest hospital to reach a highly specialized hospital (OR=0.71). In addition, the real choice offered to women in the qualitative study and the hypothetical choice scenarios in the DCE study also approved that previous birth experience has a great role in choice of specialized services. It seems that prospective first-time mothers are more concerned and uncertain about the outcome of pregnancy, which makes them more likely to opt for a hospital that provides highly specialized services.

Furthermore, women's perception of risk was shown to affect their choice in all studies. Whether we used a proxy for risk attitude (as had been done in the first study by using smoking behavior at the first trimester of pregnancy and birth experience as proxies for risk attitude), or listening to women's concerns and worries about giving birth (as we have done in the qualitative study), or a tool to measure willingness to take risks (the Dohmen's self-reported willingness to take risks in health (SOEP-H) which was used in the DCE study), perception toward risk played an important part in women's decision-making. Preferences for hospital attributes were significantly different between risk averse women versus risk seekers, meaning that women with risk-averse attitude highlight the importance of specialized services when choosing a hospital for birth. The overall aim of this PhD project was to inform policy makers about consequences of hospital choice policy with regard to equity and efficiency. Following I discuss uptake of choice and in section 4.2 consequences of choice on equity and efficiency is discussed.

### **4.1 Uptake of choice**

Within this project, we observed uptake of choice by pregnant women through register-based data and found that 29% of women exercised their choice, compared with up to 11% of non-emergency patients in Denmark as reported by Vrangbæk et al. <sup>20</sup>. Our qualitative study also informed us that women appreciate the choice and respond positively to being offered a choice of hospitals.

Uptake of choice has been observed in various studies; a systematic review reported that the rate of bypassing the local hospital ranges from 23% to 76% in countries that have introduced hospital choice policies <sup>30</sup>.

Responding to choice can be explained by patient-intrinsic factors as well as the external institutional factors <sup>20</sup>. In explaining the observed pattern of choice considering patient-intrinsic factors, we know that Danish patients are quite aware of their rights to choose, and that their awareness improved over time from 81% in 2000 to 87% in 2006 according to national surveys of patients' experiences with hospitals <sup>189–191</sup>.

One intrinsic factor in exercising the choice is patients' motivation to choose. The findings of a literature review provide substantial evidence that patients are prepared to travel beyond their nearest provider for their care or treatment <sup>30</sup>. From a psychological perspective, offering choices prospectively leads to people being more comfortable with increased choice. However, asking individuals while they are currently experiencing ill health leads to a dramatic fall in the number of people who still want to choose who should provide their care <sup>192</sup>.

According to a scoping review by Victoor et al., motivation for choice is not only on outcome indicators but also on a variety of provider characteristics <sup>73</sup>. As described in the Background section, women appear to be motivated to choose their hospital and have preferences for certain hospital attributes. However, based on the register data, we could not determine which specific aspects of the services provided or the treatment profile at the nearest and chosen hospitals affected their choice. However, the qualitative study could inform us about the important hospital attributes from women's perspective.

One of the external institutional factors that can be addressed by our results is defining catchment areas for each hospital in two regions, which was negatively associated with utilizing choice (OR=0.62). The results of the qualitative study support our findings that women actually appreciated and used the opportunity to choose, as they considered different hospital attributes and gave priority to their preferred hospital.

The effects of other institutional factors, such as availability of comprehensive and understandable information as well as incentives for hospitals, cannot be captured by register data. The role of the GP as an external factor in decision-making could not be explained by our data; however, we observed an association between up-specialization and a greater number of visits to GPs (OR = 1.13). There was a different pattern of up-specialization with regard to visits to a specialist (OR = 0.92) or midwife (OR = 0.93) during pregnancy. This to remember that in the Danish health care system, pregnant women will not visit an obstetrician unless she has a risk factor or suffers from pregnancy complications. If a measure of subjective health was available, it might be possible to utilize that measure to say something about the underlying mechanism of the choice. However, the GP showed to have no impact on women's decision about preferred hospital in the qualitative study. Interestingly, another study in Denmark have also found that female patients were

especially more likely to choose an outpatient clinic by themselves<sup>24</sup>. In general, studies show that patients rely on their GP to choose for them<sup>73</sup>, however, as recommended by Birk et al. further research is warranted on the interaction between GP and patient in choice of hospital, preferably by direct observation of the referral process<sup>63</sup>.

## **4.2 Consequences of hospital choice on equity and efficiency**

A question that emerges with regard to uptake of choice is the role of SES on an individual's utilization of choice, which raises the issue of equity of access to hospitals. If utilization of health care varies with socioeconomic position, even after controlling for sociodemographic characteristics such as age, gender, and health status, the distribution and use of health care in the population might not follow the overall goal of equal access for equal need<sup>176</sup>. In our case, the results show that allowing individuals a greater choice of hospital providers will increase the socioeconomic differentials in access to hospitals with regard to education.

The relationship between choice and equity did not receive sufficient attention when the policy was introduced into different health care systems<sup>10</sup>. This can be seen in our case; even though equity of access is a key policy objective in the Danish health care system, it has not received enough consideration in patient choice policy agendas. The evidence from other health care systems such as those of Sweden and Norway indicates similarities to the Danish system with regard to including equity as an important argument when introducing choice<sup>79, 84</sup>.

In the UK, even though equity was recognized as one of the aims when introducing patient choice, various aspects of equity and the well-established causes of inequity are not fully considered in the current patient choice policy agenda. It can be argued that important variables and predictors influencing access to services, and their implications for health care outcomes, are not considered in patient choice policy<sup>193,76</sup>.

Additionally, insights into how choices are actually made in reality are hardly ever reflected in related policy discussions<sup>76</sup>.

According to Fotaki, choice and equity cannot go hand in hand, because choice has multiple meanings in health care services – choice of what, by whom, where, and when – all of which have different implications for the process of choosing. In her opinion, current choice policy, which is only based on neoclassical economic theory, is unable to take into account how individuals make choices and how they process the information that leads them to these decisions<sup>76</sup>.

Based on our data, 54% of pregnancies were categorized as ‘complicated’. The high demand for specialized services among women with uncomplicated pregnancies may reduce accessibility for those in need of specialized care, and thereby generate conflict between equity and efficiency. If the individuals most in need are not the ones who can benefit most from health care, under the efficiency objective of maximizing health gain, equity and efficiency are in conflict<sup>194</sup>. Thus, in our specific case, the objective should be to curb the demand amongst the most resourceful women in order to ensure that health care services are delivered equitably and cost-effectively.

To improve efficiency, resources should be used to produce the most cost-effective interventions. The cost-effectiveness of health interventions has three dimensions<sup>121</sup>. First, the providers of health interventions must produce health interventions that reflect individuals’ needs and have the potential to yield the highest return on health (right care). Second, each unit of the produced health interventions must be delivered to, and used by, the individuals who need them the most and can receive the maximum health gain (right individuals). Third, health interventions are provided at the least costly location (right place)<sup>121</sup>.

However, prioritizing interventions solely on the basis of efficiency criteria is unlikely to optimize the welfare of society, because of people’s concerns about equity and the potential trade-offs between efficiency and equity<sup>195</sup>. Clearly, specified criteria are needed that both reflect these concerns and ensure that priority setting decisions account for any trade-offs between efficiency and equity that exist<sup>195</sup>.

### **4.3 Choice and rationality**

Policy makers assume that patients selectively choose high quality providers based on weighing up the information about the different providers; in other words, that they make a rational choice<sup>73,196</sup>. Rationality is typically classified under umbrella of normative (addressing the question how people “should” or “ought to” make their decisions) and descriptive theories of decision-making (which portray how people actually make their decisions)<sup>197</sup>. Example of normative theories is expected utility theory, which is arguably the only theory of choice that satisfies all mathematical axioms of rational decision making, and the descriptive theories of rationality of direct relevance to medical decision-making include e.g. bounded rationality<sup>197,198</sup>.

From policy perspectives, using EUT might be the most rational approach to decision-making<sup>197</sup>. However, from individual perspective, there are various factors involved in decision-making process. The field of behavioral economic suggests that rationality may be limited or bounded, and influenced by factors such as emotions, impulsiveness, limited willpower, social norms, and the context in which choices are made<sup>199</sup>.

Individuals often use heuristics that help them make quick and more effortless decisions. They are generally trying to relieve themselves of the cognitive burden that is required if one is to go through all alternatives systematically. Under the real-life complexity of the health care system and the limitations of human information processing, rational behavior relies on satisficing process (i.e., finding a good enough solution) instead of maximizing (i.e., finding the best possible solution) <sup>200</sup>.

The bounded rationality was also obvious in women choice of hospital as they avoided seeking more information, consulting with their GP or solely relying on a familiar hospital in their decision making. Women relied on their emotion and intuition in order to minimize perceived risk, which led them to evaluate consequences of their choices different from health care professionals.

Although women showed bounded rationality in their decision making, I stick to the initial position of considering the EUT as the main theoretical framework for this project because even though bounded rationality differs from the unbounded view -such as EUT-, it still takes unbounded rationality as the normative yardstick against which to evaluate human decision making <sup>201</sup>.

#### **4.4 Internal validity**

##### **Study 1**

For the first study, the main data sources were the Danish National Birth Registry and the Danish National Patient Registry. We carefully checked and excluded all women who had codes of complicated pregnancy in addition to those who had risk factors for a complicated pregnancy such as age, BMI, etc. This effort provided us with a sample of uncomplicated pregnancies with homogenous need for hospital services. However, even though the Danish National Patient registry provide sound data, the content and the definitions of single variables have changed over time, which may affect both the type of treatment and the completeness of registrations <sup>90</sup>. This may have an effect on classification of study population.

The data in the registered based study suffered from missingness. Inadequate handling of the missing data in a statistical analysis can lead to biased or inefficient estimates of parameters <sup>202</sup>. One approach to handle missing data is multiple imputation, which requires careful consideration of the reason for, and classification of the missing data. I did not apply such imputation techniques here because of time constraints.

Another issue regarding the validity of the results is the possibility of misclassification of uptake of choice in the register-based study. This is due to our inability to distinguish whether a woman who did not bypass her nearest hospital, made an active choice not to do so, because the nearest hospital gave her the highest utility. If this was the case, the number of women who exercised choice was larger than what we have observed

here, because there were active choosers among those who did not bypass the nearest hospital. In addition, access restriction is another source of misclassification of uptake of choice. The data do not indicate whether women would choose an alternative hospital if they did not encounter restriction in access to hospitals.

We used two proxies for risk attitude: smoking behavior at the beginning of pregnancy and experience with birth. However, we confirm that these are not validated tools to account for individual risk attitude. Risk preference appears to be domain specific, i.e., inconsistent across different domains of risk taking. The domains of risky decisions can differ in familiarity or perceived controllability; therefore, there are variables, which can affect perceptions of risk. The way, in which information about possible outcomes has been acquired by personal experience or by statistical description, influences risk taking. Some decisions are all-or-none, whereas others are incremental and some risks are static, whereas others increase or decrease over time. Because all of these situational variables have been shown to influence risk taking, it is important to use a risk-preference tool that is as similar as possible in these respects to the decision in which risk taking is to be predicted<sup>203</sup>. Therefore, in our case, experience with birth may be a better proxy of risk attitude, however further research is needed with this regard.

Beside hospital choice policy, there had been ongoing reform in the structure of hospitals/departments between 2005 and 2014 such as centralization or amalgamation of functions across physical hospitals (E.g. the birth department at Silkeborg hospital was shut down since 2012 and women were supposed to give birth at Viborg hospital instead). In this study women chose among available hospitals that provided maternity services; therefore, it is mainly the hospital choice policy that drives the choice. However, we might have observed different choice pattern if there was no other concurrent policy going on. The structural reforms of hospitals affects geographical access to hospitals and may exacerbate inequity in access to hospitals.

## **Study 2**

The qualitative study had two aims: it was designed to gain insights into priorities regarding choice of hospital, and to inform the design of the DCE study. Available studies about birthplace, compare different institution: hospital, home and midwifery-led centers. The service provision and facilities (mainly, availability of pain relief) and care providers (midwife or gynecologist/ obstetrician) varies in these different institutions, however this difference is not so huge among hospitals (for example, all hospitals provide some kind of pain relief). Thus, our focus in this project was only on hospital birth for two main reasons. First, hospital is the default birthplace in Denmark (homebirth rate is less than 2%). Second, women were willing to use the opportunity of hospital choice and they showed preferences for different hospitals. Focusing only

on hospital birth where hospital is the default birthplace is a contribution of this study to the available literature.

In this study, we did not have a hand in selecting participants. The GP and other staff at the clinic were involved in the sampling process to invite eligible women to the study; therefore, we cannot guarantee that there was no bias in the sampling process. However, all women who chose to give birth at the university hospital, accepted to be interviewed.

The qualitative study included a relatively small number of participants. This was owing to administrative agreements between the hospitals meaning that we could not prolong the inclusion period. The number of participants was also dependent on the number of women who were willing to be interviewed. However, we reached a point of saturation during the analysis where no new themes could be identified from the interview transcripts. In addition, we reached an acceptable level of information power which indicates that the more information the sample holds, relevant for the actual study, the lower amount of participants is needed <sup>204</sup>. We believe that the narrow study aim, highly specific participant characteristics, quality of communication between the researchers and participants, and analytical strategies provided us with sufficient information power <sup>204</sup>.

The small number of participants in the qualitative study is also not likely to affect the design of the DCE study. As stated in the Method chapter, the design followed a guideline that makes the chance of missing an important attribute very low <sup>93</sup>.

### **Study 3**

In the DCE study, we used an online panel, which is a cost-effective mode of conducting DCEs and meant that the data would be available within an acceptable time. We have no information on how many of the members had been offered the questionnaire and who declined to participate. However, respondents are identical to pregnant women according to age, education, and region of residency, based on data from Statistics Denmark in 2016.

In the DCE design, we included two attributes that were related to hospital level of specialty (availability of an NICU and hospital level of specialization for handling rare events during birth). Hence, we found a generic, unlabeled choice format to be more suitable for investigating trade-offs between attributes, because it mimics the actual choice situation.

Participants were forced to make a choice among the three hospitals, meaning that they were not able to opt out or choose neither option. In general, the choice to include an opt-out option is determined by the objective of the DCE <sup>205</sup>. With hospital being the default birth place in Denmark, in addition to a negligible

rate of home birth and un-availability of midwifery-led centers, it was decided not to include a 'neither' or 'opt out' option. We believe that opt-out is not a viable option for obstetrics care in the Danish setting and since we do not elicit welfare effects, the opt-out option is of minor importance. A recent DCE study about choice of different birthplaces had included an opt-out option in the design <sup>108</sup>. They found it difficult to discern the way in which respondents treated the 'Neither' option in the choice sets and concluded that 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 <sup>108</sup>.

How to define the levels is an important issue in the design of a DCE so that individuals will trade off between them <sup>170</sup>. The attribute 'continuity of midwifery care' has three levels (*yes*, *not sure* and *no*) which indicate the certainty of having the same midwife during the whole process of pregnancy and birth. One may suggest that framing the attribute levels such as '*always*', '*sometimes*' and '*never*' would better cover the certainty aspect of this attribute and make the tradeoff between the levels easier.

It seems that the middle level (*not sure*) of this attribute is more controversial as it not consistent with the other two levels (*yes* and *no*). In design phase, we discussed the initial definition of attribute and their levels with women, they reflect on their understanding of the attributes and levels. Moreover, we reached to the conclusion that we have agreement on what attributes and levels mean. However, individuals preferences maybe affected by the manner in which the question is formulated (framing effect) <sup>97</sup>. Framing the levels in the suggested format seems to have more clear connection between levels and may make the comparison between levels easier.

The question whether respondents to choice experiments attend to all attributes presented on the choice sets has gained interest in the literature. There are studies that used different approaches to account for attribute non-attendance (ANA), such as the stated non-attendance approach, the analytical non-attendance approach or eye tracking. Results of these studies indicate that ANA can have mixed effect on parameters and subsequent marginal rates of substitution (MRS) estimations <sup>188,206,207</sup>. One source of ANA might be the complexity of the choice sets as respondents may employ different answer heuristics when the choice sets become more complex <sup>188</sup>. However, non-attendance may not just be associated with attributes but may also apply to the attribute's levels (attribute-level non-attendance (ALNA)) and literature shows that respondents process each level of an attribute differently; while attending to the attribute, they ignore a subset of the attribute's levels <sup>208</sup>. As we have two attributes with levels that indicate uncertainty, it will be good to investigate whether this level assignment caused ALNA and to test if selection of attribute levels at the experimental design stag was appropriate.

Researchers investigate rationality of choice as well. Irrational responses can be due to shortcomings in the DCE design and implementation, the role DCEs may play in helping respondents construct preferences or

because conclusive rationality tests are not currently available<sup>209</sup>. In the absence of rigorous evidence of irrationality, deleting respondents may omit valid preferences leading to bias and lower statistical efficiency<sup>93</sup>. In our sample, 169 women failed the rationality test of the DCE. We have not deleted irrational respondent from the main analysis, however, results excluding irrational respondent were not significantly difference from the full sample data, confirming the robustness of the main analysis.

It would be ideal to test the extent to which women's behavior in the real world compares with their stated preferences. We tried to make women aware of the importance of their responses to choice scenarios; additionally, we used a certainty scale and a scale for complexity of choice tasks. However, there is limited evidence for using these scales to investigate hypothetical bias. Within health economics, some studies have concluded that stated preferences can be used to model the real market<sup>210, 211, 212</sup>. However, these studies are not comparable to our case and whether the hypothetical choice is able to predict true preferences is an issue to be pursued in future research.

#### **4.5 Generalizability**

The results of this project are generalizable to similar universal, tax-financed health care systems where the free choice of hospital is introduced. Our results could also be relevant to the countries following the Bismarck model, as these countries also have free access to specialized services. However, current policies in e.g. France and Germany seek to restrict choice of specialists by introducing 'soft' gatekeeping; whereas in e.g. the Netherlands, there is a system of managed competition with choice of insurer that, in principle, allows insurers to contract selectively<sup>124</sup>.

Based on the literature and in real-life situation, we observed that women are willing to exercise choice. In addition, focusing on healthy women with uncomplicated pregnancy provided us with a great opportunity to study if resources are used in an efficient way and if there is equity in access to hospital due to women's equal need for health care services. However, pregnancy is a special case and different from other group of hospital users.

Pregnant women are choosing on behalf of themselves as well as their unborn child, giving birth is a celebration, a life-event, and therefore, expectations are high. The generalizable aspects of this project to other patient groups are probably foremost related to the finding that more empowered individuals will have greater access to services when there is free choice. If low socioeconomic group of patients replicate the same behavior, equity and efficiency remain an issue for our universal health care system. However, it would be good to verify whether the choice pattern we observed can be replicated in other settings beyond pregnancy case.

We concluded that in order to make an informed decision, women need to be provided with relevant information about their pregnancy risk profile and hospital services. Information need is clearly a key issue also for other patient groups, since much of the relevant information is of a technical nature that most patients will have difficulty dealing with <sup>1</sup>.

Due to differences in patient's characteristics and specific disease condition in addition to differences in provider characteristics, there may be other factors that play a role in choice of hospital for different patients. In addition, limitation in access to highly specialized hospital may not apply for other groups of patients. It is recommended to study the issues raised in this project such as process of gathering information, the role of the GP in decision-making and preferences for hospital attributes among different patient's groups.

#### **4.6 Limitations**

There were several limitations to each of the studies in this dissertation. We acknowledge that there are unobserved explanatory variables such as hospital reputation, influence of family and friends, faith in authority, and tradition and culture, as well as facilities such as parking and road access that may inform individual preferences. However, these variables are not easily quantified in register-based studies, which was a limitation of the first study of this dissertation.

Ringgaard et al. developed the concept of patient mobility and categorized mobility into: forced mobility due to lack of specialized equipment, mobility chosen by the patient, and physician-induced mobility <sup>213</sup>. We were not able to distinguish the type of patient mobility in the first study. Forced mobility due to lack of specialized equipment at local hospitals was not a core issue for this study, which investigated healthy women with uncomplicated pregnancies. Chosen mobility and physician-induced mobility were core concepts that could not be captured from register data. Hence, we assumed that the choice is made by women or as a shared decision between the physician and the pregnant woman.

The qualitative study informed us that women make their decision independently, without seeking advice from the GP. Interviewing the GPs was not within the scope of this project; however, given that the GP have knowledge and experience from several women, interviewing the GP could reveal some aspects of gatekeeper's behavior and how the efficiency issue in allocation of scarce health resources is perceived by the GP. In addition, it could inform us about any possible conflict between women and the GP preferences and if the GP could introduce barriers for women in choice of hospital.

In the DCE design, we included the attribute 'hospital service offer', which indicate the services available for pregnant women such as water birth and hoteling services after birth. We did not disentangle these services as the qualitative study showed us that women appreciate these services in general and to avoid complexity

of the design, we present only one attribute representing the service offer. I acknowledge that women may react to this attribute differently if the services were presented separately, however in order to have manageable number of attributes, we decided to merge service attributes and present them in one attribute. In addition, presenting this attribute in current format makes policy recommendation easier as it indicate the importance of all service attributes.

The empirical DCE study had some limitations with regard to the sample. The survey was administered through an online panel, which meant that participants were from the general population. It may be speculated whether participants were a good representative of pregnant women, particularly given that almost half of them were not planning to become pregnant.

#### **4.7 Implications for policy**

In health care policy-making in many countries, there is a rhetorical emphasis on evidence-based policy. The major argument is that a policy as an intervention for a specific problem is less likely to be effective or efficient if it is not based on scientific evidence. It has also been argued that the creation of a culture of evidence-based policy-making is important for its widespread acceptance and actual implementation <sup>121</sup>.

The concept of patient-centeredness has long been recognized as a desirable attribute of health care and is considered an essential aspiration of high-quality health care system <sup>214</sup>. When providing patient-centered care, the patient's preferences and values should be honored, and this principle should be incorporated into policies by creating preference-informed policies. The findings of this project have some implications for improving hospital choice policies. First, women demonstrated preferences for certain attributes of birthing hospitals. The elicited preferences could be used to tailor services to the specific needs of women, and to inform health administrators of which attributes women value more, hence encouraging competition between hospitals.

Second, all studies emphasized the importance of risk perception in choice of birthing hospital, especially among first-time pregnant women. From the qualitative study, we found an obvious discrepancy between how risk is perceived by pregnant women and how it is perceived by clinicians. This was due to women's distorted understanding of their pregnancy risk profile, and was further due to asymmetric information provision between individuals and care providers, which calls for concrete information about the characteristics of the hospitals as well as insight into the individual woman's risk profile.

Governments worldwide –including Denmark- are increasingly incorporating the behavioral economics approach into policymaking by introducing the ‘*nudge*’ units <sup>199,215</sup>. Nudge is defined by Richard Thaler and Cass Sunsteias as any aspect of the choice architecture that alters people's behavior in a predictable way

without forbidding any options or significantly changing their economic incentives <sup>199,215</sup>. The hospital choice policy in Denmark was devised by several tools to overcome information gaps such as mandatory employment of independent patient advisors <sup>20</sup>; however, this study emphasized contributing to women's understanding of their risk profile and what different hospitals can provide. Therefore, greater involvement of the GPs as the gatekeeper of the healthcare system seems to be influential in making an informed decision.

Finally, the consequences of choice and its over all effect on equity and efficiency are yet to be investigated for different groups of patients. This is necessary to ensure that the hospital choice policy fulfils its initial objectives. However, I acknowledge that it is difficult to isolate the impact of a single policy change when there are other policies (such as restructuring of the hospital sector) being implemented simultaneously.

## 5 Conclusion

I have collected and reported on a significant body of theoretical and empirical literature regarding choice of hospital in the case of uncomplicated pregnancy; highlighted consequences of hospital choice policy with regard to uptake of choice, equity and efficiency; and further focused on individuals' information-seeking processes and their preferences for hospital attributes and trade-offs between attributes.

This project suggests that in a universal, tax-financed health care system, free choice of hospital is valued by individuals, enabling them to choose their ideal hospital provider. However, hospital choice policy may exacerbate inequity of access to health care if some groups are better at exercising their rights than others, as was found in this project. There is evidence that high education level and risk aversion are associated with selecting highly specialized hospitals without having an objective *ex ante* need for such a level of specialization. The high demand for specialized services may reduce accessibility for those in need of specialized care and thereby threaten equity and efficiency.

This dissertation showed that women make their choice independently and base their decision on their own (or peers') experiences with a hospital, which is seen as the most important source of information. Therefore, hospitals must deliver high-quality services in order to keep the loyalty of their patients. Further, preferences for birthing hospital had been elicited emphasizing the importance of service offered at hospitals, which makes choice an important factor in driving hospitals to compete for improvement in services.

Women's experience of birth and their perception of risk in pregnancy seem to be key factors in choice of birthing hospital, which raises the question of whether provision should be based on objective needs or individual preferences. In addition, it opens up discussion as to whether women have reliable information about their pregnancy risk profile and about the services provided at hospitals when they are making their decisions.

This project found that the GPs had no effect on women's choices. However, it do suggest that the GP, as a gatekeeper, can play an important role in informing women about their risk profile and the services each hospital can offer, and guide them in making an informed decision. Choice policy must be properly designed so as to meet the conditions for effectiveness and there must be mechanism for ensuring that patients are given the relevant information and help in making choices <sup>1</sup>.

In order to provide patient-centered care, where patients' preferences are valued, hospital choice policy needs to accommodate individuals' preferences in its various components. This PhD project provides some evidence of women's preferences that could be considered in such policy, and also suggests a need to elicit preferences of other groups of hospital users to contribute to providing evidence-based policy.

## **6 Future research**

To inform policy makers about individuals' reaction to choice and their preferences for hospital attributes, further research is required, focusing on uptake of choice and consequences of choice with regard to equity of access and efficient allocation of services for different groups of hospital users. Research is also needed to determine the most suitable equity and efficiency tools for studying the effects of hospital choice policy on both equity and efficiency.

Hospital choice was intended to enhance competition among providers and thus increase the quality and efficiency of the health care system. However little is known whether choice policy can actually create competition and improve quality of services. Qualitative interviews with GPs and with hospital administrators could provide information about the impact of hospital choice on competition and quality of services. It is also important to know which dimensions of quality are important from patients' and providers' perspectives.

In this project, further interviews with GPs could provide more information about the decision-making strategy of the gatekeeper in the system and how the efficiency issue in allocation of scarce health resources is perceived by the GP.

As the Capital Region of Denmark and the Central Denmark Region have encountered problems in capacity planning with regard to choice of highly specialized hospitals, the following questions arise. Does hospital choice policy work everywhere? For which groups of patients does it work? Does choice increase competition and hence quality of services in some regions? Do hospitals compete to attract patients who live only in that region or also those from other regions? Is there an alternative to defining catchment area?

Conducting well-designed and well-informed hypothetical choice scenarios for the main groups of hospital users (who are normally older patients with chronic disease) can inform hospital providers about important aspects of services and therefore generate a basis for hospital competition.

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# Does free choice of hospital conflict with equity of access to highly specialized hospitals? A case study from the Danish health care system

Nasrin Tayyari Dehbaraz<sup>a,b,\*</sup>, Dorte Gyrd-Hansen<sup>c</sup>, Niels Ulbjerg<sup>d</sup>, Rikke Søgaard<sup>b,e</sup>

<sup>a</sup> DEFACTUM-Olof Palmes Alle 15, 8200 Aarhus N, Denmark

<sup>b</sup> Department of Public Health, Aarhus University-Bartholins Alle 2, 8000 Aarhus C, Denmark

<sup>c</sup> Centre of Health Economic Research (COHERE), University of Southern Denmark-Campusvej 55, 5230 Odense M, Denmark

<sup>d</sup> Department of Obstetrics & Gynecology, Aarhus University Hospital-Palle Juul-Jensens Boulevard 99, 8200 Aarhus N, Denmark

<sup>e</sup> Department of Clinical Medicine, Aarhus University, Denmark

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## ABSTRACT

Equity of access to health care is a central objective of European health care systems. In this study, we examined whether free choice of hospital, which has been introduced in many systems to strengthen user rights and improve hospital competition, conflicts with equity of access to highly specialized hospitals. We chose to carry out a study on 134,049 women who had uncomplicated pregnancies from 2005 to 2014 in Denmark because of their homogeneity in terms of need, the availability of behavioral data, and their expected engagement in choice of hospital. Multivariate logistic regression was used to link the dependent variable of bypassing the nearest non-highly specialized public hospital in order to “up-specialize”, with independent variables related to socioeconomic status, risk attitude, and choice premises, using administrative registries. Overall, 16,426 (12%) women were observed to bypass the nearest hospital to up-specialize. Notably, high education level was significantly associated with up-specialization, with an odds ratio of 1.50 (95% CI: 1.40–1.60,  $p < 0.001$ ) compared to low education group. This confirms our hypothesis that there is a socioeconomic gradient in terms of exercising the right to a free choice of hospital, and so the results indicate that the policy exacerbates inequity of access to health care.

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## 1. Introduction

During the last two decades, a common trait in public sector governance reforms in the Nordic countries has been the implementation of “free choice of hospital” policies, which seek to accommodate patients’ preferences for provider characteristics and create market conditions that incentivize hospitals to compete. In addition, choice in itself represents a value for individuals [1–3].

How patients’ choices influence equity has been debated in the scientific literature. Proponents contend that by giving choice to individuals who previously had none, one may in fact reduce the inequalities in service use that arise from differences in individuals’ capabilities [4–6]. Opponents argue that the greater the freedom to choose amongst providers, the greater the risk of inequalities, as less resourceful patients will be less likely to exercise the right to bypass the standard choice in order to reach a provider that better

satisfies their preferences [7–10]. If this were the case, inequity of access to health care would be exacerbated. The literature refers to horizontal equity of access, which is defined by equal access to hospitals for individuals with equal need [11–13].

There is limited evidence on the effect of free choice of hospital policies on equity of access to health care. One of the few studies on this topic is the London Patient Choice Project, which found no evidence of inequalities in access to, or use of, alternative hospitals by education, income, or ethnic group. However, individuals in paid employment were more likely to opt for an alternative hospital than those not in paid employment [14]. Another study from the UK found that patients with higher levels of education were more likely to exercise their right to choose [15]. Similar results were found in a Norwegian study that showed that education was associated with using the opportunity of choice [6]. This evidence suggests that the introduction of free choice of hospital in publicly financed health care systems that are based on free and equal access might introduce a conflict between the different goals.

In this study, we examined whether a free choice of hospital policy benefits more resourceful citizens, focusing on pregnant women. Pregnant women are amongst the hospital users who

\* Corresponding author at: DEFACTUM-Olof Palmes Alle 15, 8200 Aarhus N, Denmark.

E-mail addresses: [nastay@rm.dk](mailto:nastay@rm.dk), [ntd@ph.au.dk](mailto:ntd@ph.au.dk) (N. Tayyari Dehbaraz).

are known to be both able and willing to choose which hospital they attend and who have previously demonstrated engagement by articulating their preferences [3]. Furthermore, women with uncomplicated pregnancies represent a homogeneous group with equal needs in terms of delivery hospital and the lack of complications is identifiable in the present research context due to the existence of detailed national register data [16].

In the present study, we focused on women living near a non-highly specialized hospital who selected a highly specialized hospital for delivery. Some women opted for a hospital with a higher level of specialization (referred to as “up-specialization” hereafter) despite having the same level of need as others. If these women were from more socioeconomically advantaged groups, this would result in socioeconomically related inequity of access. Hence, the aim of the study was to assess whether a free choice of hospital policy conflicts with equity of access to highly specialized hospitals.

Our data set enabled us to make a number of contributions to the existing literature. A particular feature of our study population is that all members of the population had the same level of need for hospital services, thereby improving the validity of our results. In addition, to the best of our knowledge, the study is the first of its kind to describe the association between individual risk attitude and using the opportunity of free hospital choice.

### 1.1. Institutional setting

The Danish health care system offers universal coverage and is primarily publicly funded. It is based on free and equal access for all citizens, with general practitioners acting as gatekeepers to hospitals for patients with non-acute needs. The right to free choice of hospital was introduced in 1992. This policy provided patients with the option to choose between different public hospitals, and also private or foreign hospitals that have an agreement with the Danish Regions if the public hospitals are unable to provide a service within a maximum waiting time (1 month as of October 2007) [3,17].

The homebirth rate in Denmark is <2% [18] and obstetric services are provided only at public hospitals. Hospitals level of speciality is based on the guideline for gynaecology and obstetrics functions provided by the Danish Health and Medicines Authority ([www.sst.dk](http://www.sst.dk)). The guideline presents information about hospital functions in gynaecology and obstetrics speciality, and categorises hospitals into regional functions and highly specialized functions. University hospitals located in Copenhagen, Aarhus, Aalborg and Odense provide highly-specialized services.

Pregnant women can freely choose among different birthing hospitals if there are no limitations in access. At the first prenatal visit to her GP, the woman will be referred to hospital of choice. This hospital, offers a program for prenatal control and support. If the referral does not indicate special risk factors, the program includes a nuchal translucency scan at gestational week 12, an anomaly scan at gestational week 19, and a number of midwife visit. In the Danish system, pregnant woman will not visit an obstetrician unless she has a risk factor or suffers from pregnancy complications.

Due to excess demand for giving birth at highly specialized hospitals, the Capital Region suspended the free choice policy in relation to its university hospitals in December 2010. A similar suspension was enacted in the Central Denmark Region in 2013.

### 1.2. Analytical framework

Expected utility theory is the standard framework used to predict choice under uncertainty [19]. According to this theory, an individual will choose a specific hospital if the expected utility they derive from that choice is greater than the expected utility associated with choosing other hospitals in their choice set. Furthermore,

socioeconomic status (SES) is also reported to be associated with access to health care [e.g. 6,14–15]. We tested the following hypothesis:

**Hypothesis 1.** Up-specialization is associated with high SES

The preferred level of specialization is likely to be determined by risk attitude such that risk-averse individuals will express higher demand for highly specialized care. Individuals' *risk attitude* is an important concept within the health domain. Firstly, because medical decisions are generally made under the condition of uncertainty, the optimal treatment from a patient's perspective will depend on, amongst other things, their risk attitude. Secondly, there is evidence that more risk-averse individuals are less likely to engage in unhealthy behavior such as smoking [20]. A person's attitude toward risk may thus help to explain health care utilization and outcomes as well as treatment decisions [21]. While risk attitude is rarely monitored on a routine basis, smoking has previously been used as a proxy [22]. Furthermore, women's experience of giving birth has been found to be a relevant proxy for risk [23,24]. We tested the following hypothesis:

**Hypothesis 2.** Up-specialization is, holding SES constant, associated with risk aversion proxied by not smoking during the first trimester and by having no birth experience

In Denmark, the geographical distribution of hospitals is different across regions, which means that travel investment (in terms of time and cost) varies across choice sets. For this reason, all the analyses were adjusted for a) the baseline investment associated with reaching the nearest hospital and b) the additional investment required to reach a highly specialized hospital. Finally, as mentioned, two regions suspended the free choice policy for some of their citizens during parts of the study period, and this was also controlled for in all analyses.

## 2. Materials and methods

### 2.1. Study design and population

The study is a retrospective cohort study of consecutive women who gave birth at Danish hospitals during the period 2005–2014 after an uncomplicated pregnancy (referred to as “women” hereafter). International Classification of Diseases (ICD)-10 codes were used to identify the women in the Danish National Birth Register and the Danish National Patient Register. Women were excluded from the study if they developed complications during pregnancy or birth. Fig. 1 illustrates the identification of the study population.

### 2.2. Data

The study was based on five national registries. The National Registration of Danish Residents involves the collection of individual-level information concerning each individual's unique personal identification number, marriage/partnership status, citizenship, municipality, and place of residence [25]. The Danish National Birth Register (NBR) provides information about the hospital at which each birth took place in addition to the women's age when she gave birth, parity, number of visits to health care providers during pregnancy and smoking behavior at the beginning of pregnancy. The Danish National Patient Register (NPR) includes information on the hospital ward and date and time of activity, and the clinical data include diagnoses and surgical procedures [16]. The Danish Education Registry [26] and Danish Registries on Personal Income [27] provide information about education level, employment status, and personal and family income.

We extracted information related to pregnancy from NBR and NPR. Individuals' education status was categorized in order to allow

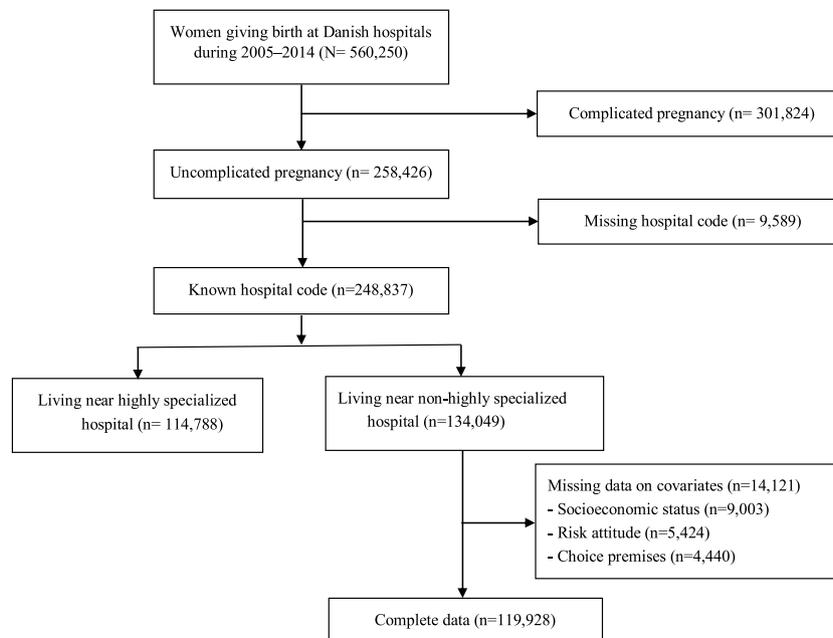


Fig. 1. Identification of the study population.

for non-linearity. The status on employment and personal income is subject to change at the time of birth and maternity leave; hence we used a one-year lagged information on employment status and income to identify associations between these variables and hospital choice. Distance to hospital is based on data from Statistic Denmark and is measured as road distance from the woman's place of residence to each hospital.

### 2.3. Statistical analysis

The dependent variable was an indicator variable on whether women bypassed the nearest hospital in order to up-specialize (yes or no). The independent variables included SES, risk aversion, control variable related to free choice restrictions and, travel investment. SES was defined by the highest level of education achieved (<3, 3–5 or  $\geq 5$  years), employment status (active or not active in labor market), and disposable personal income (quartiles). As pregnant women are often away from the labor market due to taking maternity leave, we used 1-year lagged observations for SES.

Risk attitude was defined by a variable on smoking during the first trimester (yes or no) and another variable on experience of giving birth (yes or no). The temporary suspension of the free choice policy in two regions was controlled for using an indicator variable for restriction (yes or no). Finally, travel investment required to reach a hospital was defined by a) the distance to the nearest hospital (km) and b) the additional travel distance required to reach a highly specialized hospital (km).

We estimated three multivariate logistic regression models: model 1 to test hypothesis 1 (on SES), model 2 to test hypothesis 2 (on risk attitude), and a full model including all the variables (model 3). The analysis was performed using Stata version 14 (Stata Corp LP, College Station, TX, USA) on anonymized data at a remote server operated by Statistics Denmark.

### 2.4. Sensitivity analyses

To test the robustness of the results, several sensitivity analyses were conducted. To test the proper timing and precision related to the assignment of ICD-10 diagnostic codes and assessment of subjective need, we extended our baseline model and controlled for

visits to GPs, specialists, and midwives during pregnancy (alternative model 1).

In addition, one may speculate that the observed pattern of highly educated women using more resources is due to increased awareness of the right to free choice of hospital over time, and also due to an increase in the number of highly educated women giving birth. To study the effect of passing time, we estimated alternative model 2, which exchanged the access restriction fixed effect with a year fixed effect.

## 3. Results

Of the 134,049 women who were living close to a non-highly specialized hospital, 16,426 (12%) bypassed their nearest hospital to up-specialize. Table 1 presents the characteristics of the study population.

In Table 2, the results confirm the association between high levels of education and up-specializing; women with high and medium levels of education were significantly more likely to up-specialize. However, the results show that there is no employment- or income-related inequity of access.

With respect to the effect of individuals' risk attitude on hospital choice, the results confirm our hypotheses that up-specialization is associated with having no birth experience and not smoking. All of the sensitivity analyses supported the robustness of the main findings (Table 3).

## 4. Discussion

The present study provides evidence of inequity of access to highly specialized care due to individuals with higher levels of education exercising their right to a free choice of hospital more often. Our results support the view taken by skeptics of free choice policies that allowing patients a greater choice may turn out to be another way of creating inequity in a health care system [6,8]. However, the inequity of access to highly specialized hospitals was not associated with employment status or income level. It is reassuring that in an equitable health care system such as the Danish system, the utilization of hospitals with different levels of specialization is independent of employment status and income level. Similar asso-

**Table 1**  
Characteristics of the study population.

	Living near highly specialized hospital (n = 114,788)	Living near non-highly specialized hospital (n = 134,049)		
		No bypass (n = 98,674)	Bypass nearest hospital to up-specialize (n = 16,426)	Bypass nearest hospital without up-specializing (n = 18,949)
Education (years)				
<3	53,494 (49)	60,031 (63)	6851 (50)	11,339 (68)
3–5	32,025 (29)	26,375 (28)	3983 (29)	4108 (25)
≥5	23,503 (22)	8437 (9)	2787 (21)	1138 (7)
Employment				
Not active in labor market	18,492 (16)	13,166 (13)	2805 (18)	3175 (18)
Active in labor market	96,285 (84)	85,500 (87)	12,387 (82)	14,655 (82)
Income (quartile)				
1 st	29,812 (26)	22,160 (22)	4604 (30)	5041 (28)
2nd	24,315 (21)	28,485 (29)	3506 (23)	5312 (30)
3rd	26,754 (23)	26,820 (27)	3690 (24)	4350 (24)
4th	33,896 (30)	21,201 (22)	3392 (23)	3127 (18)
Birth experience				
No	60,718 (54)	42,985 (44)	9516 (60)	8574 (47)
Yes	52,189 (46)	54,503 (56)	6410 (40)	9629 (53)
Smoker during 1st trimester				
No	102,837 (91)	82,891 (86)	14,427 (90)	15,089 (83)
Yes	10,482 (9)	13,511 (14)	1565 (10)	3079 (17)
Access restriction				
No	80,762 (70)	89,785 (91)	14,368 (91)	17,750 (96)
Yes	34,026 (30)	8889 (9)	1442 (9)	797 (4)
Mean distance to nearest hospital in km (SD)	8 (8)	17 (13)	10 (12)	27 (15)
Mean additional distance to highly specialized hospital in km (SD)	21 (15) <sup>a</sup>	50 (35)	10 (20)	49 (28)

Note: The values are number of women (%) unless otherwise stated. a: indicates additional distance from the nearest highly specialized hospital to a non-highly specialized hospital.

**Table 2**  
Effect of SES, risk attitude, and choice premises on up-specialization.

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Education (years)			
<3	1		1
3–5	1.21*** (1.15–1.28)		1.20*** (1.14–1.26)
≥5	1.52*** (1.43–1.63)		1.50*** (1.40–1.60)
Employment			
Not active in labor market	1		1
Active in labor market	.76*** (.70–.82)		.69*** (.64–.75)
Income (quartiles)			
1 st	1		1
2nd	.87*** (.81–.93)		.95 (.88–1.02)
3rd	.81*** (.75–.87)		.88** (.82–.95)
4th	.66*** (.61–.71)		.74*** (.69–.80)
Birth experience			
No		1	1
Yes		.70*** (.67–.73)	.71*** (.68–.74)
Smoker during 1st trimester			
No		1	1
Yes		.86*** (.80–.92)	.84*** (.78–.91)
Access restriction			
No	1	1	1
Yes	.64*** (.59–.69)	.61*** (.56–.66)	.62*** (.57–.67)
Distance to nearest hospital in km	.960*** (.958–.962)	.960*** (.959–.963)	.962*** (.960–.964)
Additional distance to a highly specialized hospital in km	.925*** (.923–.926)	.925*** (.923–.926)	.924*** (.923–.926)
Number of observations	108,261	108,733	104,519
Prob > chi2	0.000	0.000	0.000
Pseudo R <sup>2</sup>	0.3401	0.3388	0.3477

OR = Odds Ratio, Significance is indicated by: \*\*\* p < 0.001; \*\* p < 0.01; \* p < 0.05.

ciations between different components of SES and equity of access have also been reported in studies in Norway and the UK [6,15]. However, in a third study (the London Patient Choice Project), only employment was associated with inequity of access to hospitals [14].

Our results suggest that using the opportunity of free hospital choice is associated with risk attitude (proxied by smoking status and first-time pregnancy). The quantitative literature addressing the relationship between risk attitude and choice of birthplace is

sparse, but several qualitative studies have shown that risk attitude is an important determinant in choosing between different birthplaces. In the UK and Finland, women’s understanding of risk was found to play a substantial role in prioritizing hospital birth over either homebirth or birth at midwife-led centers [23,24]. The phenomenon of “elbowing behavior” may partially explain the fact that the more highly educated individuals selected more highly specialized care. This phenomenon reflects the fact that socioeconomically advantaged individuals are better endowed with information, net-

**Table 3**  
Results of sensitivity analyses of up-specialization.

	Base case model OR (95% CI)	Alternative model 1 OR (95% CI)	Alternative model 2 OR (95% CI)
Education (years)			
<3	1	1	1
3–5	1.20*** (1.14–1.26)	1.15*** (1.08–1.22)	1.15*** (1.08–1.22)
≥5	1.50*** (1.40–1.60)	1.37*** (1.27–1.48)	1.35*** (1.25–1.46)
Employment			
Not active in labor market	1	1	1
Active in labor market	.69*** (.64–.75)	.69*** (.63–.76)	.68*** (.62–.75)
Income (quartiles)			
1 st	1	1	1
2nd	.95 (.88–1.02)	.97 (.90–1.06)	.97 (.89–1.05)
3rd	.88** (.82–0.95)	.92* (.84–1.00)	.94 (.86–1.02)
4th	.74*** (.69–0.80)	.77*** (.70–0.84)	.82*** (.75–.89)
Birth experience			
No	1	1	1
Yes	.71*** (.68–.74)	.70*** (.67–.74)	.69*** (.66–.73)
Smoker during 1 st trimester			
No	1	1	1
Yes	.84*** (.78–.91)	.84*** (.77–.91)	.83*** (.77–.91)
Access restriction			
No	1	1	1
Yes	.62*** (.57–.67)	.66*** (.58–.75)	
Distance to nearest hospital in km	.962*** (.960–.964)	.942*** (.939–.945)	.944*** (.941–.946)
Additional distance to a highly specialized hospital in km	.924*** (.923–.926)	.918*** (.916–.920)	.919*** (.917–.921)
GP visits during pregnancy		1.14*** (1.10–1.18)	1.13*** (1.10–1.17)
Specialist visits during pregnancy		.91*** (.90–.93)	.92*** (.91–.949)
Midwife visits during pregnancy		.93*** (.91–.95)	.93*** (.91–.95)
Year fixed effect			.92*** (.91–.93)
Number of observations	104,519	90,227	90,227
Prob > chi2	0.000	0.000	0.000
Pseudo R <sup>2</sup>	0.3477	0.4076	0.4092

OR = Odds Ratio, Significance is indicated by: \*\*\* p &lt; 0.001; \*\* p &lt; 0.01; \* p &lt; 0.05.

working skills, contacts, and awareness of their rights, enabling them to exercise more effective pressure to get prioritized for treatment [28]. The fact that education was the only socioeconomic factor associated with exercising choice reveals the importance of education in empowering patients to exercise their rights. It is also well established that education level is positively associated with health literacy, which brings together many concepts that relate to what people need in order to make health decisions for themselves and their families. In particular, the ability to understand health information is a mediator in the relationship between educational attainment and health behavior [29].

To overcome the problem of social inequalities associated with the exercise of free choice, Ringard suggested that referring physicians in Norway should be encouraged to contribute to the reduction of these inequalities by providing extra help to the less-educated patients [6]. Furthermore, Dixon and Le Grand proposed a package of measures termed “supported choice” to help minimize the impact of inequity, which would build on the Patient Care Advisor experience investigated in the English NHS choice pilot [4]. At the introduction of the free choice policy in Denmark, different actions were suggested, including mandatory employment of independent patient advisors in all counties to help to overcome information gaps [3]. Although such initiatives may reduce inequity in access, they may in some instances exacerbate the inefficient use of resources if patients are empowered to exercise their rights to demand services that they do not need.

Despite the importance of controlling for need in studies of inequity, most of the literature on equity of access to health care has paid scant attention to the concept of need [12,30–32]. The strength of the present study is that the level of clinical need for hospital services is deemed identical for all individuals in the study population, which was also confirmed by controlling for visits to health care providers during pregnancy. Another strength of the study is the use of individual-level data from multiple national registries, which allowed us to take into account a range of factors that

could potentially influence access to hospitals [12]. However, there are unobserved explanatory variables that are not easily quantified in register-based studies, e.g., the influence of family and friends, faith in authority, tradition, culture, reputation, and facilities such as parking and road access. To the extent that these factors are associated with level of education, they may have contributed to the observed preference pattern.

## 5. Conclusion

In a publicly funded health care system, free choice of hospital may exacerbate inequity of access to health care if some groups are better at exercising their rights than others. We found evidence that both high education and risk aversion are associated with selecting highly specialized care without having an objective *ex ante* need for such a level of specialization. Such demand leads to both inefficient and inequitable care and raises the more general question of whether provision should be based on objective needs or individual preferences during times in which the goals of many health care systems are becoming increasingly oriented toward patient-perceived value. The high demand for specialized services amongst women with uncomplicated pregnancies may reduce accessibility for those in need of specialized care and thereby threaten vertical equity. Thus, the key objective cannot be to ensure equity in access by increasing demand for high specialized services amongst those with lower education/those with lower risk aversion. Rather, in our specific case, the objective should be to curb the demand amongst the most resourceful women in order to ensure that health care services are delivered equitably and cost-effectively.

## Ethics approval

The Central Denmark Region Data Approval Committee granted ethics approval for the study (journal number 1-16-02-40-15).

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## Conflict of interest

The authors declare that they have no conflicts of interest.

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Original Research - Qualitative

# Pregnant women's choice of birthing hospital: A qualitative study on individuals' preferences

Nasrin Tayyari Dehbaraz<sup>a,b,\*</sup>, Stina Lou<sup>a</sup>, Niels Uldbjerg<sup>c</sup>, Anne Møller<sup>a</sup>,  
Dorte Gyrd-Hansen<sup>d</sup>, Rikke Søgaard<sup>b,e</sup>

<sup>a</sup> DEFACTUM, Olof Palmes Alle 15, 8200 Aarhus N, Denmark

<sup>b</sup> Department of Public Health, Aarhus University, Bartholins Alle 2, Bldg. 1260, 8000 Aarhus, Denmark

<sup>c</sup> Department of Obstetrics and Gynecology, Aarhus University Hospital, Palle Juul-Jensens Boulevard 99, 8200 Aarhus N, Denmark

<sup>d</sup> Centre of Health Economic Research (COHERE), University of Southern Denmark, Campusvej 55, 5230 Odense M, Denmark

<sup>e</sup> Department of Clinical Medicine, Aarhus University, Palle Juul-Jensens Boulevard 82, 8200 Aarhus N, Denmark

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### ABSTRACT

**Objective:** To investigate pregnant women's decision making in relation to their choice of birthing hospital and, in particular, their priorities regarding hospital characteristics.

**Methods:** The focus of this study was the choice of birthing hospital among pregnant women. A qualitative interview design was used and women were recruited during their first pregnancy-related visit to a general practitioner. The interviews were conducted using a semi-structured interview guide, and a thematic analysis of the data was carried out.

**Results:** Women made their hospital choice decision independently and they relied extensively on their own or peers' experiences. Travel distance played a role, but some women were willing to incur longer travel times to give birth at a specialized hospital in order to try to reduce the risks (in case of unexpected events). The women associated the presence of specialized services and staff that were more qualified and experienced with increased safety. Other priorities included continuity of care (i.e., being seen by the same midwife) as well as service availability, which in this case referred to the possibility of a water birth and postnatal hoteling services.

**Conclusions:** The choice of hospital provider appears to be strongly influenced by experience, whether personal experience or the experience of peers. However, there appears to be room for more information to be provided on safety and service attributes as an instrument for making an informed decision.

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### Statement of significance

#### Issue

Little is known about pregnant women's priorities for birthing hospitals in settings with free hospital choice.

#### What is already known?

The literature focuses on comparing homebirth or midwife-led centers with hospital birth. The issues of risk and safety play an important role in giving priority to hospital birth.

### What this paper adds?

Pregnant women make choices about hospital providers independently and their decisions are predominantly influenced by personal or peers' experiences. Providing information on safety and services seems to be a key factor for making an informed decision.

### 1. Introduction

A policy allowing patients to freely choose among hospital providers has been introduced in multiple countries over the last two decades.<sup>1–5</sup> Free choice of hospital is intended to accommodate individuals' priorities regarding hospital characteristics and create market conditions that incentivize providers to compete, which is expected to improve the efficiency and quality of

\* Corresponding author at: DEFACTUM, Olof Palmes Alle 15, 8200 Aarhus N, Denmark.

E-mail address: [nastay@rm.dk](mailto:nastay@rm.dk) (N. Tayyari Dehbaraz).

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**Table 1**  
Characteristics of study participants.

Name	Age	Number of children	Week of pregnancy	Chosen hospital	Nearest hospital	Years of schooling	Paid employment
Gilda	33	2	12	University	University	3–5	Yes
Fiona	39	1	10	University	Regional	3–5	Job seeker
Kate	29	1	14	Regional	Regional	<3	Yes
Sara	32	0	12	University	University	≥5	Yes
Pia	23	0	7	Regional	Regional	<3	Yes
Samanta	29	2	12	University	Equal distance	3–5	Yes
Lada	36	1	12	University	Regional	≥5	Yes
Anna	29	2	7	Regional	Regional	3–5	Yes
Rose	37	1	10	University	University	≥5	Student
Alice	33	2	7	Regional	Regional	≥5	Yes
Tina	26	0	9	University	Regional	≥5	Job seeker
Clara	32	0	10	University	University	<3	Yes
Lilia	32	1	11	Regional	Regional	≥5	Yes

healthcare, especially in tax-financed systems.<sup>3,6,7</sup> There are two important prerequisites for such competition. First, patients must have access to reliable, meaningful, and understandable information about the quality of care offered by alternative providers, and second, they must act upon this information.<sup>3</sup> However, patients' decision making in relation to hospital choice are largely unknown today.<sup>8</sup> Little is known about the role of information in informing the choice of hospital, or about the source of information; in addition, little is known about how the use of information and information sources vary with patient characteristics.<sup>8,9</sup>

The available studies on choice of hospital are mostly based on quantitative methods that involve observed individuals' choices rather than explained choices, and the available qualitative research is mostly based on hypothetical situations.<sup>10</sup> A scoping review of healthcare provider choice concluded that patients base their decisions on provider characteristics<sup>10</sup> or their previous experience of a hospital [e.g. 10–12]. Some of the suggested patient priorities regarding hospital characteristics are the hospital's reputation [e.g. 13,14], quality of care [e.g. 14–16], travel distance [e.g. 17–19], and waiting times [e.g. 17–19]. To the best of our knowledge, there is lack of qualitative studies on real hospital choice scenarios, which can contribute to explorative and in-depth understanding of individual priorities in relation to the characteristics of hospital providers. To make such a contribution, we focused on pregnant women's choice of birthing hospital. This group was chosen because women with uncomplicated pregnancies are healthy individuals with time to seek information, reflect on the alternatives, and potentially make an informed choice. Furthermore, it has been shown that pregnant women actually take up the opportunity to choose between providers, and some are willing to invest in increased travel time to reach a hospital that satisfies their priorities.<sup>20</sup>

In this paper, we investigated pregnant women's decision making in relation to choice of birthing hospital and, in particular, their priorities in terms of hospital characteristics.

## 2. Methods

### 2.1. Study design

Qualitative interviews were used to explore women priorities regarding hospital providers. The interviews centered on identifying priorities at the time of decision making associated with a real hospital choice scenario, as well as the sources of information used to guide the decisions. The interviews were conducted using a semi-structured interview guide.

### 2.2. Study population

Eligible participants were low-risk, first-trimester pregnant women who had attended their first prenatal general practitioner (GP) consultation and had been presented with a choice of hospitals. High-risk pregnant women were excluded as they would routinely be referred to the university hospital. Although 14 women consented to participate, one had a miscarriage before the interview. The remaining 13 women (23–39 years old) were interviewed 1–10 days after the researchers had contacted them and before their first prenatal appointment at their preferred hospital.

### 2.3. Decision context

Denmark has a universal, tax-financed health care system in which citizens have the right to choose their hospital. In Denmark, the majority of births take place in hospitals and the home birth rate is less than 2%. In addition, as hospital births in Denmark are normally midwife-led, alternative options such as midwife-led centers are not part of the Danish birthing setting.

By introducing “free choice of hospital” rule, pregnant women showed preferences for giving birth at highly specialized hospitals (University hospitals) in Capital and Central Denmark Regions. This study was conducted in the Central Denmark Region, which has one highly specialized hospital and five regional hospitals that provide obstetrics services. A catchment area plan for uncomplicated deliveries was introduced in 2013 in order to regulate the high demand for giving birth at the university hospital. The plan identifies the municipalities/towns located within the catchment area of each hospital. The hospital specified for each area does not necessarily correspond to the nearest hospital.

The study was conducted in collaboration with five GP clinics in four towns *not* within the catchment area of the university hospital. To be able to investigate priorities regarding hospital characteristics, we offered pregnant women who attended these five clinics a real choice between the university hospital and the regional hospitals. At their initial GP visit, the women were given oral and written information about the study. Upon consent, the researchers subsequently contacted the women in order to provide further information about the study and to potentially set up an interview.

The researchers did not provide any information about the hospitals to the participants in order to avoid influencing their information seeking processes. All the hospitals in this study provide standard services for uncomplicated pregnancies, but there are some differences in the services available at the different

hospitals, e.g. regarding the availability of neonatal wards or length of stay at hospital after birth etc.

#### 2.4. Data collection and analysis

From February to June 2016, qualitative interviews were conducted by phone, at the participants' homes, or at the researchers' workplace. All follow-up interviews were conducted by phone. The interviews were audio-recorded, transcribed verbatim, and the data were entered into NVivo software (version 10, QSR International). During a thorough reading of all the transcripts, the researchers generated the initial codes. Following a discussion about these codes, a final set of codes was agreed upon. After coding all the material, a thematic analysis was conducted involving the examination of commonalities between the codes, relationships and differences across the data set, and identification of themes.<sup>21,22</sup>

### 3. Results

The characteristics of the participants are shown in Table 1.

The analysis resulted in the identification of two overall themes: decision making and women's priorities regarding hospital characteristics.

#### 3.1. Decision making

With few exceptions, the women made their decisions without seeking advice from health professionals or relatives. Some had shared their decision with their partners, but had not discussed it in depth:

*Uhhh, I have told about it (my choice) to my husband. He also believed that we should choose regional hospital, so we didn't discuss it any further (Alice, regional hospital).*

The women reported that their GP and other staff at their clinic had not influenced their decision; they just informed the women about the study and the opportunity of choosing between hospitals, but did not offer additional information or advice.

Only two women (both of whom were pregnant with their first child) had initially felt uncertain about which hospital to choose. However, the remaining women expressed a very strong preference for one particular hospital:

*I didn't really think about it, actually. It's mostly about the logistics for us . . . it's the easiest. And I was happy about the first time (giving birth there). So there wasn't really any reason to consider other hospitals, I think (Lilia, regional hospital).*

Very interestingly, and somewhat surprisingly, none of the women in the study seriously searched for information about the different hospitals from external sources prior to making their decisions; the women based their decision on their previous experiences or those of their peers:

*Well, I have not really received that much information. However, I made my decision because I have been there before; the feeling of it just being nice and easy to go somewhere I knew (Rose, university hospital).*

Tina (who was pregnant with her first child), had recently moved to the Region and had some relatives who had experience with the university hospital. She refrained from searching for more information as she did not expect that there were any major differences between the hospitals:

*Uhm, I probably could have looked it up myself, but hospitals' websites all seem the same; the same services, the same things they*

*offer. If there are some differences or important information, I would have liked to know about it (Tina, university hospital).*

In general, the women's or their peers' experiences with a hospital seemed to be the primary source of information that the women referred to in their decision-making processes.

#### 3.2. Women's priorities regarding hospital characteristics

The thematic analysis identified the following five categories that together comprise the theme of pregnant women's priorities regarding choice of hospital: experience, safety, distance and accessibility, continuity of care and hospital service attributes.

##### 3.2.1. Experience

The women described previous experience of a particular hospital as the main influence on their choices. Positive previous birth experience (or relatives' experiences), qualified staff, and knowing the hospital were the factors to which they ascribed the most importance.

All the women who were expecting their second or third child mentioned that positive birth experience played an important role in their decision making. For example, Lada reflected on her positive birth experience as follows:

*It definitely weighs a lot that we had such a good experience with the first (birth) (Lada, university hospital).*

When inviting the women to describe what made their previous experience positive, some referred to the qualified personnel they had met. For example, Pia mentioned that her mother's good experience with competent staff at a regional hospital had a large influence on her decision:

*The staff were really sweet at the regional hospital to which my mother was admitted for two whole weeks, so I spent a lot of time there. And I could just tell how my mother thought that the staff were really competent, sweet, and considerate; and she was happy there. Therefore, to me, that is an important thing (Pia, regional hospital).*

Contrary to Pia's positive evaluation, Sara evaluated (another) regional hospital's handling of her previous missed abortion procedure very negatively. Moreover, her father was also not satisfied with his recent stay at the hospital:

*Well, we (I and my father) have had some really unfortunate experiences there (at a regional hospital). I simply don't feel safe going through the doors there (Sara, university hospital).*

Interestingly, even the women who had experienced a complicated birth chose the same hospital for their subsequent birthing. They expressed confidence in the staff's ability to effectively manage critical situations:

*Yes, yes, I got a pretty bad (perineal) tear . . . Um, pretty bad. And there was green amniotic fluid so he (the baby) also had to be closely monitored. So, there were various things . . . but I have not felt unsafe or anything at any point (Lilia, regional hospital).*

Finally, being familiar with the hospital environment and birth department was another aspect of having previous experience with a hospital. Some women articulated that being familiar with a particular hospital environment positively influenced their selection of the hospital:

*Also, the other thing is that the hospital was familiar to us because we have been there many times and it means a lot that we know the birth department and the entrance (Fiona, university hospital).*

In summary, the women relied extensively on their own and others' experiences when choosing their birthing hospital.

### 3.2.2. Safety

The women's perceptions of safety affected their choice of hospital; in addition, their perceptions prompted some of them to request extra ultrasound scan at private clinics.

For example, Sara chose to give birth at the university hospital and associated her choice with a greater level of safety and assurance. This association was shared by Clara, who—like Sarah—had undergone an extra ultrasound scan at a private clinic. Both Sarah and Clara reported that these scans were solutions to their feelings of uncertainty in the early stages of pregnancy. Clara's pregnancy was not medically considered a high-risk pregnancy. However, due to two previous miscarriages, she was acutely aware of the risk of early miscarriage and used medical technologies to alleviate her worries:

*The worries stopped when we had an ultrasound scan in week 6 and again in week 8; and both showed that everything was as it was supposed to be. After that, there is a 47% chance that the pregnancy is going to be a success. So, at that point, I could, I could breathe again and feel that it was going to be okay* (Clara, university hospital).

Sara's and Clara's sense of having a risky pregnancy influenced their choice of hospital, and they chose a hospital with a higher level of specialization (the university hospital). Both expressed that they felt that they and their babies would be safer at the university hospital, which has more experienced, competent personnel and more specialized services:

*Well, I think they (university hospital staff) are very skilled at what they do. And, I believe I will be in safe hands; what to say, I mean that they have the responsibility of two lives during a birth so it is really important that you trust their skills* (Sara, university hospital).

*You need to act fast in the case of a complicated birth. I would feel safer knowing there are more specialists that have been in those acute and complicated situations several times. And you know . . . in the case of a complicated birth, they transfer you to the university hospital anyway, so overall it just makes me feel safer to be here (at the university hospital) in the first place* (Clara, university hospital).

However, some associated a shorter travel distance with increased safety. Kate, for example, considered a shorter distance that allowed her to get more quickly to her birthing hospital to be a source of safety and articulated her argument as follows:

*But I also feel safer knowing that the hospital is close to me. I would be worried to choose a hospital farther away, because my previous birth was really fast and I think the second birth will be even faster. So what if I chose the university hospital and suddenly there was traffic or something else happened?* (Kate, regional hospital).

### 3.2.3. Distance and accessibility

All the women who selected the nearest hospital mentioned the close distance and short travel time as a major reason for their choice.

*It takes me 20 minutes to the university hospital and 35 minutes to the regional hospital. ( . . . ) I don't know how well you know the area, but if you want to reach the regional hospital, you need to drive through small cities, so this actually takes time and makes it even longer* (Clara, university hospital).

For women who lived closer to the regional hospital, but chose the university hospital, "being in safe hands of qualified staff" and the "availability of different specialists" at the university hospital outweighed the extra distance to be covered while in labor pain:

*Oh, it is unpleasant to drive in car while you have labor pain. So that really speaks in favor of the regional hospital. ( . . . ) But, oh, if*

*you feel you are in super-safe hands, and you believe the hospital has it all, then a little more time in the car is a fair price to pay* (Lada, university hospital).

### 3.2.4. Continuity of care

Continued care from specific midwives throughout pregnancy and birth, which is known as caseload midwifery, is a relatively new aspect of the organization of Danish prenatal care services. Most of the women agreed that continuity of midwifery care during the prenatal period and birth represented an ideal birth experience. Pia, who was expecting her first child, was afraid of not being fully understood while giving birth and considered caseload midwifery an important criterion for a good birth experience and thus for her choice of hospital:

*Well, it will mean a lot to me, simply because I am scared about giving birth. So um . . . it would mean a lot to have the same midwife throughout my pregnancy. A midwife who knows who I am and what I want. Someone who supports me and explains to others about my fears. So she knows in advance what I want; therefore she can speak for me* (Pia, regional hospital).

Two women, Gilda and Clara, mentioned not having continuity of midwifery care as the only disadvantage of choosing the university hospital; however, this did not make them change their decision.

### 3.2.5. Service attributes

When choosing a birthing hospital, the women paid attention to several aspects of the hospital services on offer. Among others, the possibility of laboring in water, which was understood to represent a calm and naturalistic birth, was of interest to some women. Both the university and regional hospitals have adjacent rooms with bathtubs for some or all of their birthing rooms; however, availability depends on the hospital workload.

Moreover, all the women, especially those who were pregnant for the first time, considered adequate postnatal hoteling and support (e.g. length of stay at hospital after birth, if the father can stay at hospital) to be important. However, only a few of the women knew about the hoteling policy at their hospital of choice. They mostly gained this information from their peers' experiences.

## 4. Discussion

In this study, we found that healthy pregnant women were confident about making independent decisions regarding where to give birth and that their decisions were influenced by previous experiences, whether personal experience or the experience of their peers.

Studies show that individuals generally use several different sources of information in their decision-making processes, including comparative information provided by official sources, personal experience, peers' experiences, and recommendations from healthcare professionals such as their GP [e.g. 7,23–25]. Consistent with previous studies, we found that previous care experience represented the most important source of information for our study participants: a good experience at a particular hospital positively influenced the choice of the same hospital. Based on the women's statements about the role of their GPs in their decision making, we assume that, due to the study being conducted, the GPs wanted the women to make the decisions on their own and they did not influence the women's decisions. However, the result of a survey in Denmark showed that in settings in which there is free hospital choice, most GPs perceived that they selected their patients' hospitals on behalf of the patients.<sup>26</sup>

To the best of our knowledge, the present study is the first to investigate women's priorities regarding various hospital characteristics in a setting in which, there was free choice of hospital. For some women, choosing among hospitals raised the issue of perceived safety attributed to different hospitals. From a specialist's point of view, both university and regional hospitals provide high-quality standard care for uncomplicated pregnancies. However, there is an obvious discrepancy between how risk is perceived by pregnant women and how it is perceived by clinicians and experts; from a clinical perspective, seeking highly specialized services for an uncomplicated pregnancy is considered an unnecessary extra demand. However, the present study shows that, from some pregnant women's points of view, seeking highly specialized care is a meaningful and legitimate way to maximize safety in a potentially risky situation where a positive outcome is highly desired. In times during which the focus is on value-based healthcare and when achieving high value for patients is becoming an overarching goal of healthcare delivery,<sup>27</sup> individual priorities are legitimate constructs, even if they are not aligned with objective clinical need.

The novel feature of this study is that the choice of birthplace was limited to hospitals, whereas previous studies focused on comparing homebirths or births at midwife-led centers to hospital births. In these studies, medical interventions available at hospitals were cast as an essential safeguard against the uncertainties of birth, which led women to trust hospitals more than home or midwife-led centers as a strategy for managing uncertainty.<sup>28–30</sup> Conversely, in the present study, although the women were aware that appropriate medical interventions were available at all of the hospitals, some felt safer at a hospital with more specialist services and more experienced and competent staff (who are expected to be capable of handling any unforeseen situation). This is in accordance with the viewpoint of Hundley and Ryan, who have pointed out that preferences are influenced by knowledge of availability,<sup>31</sup> which, in some cases, prompts women to travel further to reach a hospital with highly-specialized facilities. Further research is needed on the priorities and service needs of the few Danish pregnant women who choose home birth and how perception of safety affect their choices. Such research may provide a valuable perspective from the minority's point of view and inform future hospital planning.

In this study, pregnant women with previous experience of giving birth all chose to give birth at the same hospital as they had previously given birth at, which indicates that they had each built trust in the hospital that they were already familiar with. Some studies argue that, over time, previous experiences shape our expectations of regret related to our decisions and the ensuing outcomes<sup>32</sup> and that feeling responsible for a decision is a necessary condition or at least a major determinant of regret.<sup>33</sup> Regret – or in this case fear of regret – is therefore likely to shape pregnant women's decisions. Our results suggest that based on the previous positive experience of giving birth, pregnant women are unwilling to risk the potential regret of choosing another hospital. Further studies are needed to investigate how attempting to limit future regret shapes women's choices.

This study contributes to the literature by providing evidence of the importance of hospital service attributes in the choice of birthing hospital. The results show that continuity of care, water birth availability and adequate hoteling services were factors that some women showed preferences for when choosing among the hospitals. Knowledge about the characteristics that are important to women can inform service management at the hospital level and also aid the development of general information communication strategies (in relation to capacity planning) at the health sector level.

The main strength of the study is that the interviewed women were provided with a real rather than hypothetical choice of hospital, which gave them the opportunity to consider different hospitals for giving birth at, and reflect on their priorities. Using a qualitative design along with the real choice scenario is another strength of our study, as this allowed comprehensive understanding of the women's decisions and priorities regarding hospital characteristics.

The main limitation of this study is that it included a relatively small number of participants. Due to administrative agreements between the hospitals, the inclusion period could not be prolonged. However, we can confirm that we reached the point of saturation during the analysis, at which point no new themes were identifiable from the interview transcripts. In addition, the narrow study aim, highly specific participant characteristics, quality of communication between the researchers and participants, and analytical strategies used led to an acceptable level of information power.<sup>34</sup> Due to the sampling strategy (i.e., convenience sampling), we had no hand in selecting the participants, were not informed of the number of women who were eligible for the study (during the recruitment period), and cannot guarantee that there was no bias in the sampling process (introduced by the GPs or other staff at the clinics).

Additional quantitative studies based on the findings of this study, may reveal the relative importance of different hospital characteristics for pregnant women. Since the participants were all healthy women, further studies investigating the priorities of less healthy individuals, older individuals, and males regarding hospital characteristics are recommended. Research is also needed to understand the influence of risk perception on hospital choice for cases other than those involving giving birth. Additionally, there is a lack of evidence regarding the extent to which patients are aware of the different information sources available and whether they consider these sources in their decision-making process.

## 5. Conclusion

This study showed that women make choices about hospital providers independently and their decisions are predominantly influenced by personal or peers' experiences. The perceptions of increased safety shaped some women's selection of a highly specialized hospital, which raises the issue of whether pregnant women have reliable information about safety when they are making their decisions. In addition, the women's choice regarding their birthing hospital seemed to be sensitive to the differing services provided at the hospitals. We conclude that information on safety and services seems to be a key factor for making an informed decision.

## Conflicts of interest

The authors declare that they have no conflicts of interest.

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## Ethical statement

The project was approved by the Central Denmark Region Data Approval Committee with approval number: 1-16-02-40-15 on 23th September 2015. Informed consent was obtained from all

individual participants included in the study. The interview excerpts presented in the paper were carefully anonymized.

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# Women's Preferences for Birthing Hospital in Denmark: A Discrete Choice Experiment

**Nasrin Tayyari Dehbaraz, Morten Raun Mørkbak, Dorte Gyrd-Hansen, Niels Uldbjerg & Rikke Søgaard**

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# Women's Preferences for Birthing Hospital in Denmark: A Discrete Choice Experiment

Nasrin Tayyari Dehbarez<sup>1,2</sup> · Morten Raun Mørkbak<sup>3</sup> · Dorte Gyrd-Hansen<sup>4</sup> · Niels Uldbjerg<sup>5</sup> · Rikke Søgaard<sup>2,6</sup>

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## Abstract

**Background** Free choice of hospital has been introduced in many healthcare systems to accommodate patient preferences and incentivize hospitals to compete; however, little is known about what patients actually prefer.

**Objectives** This study assessed women's preferences for birthing hospital in Denmark by quantifying the utility and trade-offs of hospital attributes.

**Methods** We conducted a discrete-choice experiment survey with 12 hypothetical scenarios in which women had to choose between three hospitals characterized by five attributes: continuity of midwifery care, availability of a neonatal intensive care unit (NICU), hospital services offered, level of specialization to handle rare events, and travel time. A random parameter logit model was used to

estimate the utility and marginal willingness to travel (WTT) for improvements in other hospital attributes.

**Results** A total of 517 women completed the survey. Significant preferences were expressed for all attributes ( $p < 0.01$ ), with the availability of a NICU being the most important driver of women's preferences; women were willing to travel 30 more minutes (95% confidence interval 28–32) to reach a hospital with a highly specialized NICU. The subgroup analyses revealed differences in WTT, with substantial heterogeneity due to prior experience with giving birth and regarding risk attitude and health literacy.

**Conclusion** A high specialization level was the most influential factor for women without previous birth experience and for risk-averse individuals but not for women with a high health literacy score. Hence, more information about the woman's risk profile and services required could play a role in affecting hospital choice.

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✉ Nasrin Tayyari Dehbarez  
nastay@rm.dk

- <sup>1</sup> DEFACTUM, Olof Palmes Alle 15, 8200 Aarhus N, Denmark
- <sup>2</sup> Department of Public Health, Aarhus University, Bartholins Alle 2, bldg. 1260, 8000 Aarhus, Denmark
- <sup>3</sup> Incentive, Holte Stationsvej 14, 2840 Holte, Denmark
- <sup>4</sup> Danish Centre for Health Economics (DaCHE), University of Southern Denmark, Campusvej 55, 5230 Odense M, Denmark
- <sup>5</sup> Department of Obstetrics and Gynecology, Aarhus University Hospital, Palle Juul-Jensens Boulevard 99, 8200 Aarhus N, Denmark
- <sup>6</sup> Department of Clinical Medicine, Aarhus University, Palle Juul-Jensens Boulevard 82, 8200 Aarhus N, Denmark

## Key Points for Decision Makers

Prior experience with giving birth reduced the willingness to travel for all hospital attributes.

A high health literacy score reduced the importance of continuity of midwifery care, availability of a specialized neonatal intensive care unit (NICU), and a highly specialized hospital that can handle complicated births.

A risk-averse attitude increased the willingness to travel to hospitals with superior attributes.

## 1 Introduction

In healthcare, patient choice is a popular reform model adopted by administrations with different political orientations in several Organisation for Economic Cooperation and Development (OECD) countries over the last two decades [1–5]. The belief is that by increasing patient choice, care providers will become more responsive to patients' demands, which in turn will drive greater efficiency in the delivery and funding of healthcare [4, 6]. However, understanding the factors that influence patients' responses to choice is important to ensure value-based delivery of services and to ascertain how demand factors affect the relative demand for care among different healthcare providers [7].

The quality of healthcare provision varies in terms of different dimensions. Individuals are likely to value each of the quality dimensions when making healthcare decisions. If individuals can easily assess differences in these dimensions across providers, they can choose a provider based on their preferences [8]. Understanding patient preferences for healthcare providers will enable healthcare planners and policy makers to design patient-centered care [9]. Achieving patient-centered care depends on a thorough understanding of patient preferences at all stages of their journey through healthcare [10].

This study was designed to assess the relative importance of several attributes of a hypothetical hospital from women's perspective, using a discrete-choice experiment (DCE). DCEs are increasingly being used to model patients' preferences regarding healthcare and provide a useful means of investigating the factors that affect patients' choice of treatment provider [11]. We chose to focus on women's choice of birthing hospital as it has been shown that women choose birthplace either before becoming pregnant or during the first trimester [12]. In addition, Regan and McElory [13] showed that most women knew what type of birth they wanted from an early stage in their pregnancy and that their choices were aligned with their understanding of risk.

To the best of our knowledge, several studies have used the DCE method to investigate preferences for choice of birthplace or choice of intrapartum care. Two studies were conducted in the Netherlands, both including home birth as an attribute in their design [14, 15]. Dutch maternity care identifies with its uniquely high rate of home birth compared with other industrialized countries [14], and the results of these studies may therefore not be applicable to other European healthcare systems, in which hospital is the default birthplace. In the third study, conducted in Scotland, the DCE method was used to elicit women's preferences for midwife-managed units. The results of this study

suggested that respondents preferred maternity units that offered a greater continuity of caregiver, more methods of pain relief, continuous fetal heart rate monitoring, a home-like appearance, routine involvement of medical staff and greater involvement for the woman in the decision-making process [16]. A recent study conducted in Ireland used DCE to investigate women's strengths of preference for different features of maternity care. In this study, the levels for each attribute broadly described service differences between consultant- and midwifery-led care centers. The results showed 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 anesthesia during labor; being actively involved in the decision making around their labor; and having extended periods of stay in hospital after the birth of their baby [17].

In total, the results of the aforementioned DCE studies are not generalizable to the Danish healthcare setting because they focused on home birth or midwifery-led centers in choice of relevant attributes.

The objective of this article is to assess women's preferences for birthing hospital in Denmark by quantifying the trade-offs of hospital attributes based on women's preferences. In addition, we conducted subgroup analyses to verify whether specific pregnancy-related or personal characteristics could explain the heterogeneity in preferences.

### 1.1 Institutional Setting

Denmark has a universal, tax-financed healthcare system in which citizens have the right to choose their hospital. In Denmark, most births take place in hospitals, and the home birth rate is < 2%. In addition, as hospital births in Denmark are normally midwife-led, alternative options such as midwife-led centers are not part of the Danish birthing setting [18]. In the Danish system, a pregnant woman will not visit an obstetrician unless she has a risk factor or experiences pregnancy complications.

All public hospitals provide standard obstetric services. However, according to the Danish Health and Medicines Authority (<http://www.sst.dk>), hospitals can offer highly specialized or regional functions. The hospitals that provide highly specialized functions provide gynecology and obstetrics services in addition to other highly specialized services such as anesthesiology (level 3), pediatrics, psychiatry, neurosurgery, thorax surgery, and plastic surgery, among others. The hospitals that provide regional functions cooperate with anesthesiology (level 2), internal medicine, neurology, surgery and pediatrics. However, in some areas with low population density, the pediatrics specialty is not available.

No midwifery-led centers are available in Denmark, but some birthing hospitals offer a 'known midwife' service. The intention of the known midwife concept is that one primary midwife (or a group of midwives) cares for the pregnant woman for most of her pregnancy, during birth and a short period after birth to provide greater continuity and security in pregnancy and the birth process (<http://www.rm.dk>). However, potential heavy workloads mean they cannot guarantee that the same midwife can attend birth in some hospitals.

Additionally, the services that are offered to pregnant women at different hospitals may vary. For example, some hospitals provide water birth (although the service is not guaranteed). Further, the hoteling services vary amongst hospitals in terms of provision of private rooms, length of stay and whether the father can stay at the hospital after birth.

## 2 Materials and Methods

### 2.1 Establishing Attributes and Levels

The attributes and levels used in the survey were developed using several approaches. First, we conducted a literature search to identify the attributes used in previously published DCEs regarding choice of birthplace. We identified six studies on preferences for birthplace that applied the DCE approach. All studies investigated preferences for different birth settings such as hospital birth, home birth or midwife-led centers. The common attributes identified in the review related to availability of pain relief at different birthplaces, involvement of medical staff, continuity of care, birthplace atmosphere, involvement in decision making and travel time. Second, we interviewed 13 pregnant women about their priorities for birthing hospital based on their real choice of birthing hospital in the first trimester of their pregnancy [18]. A detailed explanation of the shortlisting of attributes and the choice of levels can be found in appendix A in the Electronic Supplementary Material (ESM).

We chose to include four attributes with three levels: continuity of midwifery care, availability of neonatal intensive care unit (NICU), hospital services offered and a hospital's level of specialization in handling rare and serious events during childbirth in addition to a travel time attribute. To ensure the attributes and their definitions and levels were understandable, we presented and discussed them in two focus group interviews (each with three women) and two individual interviews.

Table 1 details the attributes and levels as well as the expected impact on women's utility of an increase in the level of each attribute.

### 2.2 Study Sample

We used a step-by-step guide for the calculation of the minimum sample size requirements to ensure the right sample size for the study [19]. Based on this guide, we needed a minimum sample size of 220 respondents, with a statistical power of 0.8 and 95% certainty that all parameter estimates were different from zero. To ensure robust results, we decided to recruit 500 participants. Participants were recruited by Userneeds (<http://www.userneeds.dk>). Userneeds is the largest consumer and citizen online panel in Denmark and is a member of ESOMAR (<http://www.esomar.org>). The online panel constitutes a representative sample of Danish citizens who have been actively recruited for the panel (to minimize selection bias, citizens are unable to sign up on their own initiative). To ensure that the sampling population included women of child-bearing age, we chose to invite women aged 18–40 years, distributed in different regions of Denmark, and with different levels of education. An invitation email with a link to the survey was sent to the selected members of the panel, and participation in the study was optional.

### 2.3 Experimental Design

The chosen attributes and levels were used to design the DCE, in which women were presented with choice sets containing three alternatives (hospital A, hospital B, and hospital C). We generated a fractional factorial design to create a subset of 36 profiles, divided across 12 choice sets with mean Bayesian D-error score of 0.45 using Ngene version 1.1.2 [20]. An example of a choice set is shown in Table 2.

A pilot study of 12 choice sets was undertaken to inform the main design. A total of 50 women who were members of the online panel completed the pilot study, and the data were analyzed using multinomial logistic (MNL) regression and random parameters logit (RPL) model regression in Biogeme [21], enabling priors to be obtained for updating the design. The Bayesian design was evaluated with the D-efficiency measure.

### 2.4 Constructing and Administering the Survey

The final survey consisted of three sections. Section one collected information on the participants' characteristics and their health behavior. Section two contained the DCE task as well as the respondents' rating of the difficulty of the survey and the level of assurance in their responses. Section three included questions on health literacy, regrets, and risk attitude. The full questionnaire is provided in the ESM.

**Table 1** Attributes and levels

Attribute	Level (abbreviation)	Expected impact on utility
The same midwife is responsible for the whole period of pregnancy and birth	NO (MIDWIFE_NO)	Positive
	Not sure (MIDWIFE_MAYBE)	
	Yes (MIDWIFE_YES)	
Availability of an NICU	NO (NICU_NO)	Positive
	Yes, but not at a highly specialized level (NICU_NOT SPECIALIZED)	
	Yes, at a highly specialized level (NICU_HIGHLY SPECIALIZED)	
Hospital services offer (e.g., the possibility of a water birth, hoteling services after birth, etc.)	Not available (SERVICE_NO)	Positive
	Depends on workload (SERVICE_MAYBE)	
	Available (SERVICE_YES)	
The hospital's level of specialization to handle rare and serious incidents that affect the mother's health during childbirth	Standard at handling a normal birth (SPECIALIZATION_NORMAL)	Positive
	Standard at handling a complicated birth (SPECIALIZATION_COMPLICATED)	
	Highly specialized at handling a complicated birth (SPECIALIZATION_HIGHLY SPECIALIZED)	
Travel time (mins)	15	Negative
	30	
	45	
	60	
	90	
	150	

NICU neonatal intensive care unit

**Table 2** Example of a choice set

	Hospital A	Hospital B	Hospital C
The same midwife is responsible for the whole period of pregnancy and birth	Not sure	No	Yes
Availability of an NICU	Yes, at a highly specialized level	No	Yes, but not at a highly specialized level
Hospital services offered (e.g., the possibility of a water birth)	Not available	Depends on the workload	Available
The hospital's level of specialization in handling rare and serious incidents that affect the mother's health during childbirth	Standard at handling a normal birth	Highly specialized at handling a complicated birth	Standard at handling a complicated birth
Travel time	30 min.	60 min.	30 min.
Your choice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

NICU neonatal intensive care unit

The Health Literacy Questionnaire (HLQ) is a widely used measure of health literacy developed using a validity-driven approach including in-depth grounded consultations, psychometric analyses, and cognitive interviews [22]. The HLQ consists of nine scales. The present study included two of the scales: actively engage with healthcare

providers (scale 6) and understanding health information well enough to know what to do (scale 9). Additionally, choices were evaluated based on the participating women's risk and regret attitudes. We chose to use Dohmen's self-reported willingness to take risks in health (SOEP-H), because its cross-validity and temporal stability have been

validated and proven compared with other available risk preference measures [23], and a regret scale developed by Schwartz et al. [24] was used to investigate the role of regret in future decision making.

The online survey was administered via the online panel. The data collection took place from May to June 2017. To minimize selection bias, respondents were not informed about the content of the survey.

## 2.5 Data Analysis

To measure women's preferences, the choices from the experiment were analyzed using RPL regression. In the RPL model, we accounted for the panel nature of the dataset (multiple observations obtained from the same respondent over time) and allowed for preference heterogeneity from women by estimating the distribution of preferences for each of the non-travel-time-parameters as well as a mean preference parameter [25, 26]. In each of the choice sets, women were asked to choose between three unlabeled hospitals (hospitals A, B, and C).

$U_{njt} = \beta_n X_{njt} + \varepsilon_{njt}$  represents utility from alternative  $j$  in choice situation  $t$  by woman  $n$ , with  $\varepsilon_{njt}$  being an independently and identically distributed extreme value.  $X_{njt}$  is a vector of explanatory variables, and  $\beta_n$  is a vector of coefficients of these variables representing individual's tastes. The density for  $\beta_n$  is described as  $f(\beta_n|\theta)$ , where  $\theta$  refers to the parameters of the distribution (mean and variance). The conditional probability of woman  $n$  choosing alternative  $i$  from a total of  $J$  alternatives on choice occasion  $t$  is given by Eq. 1:

$$P(i_n|x_n, \beta_n) = \frac{\exp(\beta_n X_{nit})}{\sum_{j=1}^J \exp(\beta_n X_{njt})} \quad (1)$$

Under the RPL, we assume that  $\beta_n$  are individual specific and the unconditional probability is the integral of this product over all values of  $\beta$  weighted by their density  $f(\beta_n|\theta)$  (Eq. 2):

$$P_{ni} = \int \left( \prod_{t=1}^T \frac{\exp(\beta_n X_{nit})}{\sum_{j=1}^J \exp(\beta_n X_{njt})} \right) f(\beta|\theta) d\beta \quad (2)$$

All parameters except for travel time were assumed to be random with a normal distribution. Travel time was kept fixed to make the computation of willingness to travel (WTT) more straight forward. To ensure a stable model parameter had been reached, we used 800 draws in the final model [27].

The marginal rates of substitution were calculated as the WTT relative to changes in the levels of each of the other attributes. The mean WTT was estimated as the ratio of the respective attribute coefficient to the travel time coefficient, while holding other attributes at the reference level.

We used the Delta method to calculate the confidence intervals of WTT measures, which avoided most of the simulations by deriving partly analytical expressions for the standard errors [28].

To evaluate the robustness of the results, we analyzed the impact of excluding participants who were defined as outliers: participants who failed the rationality check (i.e., an assessment of whether they consistently chose either hospital A, B, or C across all choice scenarios or did not choose a clearly dominant alternative), and those who responded to the survey at the mean response time  $\pm$  one standard deviation (SD).

Subgroup analyses further investigated the effect of birth experience, previous experience with abortion or pregnancy complications, future pregnancy plans, as well as health literacy, risk, and regret attitudes on women's preferences.

## 3 Results

### 3.1 Characteristics of Respondents

To recruit respondents, a link to the survey was made available to web panelists who met the inclusion criteria. A total of 517 women answered the survey, and 15% of them rated the DCE as difficult or very difficult. We could not calculate a participation rate because we did not know the number of invitees. However, we compared our sample with data for women who gave birth in 2016 based on data from Statistics Denmark (<http://www.statistikbanken.dk>). Please see the ESM (appendix B, Table S2) for comparable characteristics. Given that women were not informed about the content of the survey, we did not expect a selection bias with regard to unobservable parameters.

Table 3 shows the participants' socio-demographics and pregnancy- and health-related characteristics.

### 3.2 Econometric Results

Table 4 shows the regression results of the RPL model. The model demonstrates a McFadden pseudo- $R^2$  of 0.34, which indicates an acceptable model fit for a discrete-choice model [29].

All attributes were found to be statistically significant ( $p < 0.01$ ). Women's preferences were consistent with our ex ante hypotheses about the effects of the attributes on utility. Respondents assigned positive utility to an improvement in the level of attributes. The availability of a NICU was the key driver of women's preferences, as indicated by the significantly large impact on utility. As expected, a longer travel time had a significant and negative effect on utility.

**Table 3** Participant characteristics ( $n = 517$ )

Variable	Value
Age, years	30 ± 6.66
Education	
Short-term	154 (30)
Medium-term	208 (40)
Long-term	142 (28)
Other	13 (2)
Employment	
Employed	354 (68)
Unemployed	163 (32)
Personal yearly income before tax (DKK)	
< 150,000	178 (34)
150,000–375,000	185 (36)
375,000–525,000	34 (7)
> 525,000	8 (1)
Not declared	112 (22)
Owns a car	289 (56)
Owns a house	201(39)
Has children	
Yes	178 (34)
No	339 (66)
Plans to be pregnant in future	
Yes	271 (52)
No	246 (48)
Has prior experience with pregnancy complications	
No	94 (18)
Yes	84 (16)
Not applicable	339 (66)
Has prior experience with abortion	
No	414 (80)
Yes, provoked abortion	52 (10)
Yes, non-provoked abortion	51 (10)
Non-smokers	410 (79)
No alcohol consumption	290 (56)
Physically active at least one day a week	484 (94)
BMI	25.42 ± 6.21
Easy or very easy to actively engage with healthcare providers (health literacy scale 6)	147 (28.43)
Easy or very easy to understand health information (health literacy scale 9)	128 (24.76)
Time taken to complete the survey, minutes	11.14 ± 4.43

Data are presented as  $n$  (%) or mean ± standard deviation

*BMI* body mass index, *DKK* Danish krone

The estimated SD showed that, for the availability of NICU and hospital's level of specialization, there was heterogeneity among the levels of the attributes, but the SDs were smaller than the estimated coefficients and all women had positive utility for these two attributes.

The only attribute level with an SD larger than the estimated coefficient was the highest level of continuity of midwifery care. The significant SD showed that women had different preferences; the SD was larger than the

coefficient, which means that some women might have had negative utility for having continuity of midwifery care versus not having continuity of midwifery care.

Table 5 shows the WTT for improvements in the level of attributes. As expected, women were willing to spend a longer time travelling to hospital as a trade-off for better hospital attributes. Notably, women were willing to travel 30 min longer to reach a hospital with a highly specialized NICU department.

**Table 4** Regression results from the random parameter logit model

Variable	RPL model	
	Coefficient (SE)	SD (SE)
ASC_1	0.14* (0.054)	0.33** (0.137)
ASC_2	0.20** (0.046)	0.11 (0.164)
Continuity of midwifery care		
No	Reference	Reference
Not sure	0.27** (0.029)	0.08 (0.064)
Yes	0.61** (0.043)	0.70** (0.043)
Availability of a NICU		
Not available	Reference	Reference
Yes, but not highly specialized	0.71** (0.037)	0.28** (0.050)
Yes, highly specialized	0.95** (0.048)	0.45** (0.039)
Hospital services offered		
Not available	Reference	Reference
Depends on workload	0.32** (0.030)	0.02 (0.031)
Available	0.51** (0.033)	0.24** (0.039)
The hospital's level of specialization		
Standard for a normal birth	Reference	Reference
Standard for a complicated birth	0.43** (0.031)	0.20** (0.041)
Highly specialized for a complicated birth	0.62** (0.040)	0.34** (0.052)
Travel time	- 0.032** (0.002)	NA

Log-likelihood = - 4522.411; Rho-square = 0.336

ASC\_1 alternative-specific constant for alternative hospital A, ASC\_2 alternative-specific constant for alternative hospital B, NA not applicable, NICU neonatal intensive care unit, RPL random parameter logit, SE standard error

\*\*Significant at the 1% level; \*significant at the 5% level

**Table 5** Willingness to travel (mins)

Attribute	Improvement in attribute	Willingness to travel (95% CI)	
		Complete sample (n = 517)	Outliers excluded (n = 348)
Continuity of midwifery care	Maybe available vs. not available	8.61* (7.95–9.26)	9.80* (9.03–10.58)
	Available vs. not available	19.37* (17.89–20.85)	19.34* (17.45–21.23)
Availability of a NICU	Available, but not highly specialized vs. not available	22.59* (21.07–24.12)	21.27* (19.69–22.85)
	Available at a highly specialized level vs. not available	30.00* (28.47–31.53)	27.63* (25.60–29.66)
Hospital services offer	Availability is dependent on workload vs. not available	10.03* (9.25–10.81)	11.32* (10.69–11.95)
	Available vs. not available	16.14* (15.37–16.90)	16.38* (15.17–17.59)
The hospital's level of specialization	Standard for complicated births vs. standard for normal births	13.54* (12.91–14.18)	13.77* (12.88–14.65)
	Highly specialized for complicated births vs. standard for normal births	19.49* (18.73–20.25)	19.51* (18.47–20.55)

CI confidence interval, NICU neonatal intensive care unit

\*Significant at the 5% level

Table 6 presents the WTT for a range of subgroups based on pregnancy-related characteristics, health literacy scores, and risk and regret attitudes.

The subgroup analyses indicated a substantial heterogeneity regarding prior birth experience. There was a tendency toward a greater WTT for a higher level of hospital

**Table 6** Willingness to travel (95% confidence interval), subgroup analyses

Attribute	Improvement in attribute	Prior experience with giving birth		Prior experience with abortion		Prior experience with complications		Plans pregnancy	
		Yes (n = 178)	No (n = 339)	Yes (n = 103)	No (n = 414)	Yes (n = 84)	No (n = 94)	Yes (n = 271)	No (n = 246)
Continuity of midwifery care	Maybe available vs. not available	4.27* (3.68–4.87)	12.77* (11.15–14.38)	7.43* (5.74–9.11)	9.00* (7.87–10.13)	3.63* (3.11–4.16)	3.91* (2.71–5.12)	8.36* (7.21–9.51)	8.93* (7.76–10.09)
	Available vs. not available	6.21* (5.49–6.92)	30.04* (27.50–32.57)	13.67* (11.57–15.76)	19.97* (18.46–21.48)	5.33* (4.01–6.65)	4.87* (4.10–5.64)	19.90* (17.85–21.95)	18.25* (16.26–20.24)
Availability of an NICU	NICU available but not highly specialized vs. not available	18.93* (16.67–21.20)	27.54* (25.75–29.32)	21.99* (18.83–25.16)	23.04* (21.52–24.57)	17.22* (14.21–20.23)	16.89* (13.89–19.88)	25.24* (22.98–27.50)	20.55* (18.88–22.22)
	NICU available at a highly specialized level vs. not available	25.09* (21.96–28.22)	36.10* (33.90–38.29)	30.58* (27.26–33.90)	29.72* (27.91–31.53)	22.41* (18.26–26.56)	21.52* (18.11–24.94)	34.08* (31.22–36.95)	26.07* (24.00–28.15)
Hospital services offer	Availability is dependent on workload vs. not available	9.59* (9.16–10.02)	11.52* (10.02–13.01)	10.55* (8.93–12.16)	9.94* (8.96–10.91)	7.01* (6.19–7.84)	9.86* (8.60–11.12)	9.58* (8.48–10.68)	10.43* (9.45–11.41)
	Available vs. not available	13.41* (12.10–14.72)	19.20* (18.41–20.00)	15.88* (14.48–17.29)	16.21* (15.34–17.07)	9.85* (8.49–11.22)	14.17* (12.05–16.29)	16.53* (15.44–17.61)	15.52* (14.62–16.42)
The hospital's level of specialization	Standard for complicated births vs. standard for normal births	11.70* (10.55–12.68)	15.76* (14.93–16.58)	16.88* (14.72–19.04)	12.73* (12.10–13.55)	10.41* (8.67–12.16)	10.70* (9.23–12.18)	14.18* (13.12–15.24)	12.70* (11.93–13.47)
	Highly specialized for complicated births vs. standard for normal births	14.58* (12.97–16.19)	24.17* (23.20–25.13)	23.44* (20.73–26.15)	18.59* (17.74–19.43)	12.07* (10.35–13.80)	13.56* (12.23–14.89)	20.64* (19.34–21.94)	18.19* (17.25–19.13)
Attribute	Improvement in attribute	Health literacy (Scale 6)		Health literacy (Scale 9)		Risk attitude		Regret attitude	
		Low (n = 370)	High (n = 147)	Low (n = 389)	High (n = 128)	Lower (n = 174)	Averse (n = 343)	Lower (n = 311)	Averse (n = 206)
Continuity of midwifery care	Maybe available vs. not available	9.93* (8.69–11.17)	6.10* (5.32–6.88)	9.59* (8.21–10.97)	6.23* (4.99–7.48)	7.04* (6.08–8.00)	9.54* (8.33–10.76)	9.60* (8.38–10.82)	7.92* (6.86–8.98)
	Available vs. not available	22.13* (20.33–23.92)	11.78* (10.14–13.42)	20.37* (18.75–22.00)	14.19* (11.87–16.51)	19.49* (16.37–22.25)	19.09* (17.44–20.74)	21.20* (19.30–23.11)	16.97* (15.04–18.90)
Availability of an NICU	Available but not highly specialized vs. not available	23.83* (22.18–25.49)	20.38* (17.70–23.05)	23.57* (21.96–25.18)	20.35* (17.54–23.16)	18.38* (16.22–20.54)	25.60* (23.72–27.48)	24.38* (22.61–26.15)	20.95* (19.01–22.89)
	NICU available at a highly specialized level vs. not available	31.25* (29.32–33.19)	26.06* (22.85–29.26)	32.04* (29.92–34.17)	25.19* (21.93–28.45)	26.67* (23.46–29.87)	32.38* (30.22–34.54)	32.74* (30.51–34.96)	26.82* (24.44–29.20)
Hospital services offer	Availability is dependent on workload vs. not available	9.62* (8.56–10.67)	10.85* (10.06–11.63)	10.37* (9.23–11.52)	9.45* (8.65–10.25)	11.62* (10.52–12.73)	9.38* (8.39–10.37)	11.13* (9.80–12.46)	9.17* (8.36–9.99)
	Available vs. not available	16.17* (15.41–16.92)	15.63* (13.77–17.50)	16.16* (15.27–17.05)	16.36* (14.22–18.50)	18.09* (16.47–19.71)	15.21* (14.34–16.08)	18.39* (17.66–19.13)	13.68* (12.36–15.01)

**Table 6** continued

Attribute	Improvement in attribute		Health literacy (Scale 6)		Health literacy (Scale 9)		Risk attitude		Regret attitude	
	Low ( <i>n</i> = 370)	High ( <i>n</i> = 147)	Low ( <i>n</i> = 389)	High ( <i>n</i> = 128)	Lower ( <i>n</i> = 174)	Averse ( <i>n</i> = 343)	Lower ( <i>n</i> = 311)	Averse ( <i>n</i> = 206)		
The hospital's level of specialization	13.62* (13.03–14.22)	12.44* (11.05–13.83)	13.64* (13.00–14.28)	12.74* (11.11–14.37)	12.59* (11.10–14.08)	14.17* (13.56–14.78)	13.21* (12.45–13.97)	14.09* (12.90–15.27)		
Standard for complicated births vs. standard for normal births	20.80* (19.87–21.73)	16.34* (14.62–18.06)	20.27* (19.64–20.91)	16.98* (14.98–18.99)	16.13* (14.98–17.27)	21.37* (20.34–22.40)	20.07* (19.16–20.99)	19.00* (17.95–20.05)		
Highly specialized for complicated births vs. standard for normal births										

*Italicized cells indicate significant heterogeneity within groups*

*NICU neonatal intensive care unit*

\*Significant at the 5% level

attributes among women that did not have birth experience. We observed a greater WTT to access a specialized hospital that can handle complicated birth among women who had prior experience with abortion. Women who had planned for a future pregnancy were more willing to travel to access a hospital with a NICU department and a highly specialized hospital that can handle complicated births.

We also found that a high score on both health literacy scales reduced the importance of continuity of midwifery care and the availability of a highly specialized NICU and a highly specialized hospital for handling complicated births. Significant heterogeneity was also observed among women with different risk attitudes, indicating that risk-averse women were willing to travel further for higher levels of all hospital attributes except for hospital services offered. With regard to regret attitude, women who displayed regret were more willing to travel for a longer time for most levels of hospital attributes, but significant heterogeneity was observed for availability of a NICU and hospital services offered.

#### 4 Discussion

The survey revealed the relative importance of hospital attributes, with the availability of a specialized NICU being the most important factor across all subgroups of women. We found differences in preference patterns across our subgroup analyses. It was interesting that the most significant differences were found in the comparison between those with and without prior birth experience. Our results suggest that prior experience with giving birth (regardless of whether this was a positive or negative experience) reduced the WTT for all hospital attributes, albeit the relative importance of the attributes remained intact. The interpretation of this is that women with previous birth experience will be more likely to choose a hospital near their home, irrespective of the services the nearest hospital offers. In contrast, women without birth experience will be more willing to travel farther to give birth at their ideal hospital.

To the best of our knowledge, this is the first study to assess whether women's preferences for hospital attributes vary across levels of health literacy and attitudes toward risk and regret. We found substantial heterogeneity in preferences among women with different attitudes toward risk. Specifically, risk-averse women were more willing to travel to access a highly specialized hospital that can handle complications for both the mother and the infant. This brings up the question of whether women are fully aware of their pregnancy-related risk profile and the possibilities of the services offered at different hospitals. A cohort study that explored preferences and motives

regarding place of birth in the Netherlands concluded that women require concrete information about the availability and characteristics of the services available within the maternity care system and the risks and benefits associated with different birth settings (home birth, midwifery-led care, or obstetric-led care centers) to make an informed choice about where to give birth [30].

Women with different regret attitudes showed different preferences for availability of a NICU and hospital services offered. Choice models based on random regret minimization (RRM) have been applied in studies of travel choice and have recently been introduced to health economics. RRM models hypothesize that individuals attempt to minimize regret rather than maximize utility when making choices [31, 32]. A meta-analysis by Brewer et al. [33] found that anticipated regret was generally a stronger predictor of intentions and behavior than other anticipated negative emotions and risk appraisals. The study suggests that the field should give greater attention to understanding how anticipated regret differs from similar constructs, its role in health behavior theory, and its potential use in health behavior interventions [33].

As an analytical model, in addition to RPL we also used the MNL model. The results of the two models were similar in terms of the direction and significance of parameters. However, the RPL model, which accounts for individual heterogeneity, exhibited a superior fit regarding the log likelihood ratio test and had a higher Rho-squared value. Hence, we used RPL as the main model for our analyses.

We decided not to exclude irrational responses from our analyses. Lancsar and Louviere [34] outlined several reasons why deleting responses from DCEs may be inappropriate after first reviewing the theory underpinning rationality, indicating that the importance placed on rationality depends on the approach taken to consumer theory. They suggested that deleting responses may result in the removal of valid preferences, induce a sample selection bias, and reduce the statistical efficiency and power of the estimated choice models [34].

Participants were forced to make a choice among the three hospitals, meaning they were not able to opt out or choose neither option. In general, the choice to include an opt-out option is determined by the objective of the DCE [35]. With hospital being the default birth place in Denmark, in addition to a negligible rate of home birth and unavailability of midwifery-led centers, we decided not to include a “neither” or “opt out” option. We believe that opt-out is not a viable option for obstetrics care in the Danish setting and, since we do not elicit welfare effects, the opt-out option is of minor importance.

It may be speculated whether the outcomes of this study are a good proxy for the actual behavior of the participating

women. Do the hypothetical choices made by respondents reflect choices made by respondents in real-life settings? Within health economics, stated preferences have been compared to actual behavior in relation to consumption of medication [36], participation in a screening programme [37] and participation in a lifestyle intervention among patients with type 2 diabetes mellitus [38]. These studies are not comparable to our case. It is generally recommended that additional studies be conducted to investigate the predictive value of DCEs by comparing stated preferences and actual behavior. Hence, further research is needed to test the external validity of the results of this DCE study, i.e., the extent to which women's behavior in the real world compares with their stated preferences.

One strength of the current study is that the design of choice scenarios was based on prior qualitative interviews [18]. Adequate sample sizes are crucial to obtain sufficient statistical power to test hypotheses in DCEs [39]. We used a step-by-step guide for calculating the required sample size in healthcare which addressed the issue of minimum sample size requirements in terms of the statistical power of hypothesis tests on the estimated coefficients [19]. Moreover, we do have a relatively large sample size, providing us with significant results.

It could be argued that a weakness of the study is that the respondents were not pregnant and that almost half of the participants did not plan to become pregnant; however, the results of the subgroup analysis suggested that their preferences were very similar irrespective of a woman's intention for future pregnancy.

## 5 Conclusion

We elicited the preferences that influence women's choice of birthplace, and we believe it is equally important to do so for other hospital services to better understand which factors steer a patients' choice of hospital. This information can be used to tailor services to the specific needs of women, and/or be used as a basis for better circumventing non-optimal decisions by ensuring that women's choices are based on complete information regarding the characteristics of the hospitals as well as an insight into the individual woman's risk profile.

**Data Availability** The data are not publicly available because women remain easily identifiable given the information provided.

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**Author Contributions** NTD contributed to the study design, data analysis, interpretation of results, drafting the manuscript, and reporting. MRM, DG-H, and RS contributed to the study design, data analysis, interpretation of results, writing, and reporting. NU contributed to study design to ensure the applicability and relevance of the survey instrument, writing and reporting. All authors approved the manuscript.

### Compliance with Ethical Standards

**Ethical approval** The Central Denmark Region data approval committee approved the study (Journal number 1-16-02-40-15).

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**Conflicts of interest** N. Tayyari Dehbaraz, M. Raun Mørkbak, D. Gyrð-Hansen, N. Uldbjerg, and R. Søggaard have no conflicts of interest.

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## Supplementary appendix A

### Details of included attributes and levels

The analysis of the qualitative study resulted in the identification of five categories that together determined pregnant women's priorities regarding choice of hospital:

- 1) Previous experience: women had trust in the hospital that they were already familiar with, regardless of whether they had a positive or negative experience at that hospital.
- 2) Safety: women felt safer at a hospital with more specialist services and more experienced and competent staff. They showed concern both for the safety of themselves and their newborn child.
- 3) Distance and accessibility: a close distance to women's home and short travel time affected the choice of hospital; however, in some cases there was a trade-off between distance and the specialization level of services at a hospital.
- 4) Continuity of care: women agreed that continuity of midwifery care represented an ideal birth and those who did not have this opportunity expressed it as the only disadvantage of choosing a highly-specialized hospital.
- 5) Hospital service attributes: women considered several aspects of the hospital services on offer to be important when making decisions about a hospital. The possibility of laboring in water and hoteling services were the most notable attributes.

On the basis of the literature review and the qualitative study, we selected five attributes: continuity of midwifery care, availability of NICU, hospital service offer, hospital's specialization level to handle complicated birth and travel time. Women showed concern about any complication during birth as well as to the safety of their newborn child, hence we included both 'specialization level for complicated birth' and 'availability of an NICU' attributes. In addition, travel time attribute was chosen because it covers both distance and accessibility of a hospital. Danish patients pay for travel costs only if they choose a hospital beyond their home region. For this reason, the time constraints were considered to be stronger and more realistic than budget constraints, and thus more policy relevant.

We provided an understandable definition of each attribute and, assigned plausible, relevant, and sufficiently wide-ranging levels to the attributes. Three levels were identified for the attribute continuity of midwifery care as women are typically guaranteed continuity of midwifery care at regional hospitals (MIDWIFE\_YES), however this can not be guaranteed at some hospitals due to heavy workload (MIDWIFE\_MAYBE) and in some hospitals, continuity of midwifery care is not provided (MIDWIFE\_NO). Three levels were defined for availability of an NICU. Highly specialized hospitals provide highly-specialized NICU services (NICU\_HIGHLY\_SPECIALIZED). Regional hospitals may or may not provide NICU services. In case regional hospitals provide NICU services, it is provided in lower level of specialization (NICU\_NOT\_SPECIALIZED) than highly-specialized hospitals. The attribute for hospital's ability to handle rare events had three levels, which mimic the real situation of highly-specialized and regional hospitals. Highly-specialized hospital provide specialized care for all types of complicated birth (SPECIALIZATION\_HIGHLY\_SPECIALIZED), while regional hospitals provide standard services and they may be able to handle complicated birth (SPECIALIZATION\_COMPLICATED) or are just capable of handling normal birth (SPECIALIZATION\_NORMAL). For the hospital service attribute, three levels were assigned due to diversity in service provision at different hospitals and the workload. There are hospitals that guarantee access to desired services such as water birth (SERVICE\_YES). However, at some hospitals the provision of these services depends on workload (SERVICE\_MAYBE) and some other hospitals do not provide such services (SERVICE\_NO). And finally six levels were assigned to travel time attribute and describe 15, 30, 45, 60, 90 and 150 minutes of travel time. To validate the included travel time, we asked ten women living in different regions and with different educational backgrounds to specify the maximum travel time they would be prepared to undertake to reach a hospital that provided their preferred level of other attributes.

To validate the attributes to be included, their definitions, and the assigned levels, we presented and discussed them in two focus group interviews, each with three women and two individual interviews. We also asked participants if they considered any important variables to be omitted, and if they found or considered assigned attribute levels appropriate and relevant. After validation of the attributes and levels, we chose to include the selected five attributes and levels which are shown in table 1 in the manuscript.

## Supplementary appendix B

Our sample was very similar to the population in terms of age distribution and region of residency. The level of education of women who gave birth in 2016 is not available at Statistic Denmark; hence we present education level of general female population in childbearing age in 2016 (n=768,583).

Table S1 Comparing characteristics of study participants with women who gave birth in 2016- extracted from Statistic Denmark

	Denmark statistic- 2016 n=47,133	Study participants n=517
Mean age, years (SD)	30 (4.62)	30 (6.66)
Region of residency- n (%)		
Capital Region of Denmark	15,609 (33)	191 (37)
Region Sjælland	5,818 (12)	63 (12)
Region of Southern Denmark	9,303 (20)	108 (21)
Central Denmark Region	11,515 (24)	106 (21)
Region of Northern Denmark	4,888 (11)	49 (9)
Education- n (%)	n= 768,583	n=517
Short-term	316,202 (41)	154 (30)
Medium-term	304,618 (40)	208 (40)
Long-term	126,170 (16)	142 (28)
Other/ not informed	21,593 (3)	13 (2)

## **Questionnaire to assess women's views on choice of birthing hospital**

Department of Public Health, Aarhus University and DEFACTUM, Central Denmark Region are carrying out a survey of the views of women on choice of birthing hospital via a Ph.D. study.

We are asking you to participate in this study by completing the attached questionnaire.

Knowledge of your views is of great importance in future organization and development of hospital sector, even though you do not plan to be pregnant.

The questionnaire consists of three sections and it takes about 15 minutes to be filled. It is voluntary to participate in the study. All responses will be treated as strictly confidential and only used for the purpose of this study.

Thank you for your time and participation.

## 1. Section

### Demographic, socio-economic and health behavior

1. What is your date of birth? .....dd / .....mm /.....year
2. What is your post number? .....
3. Do you have children of your own? (including children over 18 years)  Yes  No  
If yes, how many? ..... If no, go to question no. 5
4. Have you experienced complications in relation to your previous pregnancies?  
 Yes  No
- 5. Have you had any abortion?  Yes, provoked abortion  Yes, unprovoked abortion  No
6. Do you plan to be pregnant in future?  Yes  No
7. Have you finished an education beyond primary or secondary school?
  - No
  - One or more courses (e.g. courses for semi-skilled workers, labor market training etc.)
  - Vocational education (e.g. office clerk , shop assistant, hairdresser, medical secretary, social and healthcare worker/assistant, farmer)
  - 2-3 years of high education (e.g. laboratory technician, mechanical technician, dental hygienist)
  - 3-4 years of high education (e.g. primary school teacher, social worker, nurse, physiotherapist, bachelor of engineering, pedagogue)
  - More than 4 years of high education (e.g. civil engineer, medical doctor, psychologist, master and above degrees)
  - Other education
8. Are you under education?  Yes  No
9. Which education are you taking? .....
10. Do you have a job?  Yes  No
11. How much was you income in 2016 before tax and other deductions?
  - 0-99.000 kr.
  - 100.000 - 149.000 kr.
  - 150.000 - 249.000 kr.
  - 250.000 - 374.000 kr.
  - 375.000 - 524.000 kr.

- 525.000 - 699.000 kr.
- 700.000 - 849.000 kr.
- 850.000 kr. and more
- Do not want to disclose

**12. Do you live alone or with others?**

- I live alone
- I live with spouse/ partner or boy friend
- I live with child/ children under 16
- I live with others older than 16

**13. Do you or others at your household own ...**

- The place you are living in?             Yes             No
- ... A car?                                     Yes             No

**14. Do you receive treatment or medication for one or more sicknesses, or are you under rehabilitation or regular control?    Yes    No**

**15. How do you think your health is in general?**

- Excellent
- Very good
- Good
- Not so good
- Bad

**16. Do you smoke cigaret?**

- Yes, every day
- Yes, at least once a week
- Yes, Less often than every week
- No, I have stopped
- No, I have never smoked

**17. On an average week, how many days a week do you drink alcohol?**

0 day    1 day    2 days    3 days    4 days    5 days    6 days    7 days  
                           

**18. On an average week, how many days a week are you physically active at least 30 minutes a day?**

0 day    1 day    2 days    3 days    4 days    5 days    6 days    Every day  
                           

**19. How do you evaluate your dietary habits altogether?**

- Very healthy
- Healthy
- To some extent healthy
- Not healthy
- Very unhealthy

**20. What is your height (without heels) ..... cm (e.g. 172 cm)**

**21. How much do you weigh (without clothes) ..... kg**

## 2. Section – Choosing between different hospitals

Now we will present 12 different scenarios. In each scenario, there are three different hospital to choose among them. The hospitals are different in five factors.

The following table shows and explains different factors. Furthermore, the different level of each factor is also presented.

No.	Factor	Explanation	Level
1	The same midwife is responsible for the whole period of pregnancy and birth	Indicate 'known midwife' concept, in which the same midwife(s) will be in charge during whole period of pregnancy and birth	- Yes - Not sure - No
2	Availability of a neonatal intensive care unit (NICU)	The Neonatal Department specializes in the treatment and care of children born prematurely or having other acute problems after birth.	- No - Yes, but not at highly specialized level - Yes, at highly specialized level
3	Hospital services offer	for example the possibility of a water birth, hoteling services after birth etc.	- Available - Depends on workload - Not available
4	The hospital's level of specialization to handle rare and serious incidents that affect the mother's health during childbirth	To which level can the hospital handle rare and serious event for mother?	- Standard at handling of normal birth - Standard at handling of complicated birth - Highly specialized at handling of complicated birth
5	Transport time	Transport time from your residency place to hospital (by car)	15 min. 30 min. 45 min. 60 min. 90 min. 150 min.

As we mentioned above, in following part, you will be presented with 12 different choice of three hospitals (Hospital A, Hospital B or Hospital C). Hospitals are different based on the factors we described in the table.

In each question, we ask you to consider which hospital you will choose (Hospital A, Hospital B or Hospital C). If you think that none of the hospitals is optimal, we ask you to choose the one that you find most attractive.

Now it is your turn and we remind you that there is no right or wrong answer, and we are only interested in your preferences for choice of birthing hospital.

Question 1	Hospital A	Hospital B	Hospital C
The same midwife is responsible for the whole period of pregnancy and birth	Not sure	No	Yes
Availability of a neonatal intensive care unit	Yes, at highly specialized level	No	Yes, but not at highly specialized level
Hospital services offer	Not available	Depends on workload	Available
The hospital's level of specialization to handle rare and serious incidents that affect the mother's health during childbirth	Standard at handling of normal birth	Highly specialized at handling of complicated birth	Standard at handling of complicated birth
Travel time	30 min.	60 min.	30 min.
Your choice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 2	Hospital A	Hospital B	Hospital C
The same midwife is responsible for the whole period of pregnancy and birth	No	Yes	Not sure
Availability of a neonatal intensive care unit	No	Yes, but not at highly specialized level	Yes, at highly specialized level
Hospital services offer	Available	Not available	Depends on workload
The hospital's level of specialization to handle rare and serious incidents that affect the mother's health during childbirth	Standard at handling of normal birth	Standard at handling of complicated birth	Highly specialized at handling of complicated birth
Travel time	90 min.	150 min.	90 min.

Your choice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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Question 3	Hospital A	Hospital B	Hospital C
The same midwife is responsible for the whole period of pregnancy and birth	No	Yes	No
Availability of a neonatal intensive care unit	Yes, but not at highly specialized level	No	Yes, at highly specialized level
Hospital services offer	Not available	Depends on workload	Available
The hospital's level of specialization to handle rare and serious incidents that affect the mother's health during childbirth	Standard at handling of normal birth	Highly specialized at handling of complicated birth	Standard at handling of complicated birth
Travel time	150 min.	90 min.	90 min.
Your choice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 4	Hospital A	Hospital B	Hospital C
The same midwife is responsible for the whole period of pregnancy and birth	No	Not sure	Yes
Availability of a neonatal intensive care unit	No	Yes, but not at highly specialized level	Yes, at highly specialized level
Hospital services offer	Depends on workload	Not available	Available
The hospital's level of specialization to handle rare and serious incidents that affect the mother's health during childbirth	Highly specialized at handling of complicated birth	Standard at handling of complicated birth	Standard at handling of normal birth
Travel time	60 min.	45 min.	60 min.
Your choice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 5	Hospital A	Hospital B	Hospital C
The same midwife is responsible for the whole period of pregnancy and birth	No	Not sure	Yes
Availability of a neonatal intensive care unit	Yes, at highly specialized level	No	Yes, but not at highly specialized level
Hospital services offer	Depends on workload	Available	Not available
The hospital's level of specialization to handle rare and serious incidents that affect the	Standard at handling of complicated birth	Standard at handling of normal birth	Highly specialized at handling of

mother's health during childbirth			complicated birth
Travel time	15 min.	15 min.	30 min.
Your choice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 6	Hospital A	Hospital B	Hospital C
The same midwife is responsible for the whole period of pregnancy and birth	Yes	No	Not sure
Availability of a neonatal intensive care unit	Yes, at highly specialized level	Yes, but not at highly specialized level	No
Hospital services offer	Available	Not available	Depends on workload
The hospital's level of specialization to handle rare and serious incidents that affect the mother's health during childbirth	Highly specialized at handling of complicated birth	Standard at handling of normal birth	Standard at handling of complicated birth
Travel time	30 min.	30 min.	15 min.
Your choice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 7	Hospital A	Hospital B	Hospital C
The same midwife is responsible for the whole period of pregnancy and birth	Yes	Not sure	Yes
Availability of a neonatal intensive care unit	Yes, but not at highly specialized level	Yes, at highly specialized level	No
Hospital services offer	Depends on workload	Available	Available
The hospital's level of specialization to handle rare and serious incidents that affect the mother's health during childbirth	Standard at handling of normal birth	Standard at handling of complicated birth	Highly specialized at handling of complicated birth
Travel time	90 min.	90 min.	150 min.
Your choice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 8	Hospital A	Hospital B	Hospital C
The same midwife is responsible for the whole period of pregnancy and birth	Not sure	Yes	No
Availability of a neonatal intensive care unit	Yes, but not at highly specialized level	No	Yes, at highly specialized level
Hospital services offer	Available	Not available	Depends on workload

The hospital's level of specialization to handle rare and serious incidents that affect the mother's health during childbirth	Highly specialized at handling of complicated birth	Standard at handling of complicated birth	Standard at handling of normal birth
Travel time	15 min.	30 min.	45 min.
Your choice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 9	Hospital A	Hospital B	Hospital C
The same midwife is responsible for the whole period of pregnancy and birth	Yes	No	Not sure
Availability of a neonatal intensive care unit	Yes, at highly specialized level	Yes, but not at highly specialized level	No
Hospital services offer	Not available	Available	Depends on workload
The hospital's level of specialization to handle rare and serious incidents that affect the mother's health during childbirth	Standard at handling of complicated birth	Highly specialized at handling of complicated birth	Standard at handling of normal birth
Travel time	60 min.	45 min.	60 min.
Your choice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 10	Hospital A	Hospital B	Hospital C
The same midwife is responsible for the whole period of pregnancy and birth	Not sure	Yes	No
Availability of a neonatal intensive care unit	No	Yes, at highly specialized level	Yes, but not at highly specialized level
Hospital services offer	Not available	Depends on workload	Available
The hospital's level of specialization to handle rare and serious incidents that affect the mother's health during childbirth	Highly specialized at handling of complicated birth	Standard at handling of normal birth	Standard at handling of complicated birth
Travel time	45 min.	15 min.	45 min.
Your choice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 11	Hospital A	Hospital B	Hospital C
The same midwife is responsible for the whole period of pregnancy and birth	Not sure	Not sure	No
Availability of a neonatal intensive care unit	Yes, but not at highly specialized level	Yes, at highly specialized level	No

Hospital services offer	Depends on workload	Available	Not available
The hospital's level of specialization to handle rare and serious incidents that affect the mother's health during childbirth	Standard at handling of complicated birth	Standard at handling of normal birth	Highly specialized at handling of complicated birth
Travel time	45 min.	60 min.	15 min.
Your choice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 12	Hospital A	Hospital B	Hospital C
The same midwife is responsible for the whole period of pregnancy and birth	Yes	No	Not sure
Availability of a neonatal intensive care unit	No	Yes, at highly specialized level	Yes, but not at highly specialized level
Hospital services offer	Available	Depends on workload	Not available
The hospital's level of specialization to handle rare and serious incidents that affect the mother's health during childbirth	Standard at handling of complicated birth	Highly specialized at handling of complicated birth	Standard at handling of normal birth
Travel time	150 min.	150 min.	150 min.
Your choice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How sure were you in your answers?

Very unsure

Unsure

Sure

Very sure

Do not know

To what extent you found the choices between hospitals easy or difficult.

Very easy

Easy

To some extent difficult

Difficult

Very difficult

### 3. Section

#### Health literacy

Indicate to what extent you find the following easy or difficult - think about your own experiences:

	Always difficult	Usually difficult	Sometimes difficult	Usually easy	Always easy
Make sure that healthcare providers understand your problems properly	<input type="checkbox"/>				
Feel able to discuss your health concerns with a healthcare provider	<input type="checkbox"/>				
Confidently fill medical forms in the correct way	<input type="checkbox"/>				
Have good discussions about your health with doctors	<input type="checkbox"/>				
Accurately follow instructions from healthcare providers	<input type="checkbox"/>				
Read and understand written health information	<input type="checkbox"/>				
Discuss things with healthcare providers until you understand all you need to	<input type="checkbox"/>				
Read and understand all the information on medication labels	<input type="checkbox"/>				
Ask healthcare providers questions to get the health information you need	<input type="checkbox"/>				
Understand what healthcare providers are asking you to do	<input type="checkbox"/>				

Below we ask you to indicate how much do you agree or disagree with the following statements.

	Completely disagree 1	2	3	4	5	6	Completely agree 7
Once I make a decision, I don't look back.	<input type="checkbox"/>						
Whenever I make a choice, I'm curious about what would have happened if I had chosen differently.	<input type="checkbox"/>						
Whenever I make a choice, I try to get information about how the other alternatives turned out.	<input type="checkbox"/>						
If I make a choice and it turns out well, I still feel like something of a failure if I find out that another choice would have turned out better.	<input type="checkbox"/>						
When I think about how I'm doing in life, I often assess opportunities I have passed up.	<input type="checkbox"/>						

**The last question deals with how you deal with risk.**

Are you generally a person who is willing to take risk or do you try to avoid taking risk in **health**?

Indicate on a scale from 0-10 how risky you are, where

0 means: I am generally a person who is unwilling to take risk

10 means: I am generally a person who is fully prepared to take risk

Unwilling to take risk

Fully prepared to take risk

0	1	2	3	4	5	6	7	8	9	10
<input type="checkbox"/>										

## Interviewguide

### Introduktion:

- Vi er med vores projekt interesseret i at høre, hvilke tanker du har gjort dig, om hvor du gerne vil føde.
- Det er et kvalitativt interview, så derfor er der ingen rigtige eller forkerte svar, men vi er interesseret i at høre om dine oplevelser.
- Hvis det er okay med dig, vil vi gerne have lov til at optage interviewet, og du vil selvfølgelig være anonym i vores projekt.
- Du siger bare til, hvis der er nogle spørgsmål, du ikke har lyst til at svare på, eller hvis der er noget, jeg har misforstået.
- Spørg endelig undervejs, hvis du har nogle spørgsmål eller er i tvivl om noget.

### Oplysninger om den gravide:

Inden vi går i gang med at tale om din graviditet, er der nogle praktiske oplysninger, jeg skal have styr på. Først vil jeg gerne have lidt at vide om dig og hvordan du bor ift. fødestederne.

- Hvor bor du henne?
- Hvor arbejder du henne til dagligt?
- Bor du sammen med en partner?
- Hvilket hospital er det nærmeste? (NN hospital eller Skejby Sygehus?)
- Skejby Sygehus har jo været nødt til at indkredse området for at høre til sygehuset. Derfor kan der være længere til det hospital man hører til end Skejby. Hvad synes du om den ordning?
- Hvilket hospital har du (og din familie) oftest anvendt?
- Hvilke transportmuligheder har du for at komme til hospitalet, når du skal føde?

### Graviditeten:

Så kunne jeg godt tænke mig at høre lidt om din graviditet.

- Hvor langt henne er du i graviditeten nu?
- Hvordan har du haft det indtil nu? (Bekymringer?)

- Var det en planlagt graviditet? Hvis ja, har du fået hjælp til at blive gravid altså har du været i fertilitetsbehandling eller tilsvarende?
- Hvis ja, har det været en lang proces?
- Er det din første graviditet?

OBS: tidligere (ufrivillige) aborter (se spørgsmål nedenfor)

- Har du været til nogle undersøgelser hos din praktiserende læge, i forbindelse med din graviditet, udover den første konsultation? (Tidlig scanning eller lignende – hvorfor? Undersøg bekymring)
- Har du fortalt til venner og familie at du er gravid? Hvorfor, hvorfor ikke?
- Fortalte I det før eller efter nakkefoldsscanningen? Hvorfor ventede du/hvorfor ventede du ikke?
- Hvad fylder mest i dine tanker lige nu i forhold til graviditeten?
- Hvor meget fylder fødslen i dine tanker?
- Har du allerede nu bestemt dig for, hvem der skal med til fødslen?

OBS: Spørgsmål til gravide med tidligere aborter:

- Var det en spontan abort?
- Det at du tidligere har prøvet at abortere spontant, påvirker det dig i din nuværende graviditet?

OBS: Spørgsmål til tidligere gravide:

Vi skal tale om denne graviditet, men jeg vil gerne høre:

- Hvordan vil du sådan helt kort beskrive din(e) tidligere graviditet – var den ukompliceret eller...?
- Hvad med fødslen – gik den som den skulle, eller var der komplikationer?
- Husker du fødslen som en god oplevelse?
- Var det også (den der skal med til fødslen) der var med dig der?
- Hvor fødte du sidste gang?
- Hvor gamle er barnet (børnene)?

Valg af fødested:

Til din første konsultation hos lægen, blev du bedt om at vælge, hvor du gerne vil føde.

- Hvordan blev muligheden for at vælge præsenteret for dig og talte du med lægen eller sygeplejersken om det?
- Hvilke overvejelser gjorde du dig?
  - Evt. opfordre den gravide til at uddybe svar som 'mindre risikofyldt' (hvad betyder det, kan du give mig et eksempel, når du siger 'utrygt', for hvem er det så?), 'at være i trygge hænder' (hvad vil det sige? Eksempler på at være i utrygge hænder) osv.
- Hvad er dit vigtigste argument for at vælge NN hospital?
- Er der andre vigtige argumenter? Evt. spørg om afstand gjorde nogen forskel, eller kun mentalt.
- Er der nogle ulemper ved at vælge NN hospital?
- Ville du være træt af, hvis du skulle føde på NN hospital? Hvorfor?
- De der vil føde på Skejby: Hvis du nu skulle overveje den hypotetiske situation, at du under graviditeten bliver vurderet til at skulle have et planlagt kejsersnit, hvilket skal foregå på Randers, ville det så ændre dit valg om at skulle føde på Skejby?
- anbefalede lægen eller sygeplejersken et bestemt sygehus?
- Har du overvejet eller kunne du finde på at overveje at føde hjemme? (hvorfor/hvorfor ikke)

#### Erfaringer og overvejelser:

Nu vil jeg gerne høre dig om, hvilke erfaringer du har med de forskellige hospitaler.

- Har du nogle erfaringer med NN hospital? Skejby Sygehus?
- Hvis ja, i hvilken forbindelse?
- Har det påvirket dig, da du skulle tage beslutningen om fødested? På hvilken måde?
- Hvem har du talt med om valg af fødested? (Fx partner, familie/venner, praktiserende læge)
- Har du søgt yderligere information? (hvorfor/hvorfor ikke)
- Synes du, at du har fået nok information til at kunne tage beslutningen?
- Synes du, at det var et vanskeligt eller et let valg at tage?
- Synes du, det var et passende tidspunkt, du skulle bestemme dig for valg af fødested?

#### Graviditeten fremadrettet:

- Hvad er den perfekte fødsel for dig?
- Der er jo længe til, så hvad er det næste, som du ser frem til i din graviditet?

### Kontinuum:

Til sidst kunne jeg godt tænke mig at høre, hvordan du ser dig selv som gravid.

- Ser du overordnet dig selv som en bekymret gravid eller en glad gravid. Hvorfor/hvorfor ikke?

### Afslutning:

- Her afsluttende vil jeg lige nævne nogle ting, som vi forestiller os kan have en betydning for gravides valg af fødested. Jeg vil i den forbindelse spørge dig, om der er nogle af de forhold, som har betydet noget for dit valg af hvor du skal føde henne.
  - Hvor hurtigt man kan få akut kejsersnit?
  - Hvor længe man kan blive på hospitalet efter fødslen?
  - Om der bor familie i nærheden?
  - Om man kan føde med sin egen jordemoder?
  - Er der andre forhold, som kunne spille ind?
- Nu vil jeg høre, om du synes, vi har været omkring det du forventede, eller om der er noget, du synes vi har overset?
- Så vil jeg høre, om det er I orden, at vi kontakter dig, hvis vi får nogle opfølgende spørgsmål? Du er selvfølgelig meget velkommen til at kontakte os, hvis du har nogle spørgsmål.

## Samtykkeerklæring

Jeg bekræfter hermed, at jeg (efter at have modtaget information såvel mundtligt som skriftligt) indvilger i at deltage i det beskrevne projekt.

Jeg er informeret om, at det er frivilligt at deltage, og at jeg når som helst uden begrundelse kan trække mit tilsagn om deltagelse tilbage, uden at dette vil påvirke den nuværende eller fremtidige behandling af mig.

Dato \_\_\_\_\_

Navn (deltager) \_\_\_\_\_

Underskrift \_\_\_\_\_

Dato \_\_\_\_\_

Navn (informerende ph.d.-studerende) \_\_\_\_\_

Underskrift \_\_\_\_\_

Samtykkeerklæringen underskrives i forbindelse med interviewet

## Valg af fødested



Foto: Colourbox

## Hvad er vigtigt for dig?

Aarhus Universitet og Region Midtjylland undersøger, hvad der er vigtigt for gravide kvinder, når de vælger, hvor de gerne vil føde.

I denne folder præsenterer vi undersøgelsen og inviterer dig til at deltage.

## Indledning

Først og fremmest tillykke med din graviditet.

Du modtager denne information, fordi din praktiserende læge er en del af et forskningsprojekt om gravides valg af fødested.

Der er frit sygehusvalg i Danmark. Det betyder, at du i princippet selv kan vælge, hvor du vil føde. Du kan vælge mellem at føde på dit nærmeste regionshospital eller på andre regionshospitaler, hvis der er plads. I dette forskningsprojekt, har du også mulighed for at vælge Aarhus Universitetshospital, Skejby.

Vi undersøger, hvilke faktorer, der er vigtige for dig, når du vælger fødested. Dine holdninger, erfaringer og overvejelser vil give forskere indsigt i, hvad der er vigtigt for valg af fødested.

## Disse serviceydelser vil du modtage på dit valgte hospital

I graviditeten tilbydes du to ultralydsundersøgelser (i graviditetsuge 12 og 19). Disse finder sted på det hospital, hvor du har valgt at føde.

I graviditeten tilbydes du en række jordemoderkonsultationer. Disse foregår på det lokale jordemodercenter, uanset hvor du har valgt at føde.

## Hvad skal du gøre for at deltage i undersøgelsen?

Hvis du ønsker at deltage i undersøgelsen skal du give din praktiserende læge eller lægesekretæren besked. Herefter kontakter vi dig og fortæller mere om undersøgelsen. Først herefter beslutter du, om du vil deltage i et forskningsinterview.

Forskningsinterviewet varer 30 minutter og foregår på et tidspunkt, der passer dig. Interviewet kan foregår i dit hjem, på hospitalet eller over telefonen. Forud for interviewet beder vi dig udfylde et spørgeskema.

Du kan til enhver tid trække din deltagelse tilbage uden at det får konsekvenser for behandlingen af dig eller dit barn.

Du vil blive anonymiseret i rapporteringen af projektresultaterne.

Hvis du gerne vil høre om resultaterne af projektet, får du besked, når projektet er slut.

## Studieprocessen



Billede: Colourbox

Uge 6: Du informerer din egen læge om din graviditet og vil få denne pjece.

Uge 9: Du informerer din egen læge om, at du vil deltage i studiet.

Uge 9 -11: Vi vil have en samtale med dig.

Uge 12 og 19: Du får ultralydsundersøgelse på dit valgte fødested.

Du føder på dit valgte fødested.

## Er du interesseret i at høre mere om forsøget, kan du ringe til:



**Nasrin Tayyari Dehbarez**  
**Ph.d.-studerende og**  
**projektansvarlig**

Tlf.: 7841 4372  
mandag til fredag kl. 9-16



**Anne Møller**  
**Praktikant**

Tlf.: 7841 4322  
mandag og onsdag til fredag  
kl. 8.30-15.30

E-mail: [projektfoedested@rm.dk](mailto:projektfoedested@rm.dk)

**Adresse: DEFACTUM**

**Olof Palmes Alle 15, 8200 Aarhus N**