Birth centre care:
opening the black box

Marit Hitzert

Birth centre care:
opening the black box

Marit Hitzert

ACKNOWLEDGEMENTS

The work presented in this thesis was conducted at the Erasmus University Medical Centre, Department of Obstetrics and Gynaecology, in collaboration with NIVEL (Netherlands Institute for Health Services Research), TNO, Jan van Es Institute (Netherlands Expert Centre Integrated Primary Care), University Medical Centre Utrecht, Tilburg University and Leiden University Medical Centre, all located in the Netherlands.

Funding

The work presented in this thesis was supported with a grant (grant no. 50-50200-98-102) from the Netherlands Organisation for Health Research and Development as part of the Pregnancy and Childbirth Program, funding the Dutch Birth Centre Study.

The printing of this thesis has been financially supported by the Erasmus University Rotterdam. Further financial support for this dissertation was kindly provided by the Department of Obstetrics and Gynaecology, Erasmus Medical Center, Erasmus University Rotterdam.

ISBN: 978-94-6361-045-2

Layout and printing: Optima Grafische Communicatie, Rotterdam, the Netherlands (www.ogc.nl)
Cover design: Nienke Vletter, www.lettertype.studio

BIRTH CENTRE CARE:
OPENING THE BLACK BOX

GEBOORTECENTRUM ZORG:
HET OPENEN VAN DE ZWARTE DOOS

Proefschrift

ter verkrijging van de graad van doctor aan de
Erasmus Universiteit Rotterdam
op gezag van
de rector magnificus

Prof. dr. H.A.P. Pols

en volgens besluit van het College voor Promoties.
De openbare verdediging zal plaatsvinden op
woensdag 31 januari 2018 om 9.30 uur

door

Marit Hitzert
geboren te Rotterdam

Erasmus University Rotterdam

PROMOTIECOMMISSIE

Promotoren:	Prof. dr. E.A.P. Steegers
	Prof. dr. H.A. Akkermans
Overige leden:	Prof. dr. I.K.M. Reiss
	Prof. dr. C.A. Uyl-de Groot
	Prof. dr. J.M.M. van Lith
Copromotoren:	Dr. M.E. van den Akker-van Marle
	Dr. J.P. de Graaf

Paranimfen:	L.G. Jiskoot
	C. Meun

CONTENTS

Chapter 1

General introduction

THE DUTCH MATERNITY CARE SYSTEM

Throughout the industrialized world, there are many variations in organization of maternity care. The most industrialized countries, except the Netherlands, have seen shifts in the roles and responsibilities of the different healthcare professionals in their maternity care systems. Many saw responsibility moving from midwives to doctors in the beginning of the 20th century. In the course of the 20th century, calls for more natural childbirth and more community based maternity services have contributed to a trend towards reintroducing or strengthening the roles of midwives.

The historical organization of the Dutch maternity care system is typically functional with a clear segmentation of primary and secondary care (1-3). The system is based on community care provided by independently operating community midwives providing care for what are considered as low-risk pregnant women (primary care). Obstetricians provide in-hospital care for high-risk pregnant women (secondary care). Low-risk pregnant women can choose where they would like the birth to take place: at home, in a hospital or in a birth centre, all supervised by a community midwife. When a pregnant woman faces changes in her risk status during her pregnancy, labour or birth, or when pharmaceutical pain relief is requested, she will be referred from primary to secondary care. In 2015, 46% of the women who started labour under supervision of a community midwife were referred to secondary care during labour and birth (4). Timely and adequate risk selection is therefore, antenatally as well as during childbirth, a basic feature of the system's performance (3).

Historically, the percentage of planned home births in the Netherlands is high compared to other developed nations. In 2000, around 30% of all births in the Netherlands took place at home, in 2015 this number has fallen to 13% (4). More women are planning birth out of home, because they do not feel safe at home or are asking for a referral to get pain relief (5). This change may partly be caused by the media attention given to the results from the EURO-PERISTAT. These results put the Netherlands in terms of perinatal health outcomes close to the bottom of a ranked list of European countries, between Northern Ireland and Latvia (6). As a result, a steering committee by the ministry of Health, Welfare and Sport came up with suggestions for improvements (7). One of the suggestions was increased integration of primary and secondary maternity care, which is nowadays promoted explicitly by the Dutch government. In most regions, some form of collaboration between primary and secondary maternity care existed already in regional networks. Another suggestion was the introduction of birth centres (8).

THE ESTABLISHMENT OF BIRTH CENTRES IN THE NETHERLANDS

In the last 15 years, there was a rapid increase in the number of birth centres. Birth centres have been established because of various reasons such as a more homelike environment than in a hospital, competition with neighbouring hospitals, extra facilities during childbirth (e.g. bath and nitrous oxide), the possibility to go earlier to the planned place of birth during labour and as a means to reduce the pressure on hospital maternity wards. There is not only a great variation in reason for establishment of birth centres, the birth centres vary also in philosophies, characteristics and service delivery models (9, 10). The views on birth centres have changed over time, from an alternative place of birth to an alternative way of working: an opportunity to integrate primary and secondary maternity care further. One would assume that birth centres provide better quality of care due to better collaboration when compared to the existing system of primary and secondary care (11), but it is yet unknown how birth centres perform.

BIRTH CENTRES ABROAD

In the United Kingdom, the United States and Australia several studies have been performed on birth centre care (12-15). The results of the national Birth Place study in the United Kingdom showed that women who planned to give birth in a birth centre and multiparous women who planned to give birth at home experience fewer interventions than those who planned to give birth in an obstetric unit with no impact on perinatal outcomes (13). For multiparous women at low-risk of complications, planned birth at home was the most cost-effective option compared to planned birth in an alongside or freestanding midwifery unit or in an obstetric unit in the United Kingdom. A planned home birth is associated with an increase in adverse perinatal outcomes for nulliparous low-risk women (16). A Cochrane review of alternative versus conventional institutional settings for birth showed that alternative hospital birth settings, including birth centres, are associated with lower rates of medical interventions during labour and birth and higher levels of satisfaction, without increasing risk to women or their babies (17)**.** As the maternity care system in the Netherlands is profoundly different from anywhere else, the results from these studies may not be applicable for the Netherlands.

THE DUTCH BIRTH CENTRE STUDY

In June 2011, the Netherlands Organization for Health Research and Development invited researchers to submit proposals on the effects of birth centres in terms of costs, cli-

ent experiences, health outcomes and implementation requirements. Birth centres were referred to as locations other than home where low-risk pregnant women can give birth under supervision of a community midwife. In a unique collaboration among research institutes, academic medical centres and health care providers, a three-year research project, the Dutch Birth Centre Study, was conducted. The Birth Centre Study focuses on the effects of different types of birth centres (based on location and integration profile) on the quality and organization of care, the experiences of clients and caregivers, medical outcomes and costs by comparing planned births in birth centres, with births planned in hospitals and at home, all supervised by a community midwife (18).

The definition of a birth centre as developed and used in this study is: "*a midwifery-managed setting offering care to low-risk women during labour and birth. They provide facilities that support physiological birth and offer a homelike environment. Community midwives take primary professional responsibility for care. In case of referral, an obstetrician takes over the professional responsibility for care*"(10). Based on location, three types of birth centres can be distinguished. Some birth centres in the study are *freestanding* from a hospital with obstetric services (n=3); others are located separately from an obstetric unit but in a hospital or on hospital grounds (*alongside, n=14*) or integrated within an obstetric unit (*on-site, n=6*). In case of referral from a freestanding birth centre to secondary care, the woman needs to be transferred by car or ambulance while transfer from an alongside birth centre takes normally place with a bed or wheelchair and in case of referral from an on-site birth centre, the woman does not need to be transferred: the secondary caregiver (obstetrician or paediatrician) enters the room (9, 10). According to the definition, 23 birth centres were identified and evaluated within the Dutch Birth Centre Study in September 2013, see Figure 1.

All the aims of this thesis were addressed in the Dutch Birth Centre Study.

AIMS OF THE THESIS

The aims of this thesis can be summarized as follows:

- To study the organizational processes in a limited number of birth centres.
- To study maternal and perinatal outcomes of planned birth in a birth centre compared with planned birth in a hospital and at home by using, among others the optimality index and a composite adverse outcome score.
- To study the costs of planned birth in a birth centre compared with planned birth in a hospital and at home.
- To assess the client experiences of planned birth in a birth centre compared with planned birth in a hospital and at home.

Figure 1: *Birth centres in the Netherlands, September 2013*

OUTLINE OF THE THESIS

This thesis applies a mixed method approach in that it combines elements of qualitative and quantitative research approaches for the broad purposes of breadth and depth of understanding birth centres (19). This may provide a better understanding of the phenomena studied and improves the interpretation of the results (20). This thesis consists of two parts, of which one includes process studies and one includes variance studies and each draws evidence from different sources (21). Part I (chapter 2-4) focusses on how processes in and around birth centres link the structure to outcomes, as the way in which a certain type of organizational structure leads to outcomes remains mostly an intransparant black box (see Figure 2). Therefore, the aim of part I is to understand how daily care is being organized. It is assumed that birth centres provide better quality of care due to better collaboration when compared to the existing system of primary and

secondary care (11), but it is yet unknown how the professionals working in and with a birth centre collaborate, make decisions and communicate. The analysis of these processes requires an in-depth study with an exploratory approach (22). Data were mainly collected through direct observation in the birth centres and took in total around 1000 hours, spread over one year. Additionally a questionnaire and spatial data were used. Part II includes the study of the effects of organizational structure on perinatal and maternal outcomes (chapter 5), costs (chapter 6) and client experiences (chapter 7). The primary clinical outcomes were measured by the optimality index (OI) and a composite adverse outcome score (CAO). The optimality index is a tool to measure 'maximum outcome with minimal intervention' and contains both process and outcome items. The tool is suitable to compare different low-risk groups, with few adverse outcomes, in terms of achieving the most optimal situation (maximum outcome with minimal intervention) (23-25). In addition, the CAO, a combined measure of adverse outcomes (including maternal mortality within 42 days after birth, perinatal mortality within 7 days after birth and admission to the neonatal intensive care unit) was used. This measure is based on the occurrence of at least one adverse outcome (26). Traditionally, the quality of maternity care is measured by clinical outcomes. Currently, other aspects of health care such as client experiences are important as well (27-30).

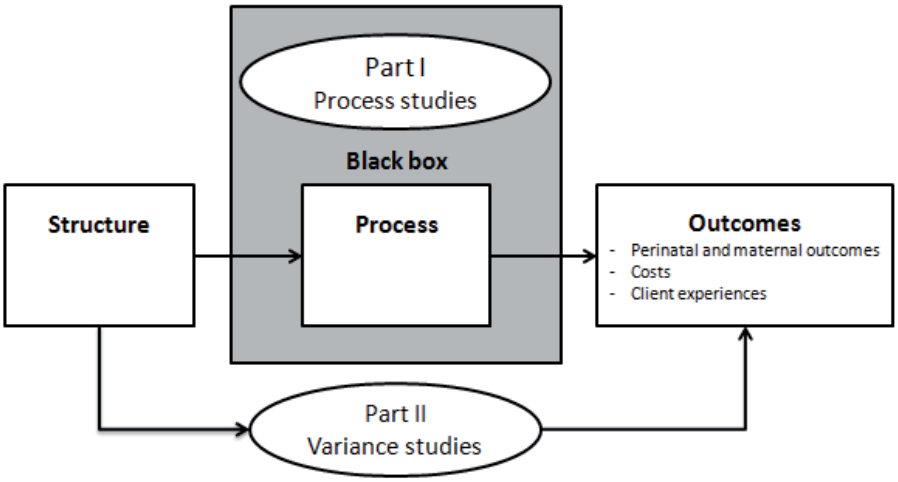


Figure 2: *Research design of this thesis*

REFERENCES

1. Van Daalen R. Dutch obstetric care: home or hospital, midwife or gynaecologist? Health Promotion International. 1987;2(3):247-55.
2. Amelink-Verburg MP, Buitendijk SE. Pregnancy and Labour in the Dutch Maternity Care System: What Is Normal? The Role Division Between Midwives and Obstetricians. Journal of Midwifery & Women's Health. 2010;55(3):216-25.
3. Pieters A, Van Oirschot C, Akkermans H. No cure for all evils. International Journal of Operations & Production Management. 2010;30(11).
4. The Netherlands Perinatal Registry. Perinatal care in the Netherlands 2015 (in Dutch: Perinatale zorg in Nederland 2015). Utrecht: 2016.
5. Offerhaus PM, Hukkelhoven CWPM, Jonge A, Pal- de Bruin KM, Scheepers PLH, Lagro- Janssen ALM. Persisting rise in referrals during labor in primary midwife- led care in the Netherlands. Birth. 2013;40(3):192-201.
6. Mohangoo AD, Buitendijk SE, Hukkelhoven CW, Ravelli AC, Rijninks-van Driel GC, Tamminga P, et al. Higher perinatal mortality in The Netherlands than in other European countries: the Peristat-II study. Nederlands tijdschrift voor geneeskunde. 2008;152(50):2718-27.
7. The ministry of Health Welfare and Sport. Letter: Ketenzorg zwangerschap en geboorte. Den Haag: 2008.
8. Steering committee Pregnancy and Birth. A good beginning, safe care around pregnancy and birth. (in Dutch: Een goed begin, veilige zorg rond zwangerschap en geboorte). Advice steering committee Pregnancy and Birth. Utrecht: 2009.
9. Wiegers T, de Graaf H, van der Pal K. The rise of birth centres and their role in health care [in Dutch: De opkomst van geboortecentra en hun rol in de zorg]. Tijdschrift voor gezondheidswetenschappen. 2012;90(8):475-8.
10. Hermus M, Boesveld I, Hitzert M, Franx A, de Graaf J, Steegers E, et al. Defining and describing birth centres in the Netherlands-a component study of the Dutch Birth Centre Study. BMC Pregnancy and Childbirth. 2017;17:210.
11. Bonsel GJ, Birnie E, Denktas S, Poeran J, Steegers EAP. Dutch report:Lines in the perinatal mortality, signalement study of pregnancy and birth in 2010 [in Dutch: Lijnen in de perinatale sterfte, signalementstudie zwangerschap en geboorte in 2010]. Rotterdam: Erasmus MC. 2010.
12. Stewart M, McCandlish R, Henderson J, Brocklehurst P. Review of evidence about clinical, psychosocial and economic outcomes for women with straightforward pregnancies who plan to give birth in a midwife-led birth centre, and outcomes for their babies. Report of a structured review of birth centre outcomes. Updated July 2005.
13. Brocklehurst P, Hardy P, Hollowell J, Linsell L, Macfarlane A, McCourt C, et al. Perinatal and maternal outcomes by planned place of birth for healthy women with low risk pregnancies: the Birthplace in England national prospective cohort study. BMJ. 2011;343(7840):d7400.
14. Laws PJ, Tracy SK, Sullivan EA. Perinatal outcomes of women intending to give birth in birth centers in Australia. Birth. 2010;37:28-36.
15. Stapleton SR, Osborne C, Illuzzi J. Outcomes of care in birth centers: demonstration of a durable model. Journal of Midwifery & Women's Health. 2013;58:3-14.
16. Schroeder E, Petrou S, Patel N, Hollowell J, Puddicombe D, Redshaw M, et al. Cost effectiveness of alternative planned places of birth in woman at low risk of complications: evidence from the Birthplace in England national prospective cohort study. BMJ. 2012;344.

17. Hodnett ED, Downe S, Walsh D. Alternative versus conventional institutional settings for birth. The Cochrane Library. 2012.
18. Hermus MAA, Wiegers TA, Hitzert MF, Boesveld IC, van den Akker-van ME, Akkermans HA, et al. The Dutch Birth Centre Study: study design of a programmatic evaluation of the effect of birth centre care in the Netherlands. BMC pregnancy and childbirth. 2015;15:148.
19. Johnson RB, Onwuegbuzie AJ, Turner LA. Toward a definition of mixed methods research. Journal of mixed methods research. 2007;1:112-33.
20. Creswell JW, Clark VLP. Designing and conducting mixed methods research. 2007.
21. Van de Ven Andrew H. Engaged scholarship: A guide for organizational and social research. 2007.
22. Yin RK. Applications of case study research (applied social research Methods). Series, 4th edn Thousand Oaks: Sage Publications. 2003.
23. Wiegers TA, Keirse M, Berghs GAH, Van der Zee J. An approach to measuring quality of midwifery care. Journal of clinical epidemiology. 1996;49(3):319-25.
24. Low LK, Miller J. A Clinical Evaluation of Evidence- Based Maternity Care Using the Optimality Index. Journal of Obstetric, Gynecologic, & Neonatal Nursing. 2006;35(6):786-93.
25. Sheridan M, Sandall J. Measuring the best outcome for the least intervention: can the Optimality Index-US be applied in the UK? Midwifery. 2010;26(6):e9-e15.
26. Hermus MAA, Hitzert M, Boesveld IC, van den Akker-van Marle EM, van Dommelen P, Franx A, et al. Differences in optimality index between planned place of birth in a birth centre and alternative planned places of birth, a nationwide prospective cohort study in the Netherlands. Results of the Dutch Birth Centre Study. BMJ Open. 2017.
27. Sitzia J, Wood N. Patient satisfaction: a review of issues and concepts. Social science & medicine. 1997;45(12):1829-43.
28. Wensing M, Jung HP, Mainz J, Olesen F, Grol R. A systematic review of the literature on patient priorities for general practice care. Part 1: Description of the research domain. Social science & medicine. 1998;47(10):1573-88.
29. Campbell SM, Roland MO, Buetow SA. Defining quality of care. Social science & medicine. 2000;51(11):1611-25.
30. Valentine N, Darby C, Bonsel GJ. Which aspects of non-clinical quality of care are most important? Results from WHO's general population surveys of "health systems responsiveness" in 41 countries. Social science & medicine. 2008;66(9):1939-50.

Chapter 2

Co-location and inter-organizational collaboration in Dutch maternity care

Results of the Dutch Birth Centre Study

Marit Hitzert
Berthold R. Meijboom
Johanna P. de Graaf
Karin M. van der Pal-de Bruin
Eric A.P. Steegers
Henk A. Akkermans

Submitted

ABSTRACT

Inter-organizational collaboration is seen as an important element in good quality and safe health care. Co-location may strengthen this process of collaboration. The objective of this study was to explore the importance of co-location for inter-organizational collaboration in maternity care. In this exploratory research data were collected from seven Dutch birth centres. These are settings were women with uncomplicated pregnancies can give birth, supervised by a community midwife. We focussed on a proposition that has emerged from our field work: *co-location of birth centres and hospitals is important for the quality of collaboration within maternity care*. The primary methods of data collection were observations and informal conversations, complemented with a questionnaire and spatial data. Our research has ranged from macro-level to micro-level. At macro-level, proximity and distance to an obstetric unit were both major factors in deciding where to locate a birth centre. At meso-level, a low geographical distance seems to have relevance; the shorter the distance between the birth centre and the obstetric care unit was, the more the professionals seem to value the collaboration. At micro-level, co-location seems to be of varying importance; direct personal interactions among the different providers produced contrasting interrelations. This research teaches us that the importance of co-location appears to vary across different levels of analysis and that co-location is not enough for better collaboration. We aimed to make a contribution on process instead of structure explanations for outcomes. These results might be transferrable to other countries with birth centres.

INTRODUCTION

Maternity care consists of specialized services provided by different professionals like (community) midwives. obstetricians, maternity care assistants, and nurses working in different departments or organizations like midwifery practices, maternity care organizations and hospitals. Maternity care has been high on the social and political agenda in the Netherlands during the last decade (1). The political debate increased after the results from the EURO-PERISTAT, which put the Netherlands in terms of perinatal health outcomes near the bottom of a ranked list of European countries (2).

Background

In the debate, the results were linked directly to the operational set-up of the maternity care system, which is different from the surrounding countries. In the Netherlands, maternity care has a clear segmentation of the first echelon (community based, community midwife-led) from the second echelon (hospital based, obstetrician-led) (3, 4). Pregnant women that are low-risk for complications at birth, can choose where they would like the birth to take place: at home, in the hospital or in a birth centre, all being supervised by a community midwife. Community midwives are not attached to hospitals and work independently until they need to refer. If a pregnant woman's risk status changes during her pregnancy or labour or pharmaceutical pain relief is requested, she will be referred.

As a result of the poor perinatal outcomes, a steering committee by the ministry of Health, Welfare and Sport came up with suggestions for improvements that were related to this operational set-up (5). Two of their key recommendations were that the maternity healthcare professionals, such as community midwives and obstetricians ought to collaborate more and to investigate a new development: birth centres (5). Birth centres are regarded as settings where women with uncomplicated pregnancies can give birth, supervised by a community midwife and a maternity care assistant. When complications arise or pharmacological pain relief is requested, referral to an obstetrician/paediatrician is needed (6). Some birth centres are freestanding from a hospital, others are separated from an obstetric unit but in a hospital and some birth centres are located within an obstetric unit (7).

It is assumed that birth centres provide better quality of care due to co-location of the two echelons and thereby better collaboration when compared to the existing system of primary and secondary care, but evidence on this is still lacking (8). Co-location has been defined as "……physical proximity of various individuals, teams, functional areas and organizational sub-units involved in the development of particular product or process…." (9). Co-location strengthens the organizational process of collaboration. Increased interactions, informal communication and increase in efficiency of use of resources are major benefits of co-location (10, 11). There are many examples of co-location in present

day business practice (e.g.(12-15)). Research on co-location within the maternity care sector is relatively rare (16).

In this study we have investigated in what ways co-location is an enabler for inter-organizational collaboration in maternity care settings. Our research has ranged from macro-level to meso-level to micro-level. At macro-level we investigated the factor in deciding where to locate the birth centre. At meso-level we investigated if co-location has impact on the valued collaboration. At micro-level we studied the influence of co-location on the direct personal interactions.

METHODS

Research design

The study we report upon here is part of a larger research project, the Dutch Birth Centre Study (6). This study evaluates the Dutch birth centres on aspects such as quality, effectiveness, cost-effectiveness, client and professional experiences. To get a deeper understanding of the phenomenon 'birth centres' we did not look only into outcomes, but also into the processes that lead to and, thereby, influence these outcomes. This is exploratory research, since the problem is not clearly defined yet. Methodologically, that calls for a case study approach (17). This allows the questions what, why, and how to be answered with a relatively full understanding of the nature and complexity of the complete phenomenon. Any analysis of how maternity care professionals, whether community midwives, maternity care assistants, obstetricians or paediatricians, make decisions, communicate and collaborate in a complex environment as a birth centre - and of how this affects the professionals' actions and thereby outcomes, - requires an in-depth study. In this multiple case study, an abductive approach was used. It goes from an observation to a theory which accounts for the observation (18). Thus we do not begin with a theory that we aim to test; rather, we allow propositions to *emerge* from the case study.

Case selection

Cases were selected from birth centre organizations. In multiple case study research, one uses theory-driven case selection (17), rather than statistical sampling. In our research, the main criteria for case selection included:

- a variation in physical distance between birth centre and the obstetric care unit (freestanding from a hospital, alongside a hospital or on-site a hospital).
- a spread in operational period, maturity (developing - more developed birth centre);
- a spread of birth centres from metropolitan, urbanized and rural areas.

All birth centres in the Netherlands were identified during the Dutch Birth Centre Study (6). After an initial first exploratory round of visits, seven of the 23 birth centres were selected based on above mentioned criteria, with the aim to achieve maximum variation.

The initiators of the seven birth centres include maternity care organizations, boards of hospitals, insurance companies and a municipality. The birth centres are established between 2004 and 2013, with different reasons (e.g. capacity problems in the hospitals or enhancement of collaboration). The establishment of the birth centres was financed in many different ways; including the involvement of the local hospital, maternity care organizations, insurance companies and community midwives. They are located in small cities (n=2), medium-size cities (n=2) and in large cities (n=3). The sample includes a freestanding birth centre (n=1), alongside birth centres (n=3) and on-site birth centres (n=3). The number of births in the centres varies between 113 and 1090 per year per centre. Descriptions of the chosen birth centres are provided in Table 1.

Data collection

The primary methods of data collection were observations of the birth centres studied and informal conversations with managers and maternity care professionals, complemented with a questionnaire filled out by the professionals working in the birth centres and spatial data. The direct observations in work rooms, birthing rooms, corridors and during meetings were guided by several sensitizing concepts which helped to define the boundaries of the observations. Sensitizing concepts give a general sense of reference and guidance in approaching empirical instances (19). The concepts included the researchers knowledge of collaboration (e.g. communication, shared goals and knowledge, respect and trust) and obstetrics and were discussed between the researchers and adapted during the data collection period. The observations allowed for a deeper understanding of birth centres and the chance to have informal conversations with many professionals involved in birth centre care. The observations took in total around 1000 hours, spread over one year (April 2013 - April 2014). This high number of hours was needed since there was sometimes hardly any activity in a birth centre. The primary researcher made comprehensive field notes of the observations and informal conversations.

During the first visits for observation, the managers of the seven birth centres were during informal conversations asked about the establishment of the birth centre and the main factor in deciding where to locate the birth centre.

Table 1: *Description of chosen birth centres*

Birth centre	Initiators	Founded in	Type of region	Type of birth centre	Function of birth centre	Number of births in 2013
A	insurance company	2009	rural area (1300 inhabitants per km^2) with seasonal crowds	freestanding, in case of referral the woman has to be transferred to the hospital, by car or ambulance.	alternative to home birth, since home birth is not supported anymore in this region	113
B	ten community midwifery practices	2007	large city (4888 inhabitants per km^2)	alongside a hospital, at the same level as the obstetric care unit but with a door in between. In case of referral the woman has to be transferred to the hospital, by wheelchair or bed.	alternative to a midwifery led hospital birth	1090
C	community midwives	2012	small city (1183 inhabitants per km^2)	alongside a hospital, one level below the obstetric care unit. In case of referral the women has to be transferred to the hospital by elevator in bed or wheelchair.	alternative to a midwifery led hospital birth	235
D	community midwives, obstetricians, organization of maternity care assistance, insurance company, the board of the hospital and the municipality	2009	large city (2960 inhabitants per km^2)	alongside a hospital at the same floor as the obstetric care unit, but in different units. In case of referral the woman has to be transferred to the hospital, by wheelchair or bed.	alternative to a midwifery led hospital birth and a maternity hotel	734
E	community midwives	2004	large city (3481 inhabitants per km^2)	on-site, in case of referral to the hospital, the woman does not need to be transferred: the obstetrician/paediatrician will enter the delivery room.	alternative to a midwifery led hospital birth	888
F	health care professionals from different backgrounds	2011	medium-size city (1794 inhabitants per km^2)	on-site, in case of referral to the hospital, the woman does not need to be transferred: the obstetrician/paediatrician will enter the delivery room.	alternative to a midwifery led hospital birth and a maternity hotel	402
G	board of the hospital, community midwives and obstetricians	2013	medium-size city (2037 inhabitants per km^2)	on-site, in case of referral to the hospital, the woman does not need to be transferred: the obstetrician/paediatrician will enter the delivery room.	alternative to a midwifery led hospital birth	264 (since May)

In addition, in every birth centre four maternity care assistants, four community midwives, an obstetrician and a paediatrician were asked to fill out a questionnaire (see Appendix 1) about one type of inter-organizational collaboration: the relational coordination in and around the birth centre (20). Relational coordination is defined as a mutually reinforcing process of interaction between communication and relationships carried out for the purpose of task integration, in which the following dimensions are important: frequent, timely, accurate and problem solving communication, shared goals, shared knowledge and mutual respect (20). The manager of each birth centre has selected respondents based on their involvement in the birth centre (policy). In most birth centres there is a fixed pool of maternity care assistants (about 15), a group of midwifery practices (about 10) and a smaller number of obstetricians and paediatricians involved.

Furthermore, the required time of a referral from a birth centre to an obstetric unit was measured twice. In case of a freestanding or alongside birth centre the transfer time of the woman was measured, in case of an on-site birth centre the transfer of the caregiver was measured. The time needed is not included in the standard registration of the birth centres of hospitals. To collect spatial data pictures were taken in the seven birth centres.

In a common formal meeting the findings and conclusions were submitted to the participants and discussed as a form of respondent validation (21). During this member check meeting, the participants agreed with the findings and conclusions drawn in this paper.

Data analysis

The constant comparative method to analyse the data was used (22). This method is part of the abductive approach in which concepts emerge. We allowed propositions to emerge from our case study (18). Analysis started as soon as the first data were collected and continued with each additional observation. The first step in the analysis was coding the transcripts of the observations and interviews. The purpose is to attain new insights by breaking through standard ways of thinking about phenomena reflected in the data (22). Codes that relate closely to the text fragments were used, e.g. communication, proximity, location and trust. After a while two researchers (MH, HAA) discussed them. The coded transcripts were then analysed to identify returning topics of which co-location is one. It is here where a proposition has emerged from our field work: *co-location of birth centres and hospitals is important for the quality of collaboration within maternity care*. We investigated this topic in more detail by using three levels of analysis: (1) macro-, (2) meso- and (3) micro-level aspects of co-location. The levels emerged during the analysis.

At macro-level we investigated the location factor of a birth centre with respect to that of an obstetric unit. The answers of the seven managers about the establishment

and the factors in deciding where to locate the birth centre were analysed by two researchers and categorized after consensus was reached.

At meso-level we investigated if co-location has impact on the valued collaboration. The answers to the questions about relational coordination were measured on a 5-point scale and the maximum score per questionnaire was 210. To calculate an average 'relational coordination score', the total score of a birth centre has been divided by the number of respondents of that centre. The dimensions of relational coordination were discovered through inductive field research, and have been validated through several subsequent studies (23-27). There are seven dimensions: frequent, timely, accurate, problem-solving communication, and relationships of shared goals, shared knowledge and mutual respect. Furthermore, the required time of a referral to the obstetrician/paediatrician was measured twice per birth centre and an average has been calculated.

At micro-level we studied the influence of co-location on the direct personal interactions. In addition to the observations, pictures of the environment of the birth centres were compared to each other by two researchers and maps were drawn.

ATLAS was used for data-management and analysis of the observations. Descriptive data analyses were conducted using the Statistical Package for Social Sciences (SPSS) version 22.0 (SPSS Inc., Chicago, IL, USa).

Ethical considerations

Oral informed consent was obtained from the management team and clients of the birth centres. The responsible community midwives asked the clients if presence of the researcher (MH) during birth was allowed. The design and planning of the study were presented to the Medical Ethics Committee of the University Medical Centre Utrecht. They confirmed that this study agrees with Dutch legal regulations for the methods used in this study [WAG/om/13/067286].

FINDINGS

As mentioned before, we focus on a proposition that has emerged so far from our field work: *co-location of birth centres and hospitals is important for the quality of collaboration within maternity care*.

The proximity and distance to the obstetric unit

The first level of analysis is the macro-level where we investigated the location factor of a birth centre with respect to that of the obstetric unit. Interestingly, in the settings studied, proximity and distance were both major factors for the establishment of these birth centres, see Table 2. On the one hand proximity of the obstetric unit was mentioned as

factor to enable a quick transfer from birth centre to the obstetric unit when needed and to provide integrated care. On the other hand distance to the obstetric unit was mentioned as factor to support the physiological birth and to prevent over-medicalization. The location of the birth centres seems to be associated with the philosophy of the birth centres. Freestanding and alongside birth centres indicated minimal obstetric intervention more important than on-site birth centres.

Table 2: *Location factor of a birth centre with respect to that of an obstetric unit*

	Location	Factor
Case A	freestanding	Distance to a hospital for emergency care during home birth is otherwise too long, birth centre that is located in the community ensures fast transport to hospital
Case B	alongside	The distance (door) between birth centre and hospital to prevent over-medicalization
Case C	alongside	Practical: floor under the obstetric care unit was empty
Case D	alongside	To enable a quick transfer from birth centre to hospital when needed
Case E	on-site	Close proximity to provide integrated care
Case F	on-site	Close proximity to provide integrated care
Case G	on-site	Close proximity to provide integrated care

The importance of co-location at the meso-level

At the meso-level we investigated the influence of the distance between the birth centre and the hospital obstetric care unit on collaboration. Some physical elements are mentioned in Figure 1. In the event of a referral of a woman from the birth centre to the obstetric care unit, no transfer is needed in three cases where professionals replace each other within the same room. In one case an elevator has to be used. In one case the woman has to be transferred to another hospital in another city. In the two other cases the women are transferred to another room on the same floor. Figure 1 shows the effect of co-location on the meso-level; the shorter the distance between the birth centre and the obstetric care unit was, the higher the health care professionals seem to value the relational coordination.

The relational coordination score varies within birth centres, from 60 to 199 with a maximum score of 210. The lowest score is given by a community midwife working in birth centre A. Two midwifery practices are affiliated to this birth centre, one practice consists of three community midwives. The other midwifery practice consists only of one community midwife. She is the one with the lower score. The manager of this birth centre said: *"We do not have such a pleasant collaboration with community midwife X. We jointly established this birth centre, but she barely comes to this birth centre, strange."* The highest score is given by an obstetrician working in birth centre F. He was involved with

the establishment of the birth centre and is still the focal point of the obstetric unit for cases concerning the birth centre. The scores of the professionals working in birth centre E, the most developed birth centre, do not vary much.

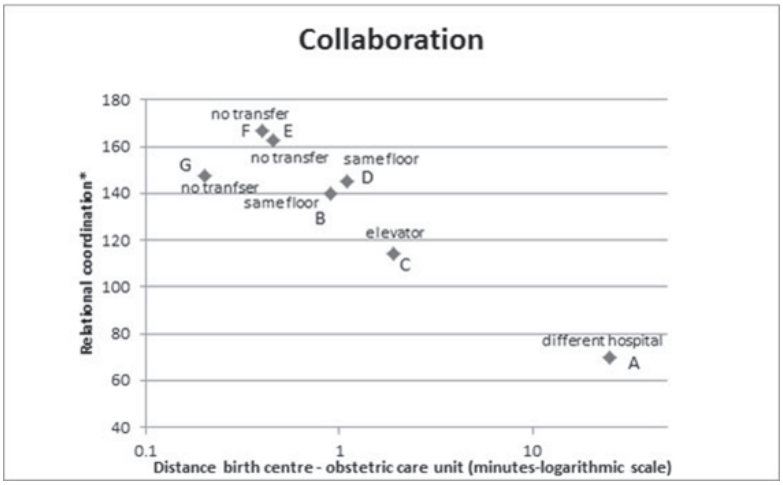


Figure 1: *Relation distance and relational coordination*
** Relational coordination is defined as a mutually reinforcing process of interaction between communication and relationships carried out for the purpose of task integration, in which the following dimensions are important: frequent, timely, accurate and problem solving communication, shared goals, shared knowledge and mutual respect (20).*

The varying importance of co-location at the micro-level

The third level of analysis is the micro-level of co-location. At this level contrasting interrelations of direct personal interactions among the different providers can be observed. Two maps of different birth centres are used as an example (see Figure 2a and b), because they both have a different effect on interrelations than intended. In one example the direct personal interactions were not intended but achieved and in the other example the direct personal interactions were intended but not achieved. The map in Figure 2a shows a birth centre (two birthing rooms) and the obstetric care unit. In the middle is an work room (office) for the different professionals (maternity care assistants, nurses, (community) midwives, obstetricians). During different observations we noticed that this joint work room did not lead immediately to informal contact among the different professionals. An example, a maternity care assistant says: *"I'm really sorry that we are never asked by the nursing staff for a coffee or lunch, it feels like we do not matter".* Another example, a midwife says: *"If I have to wait here in the birth centre I often go to another, empty room. I do not like to stay in this common office, it is too noisy."* The map in Figure 2b shows another birth centre and obstetric unit. They are separated by a door.

During different observations we noticed that the passage through the birth centre, which leads to the common stairwell of the hospital, is often used by the professionals of the obstetric care unit as a shortcut. Some professionals of the birth centre experience this as disturbing, as it leads to noise while silence is pursued. However, it also brings a lot of informal contact. An example, a maternity care assistant says: *"Regularly someone from the second echelon walks through the passage to the common stairwell and asks how we are doing".* Another example, a community midwife says: *"Many professionals of the second echelon use the birth centre as a shortcut, everyone comes here, even people who are not important here, even though we are pursuing a quiet atmosphere".*

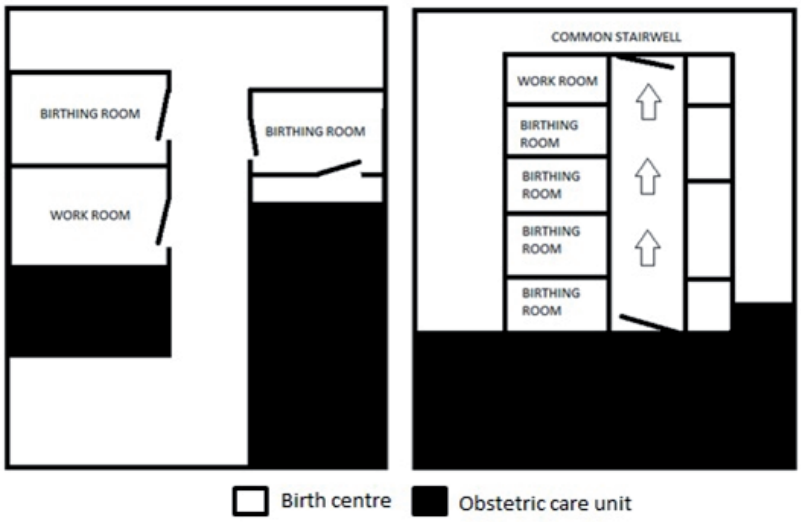


Figure 2a & b: *Map birth centre and obstetric care unit*

DISCUSSION AND CONCLUSION

In this paper, we have focused on a proposition that has emerged from our explorative field work: *co-location of birth centres and hospitals is important for the quality of collaboration within maternity care*. This research teaches us that the importance of co-location appears to vary across different levels of analysis and that co-location is not enough for better collaboration, see Figure 3:

- Macro-level: Both, proximity and distance to the receiving hospital were, in the settings studied, major factors in deciding where to locate the birth centres.
- Meso-level: The shorter the distance between the studied birth centres and the obstetric care units was, the more the health care professionals seem to value the collaboration. In other words, the shorter the distance was, the more the profession-

als value the mutual communication, shared goals, shared knowledge and mutual respect.

- Micro-level: short distances between the birth centre and the obstetric care unit not always increase personal interaction, habituation and collaboration in the settings studied.

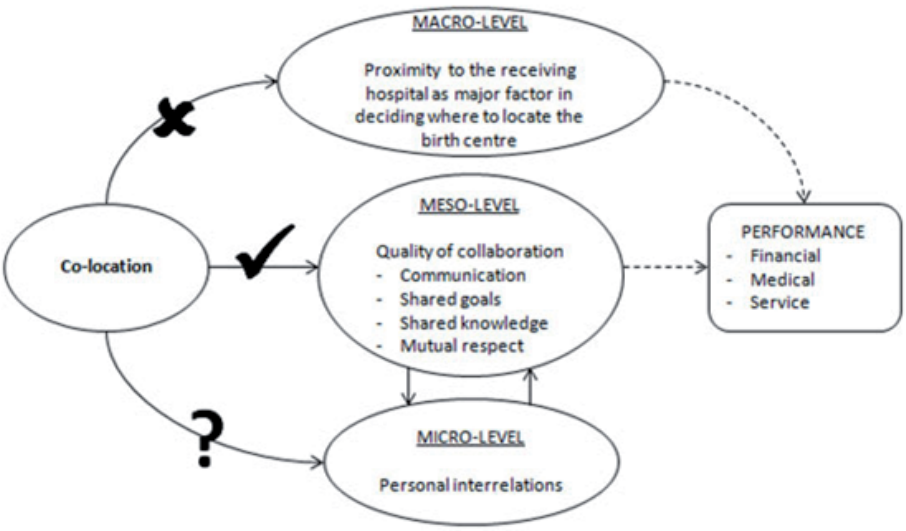


Figure 3: *Research model*

Co-location has been studied from a variety of domains, all focussing on *structure and performance outcomes* instead of the process and mainly based on *quantitative* data. These studies ignore the 'black box' of how processes link structure (e.g. co-location) to outcome. We focussed on the influence of co-location on the *process* (collaboration) instead of performance outcomes. Since this study is exploratory in nature, it does not seek to draw statistical and/or definitive conclusions about the importance of co-location. The case research methodology and case selection leads to several limitations.

Although the validity of the data was increased by our observations of co-location in the natural setting (28), all these observations were assessed by a single researcher. This may led to observer bias and threatened the study's internal validity. We selected cases with the aim to achieve maximum variation. Looking at the birth centre locations, there were three alongside, three on-site and only one freestanding birth centre selected. This is in line with the number of freestanding birth centres in the Netherlands, and it is desirable to have a not co-located birth centre in the selection. We studied the influence of co-location on the process of collaboration, without taking the outcome of care into consideration. Co-location may have an influence on the referral and intervention rates.

Collaboration among caregivers is increasingly seen as an important element in good quality and safe health care. This is especially important in the context of maternity care, where some women are crossing boundaries, from primary to secondary care and vice versa (16, 29). These boundaries, which are reinforced by identities, specialized knowledge and status differentials, undermine relationships and make communication more difficult. Other barriers to collaboration include distrust, lack of respect for the other's profession and different philosophies on care (29, 30). Co-location can overcome these barriers (31). Increased interactions, informal communication and increase in efficiency of use of resources are the major benefits of co-location (10, 11). Nearly all of the research on not co-located teams has concluded that they experience more conflict and function less effectively than co-located teams (32-35). This research looked more in-depth and showed that the importance of co-location appears to vary across different levels of analysis.

It is useful to have this qualitative research to provide a platform for the larger project, the Dutch Birth Centre Study. The interest in the project and specifically in this sub-study is shown by the enthusiastic participation of the birth centres and professionals. The professionals were eager to show the birth centres. In addition, many regions are still searching for how to organize maternity care in their region. In this study we focused mainly on the birth period, the period in which birth centres provide care. A large part of obstetric care is provided, however, during pregnancy and the postpartum phase, outside of the birth centre. Thus, in this study we evaluated birth centre care, being a small part of the entire maternity chain. Future research on co-location and collaboration may focus more on another period, for example pregnancy.

An implication for practice is that it would be sensible to pay more attention to the role that meso- and micro-level co-location can play in the development of birth centres and to pay more attention to the informal collaboration. The results might be transferrable to other countries with birth centres, including the United States of America and the United Kingdom.

REFERENCES

1. The ministry of Health Welfare and Sport. Letter: Ketenzorg zwangerschap en geboorte. Den Haag 2008.
2. Mohangoo AD, Buitendijk SE, Hukkelhoven CW, Ravelli AC, Rijninks-van Driel GC, Tamminga P, et al. Higher perinatal mortality in The Netherlands than in other European countries: the Peristat-II study. Nederlands tijdschrift voor geneeskunde. 2008;152(50):2718-27.
3. Amelink-Verburg MP, Buitendijk SE. Pregnancy and Labour in the Dutch Maternity Care System: What Is Normal? The Role Division Between Midwives and Obstetricians. Journal of Midwifery & Women's Health. 2010;55(3):216-25.
4. Pieters A, Van Oirschot C, Akkermans H. No cure for all evils. International Journal of Operations & Production Management. 2010;30(11).
5. Steering committee Pregnancy and Birth. A good beginning, safe care around pregnancy and birth. (in Dutch: Een goed begin, veilige zorg rond zwangerschap en geboorte). Advice steering committee Pregnancy and Birth. Utrecht 2009.
6. Hermus M, Wiegers T, Hitzert M, Boesveld I, van den Akker-van Marle E, Akkermans H, et al. The Dutch Birth Centre Study: study design of a programmatic evaluation of the effect of birth centre care in the Netherlands. BMC pregnancy and childbirth. 2015;15:148.
7. Wiegers T, de Graaf H, van der Pal K. The rise of birth centres and their role in health care [in Dutch: De opkomst van geboortecentra en hun rol in de zorg]. Tijdschrift voor gezondheidswetenschappen. 2012;90(8):475-8.
8. Bonsel GJ, Birnie E, Denktas S, Poeran J, Steegers EAP. Dutch report:Lines in the perinatal mortality, signalement study of pregnancy and birth in 2010 [in Dutch: Lijnen in de perinatale sterfte, signalementstudie zwangerschap en geboorte in 2010]. Rotterdam: Erasmus MC. 2010.
9. Rafii F. How important is physical collocation to product development success? Business Horizons. 1995;38:78-84.
10. Sharifi S, Pawar KS. Virtually co-located product design teams: sharing teaming experiences after the event? International Journal of Operations & Production Management. 2002;22(6):656-79.
11. Reichhart A, Holweg M. Co-located supplier clusters: forms, functions and theoretical perspectives. International Journal of Operations & Production Management. 2008;28:53-78.
12. Memon AR, Kinder T. Co-location as a catalyst for service innovation: a study of Scottish health and social care. Public Management Review. 2016:1-25.
13. Zschoche M. The Effects of Foreign Direct Investment Colocation: Differences Between Manufacturing and Service Firms. Managerial and Decision Economics. 2016;37(7):447-60.
14. Fynes B, Professor Paul Coughlan P, Brennan L, Ferdows K, Godsell J, Golini R, et al. Manufacturing in the world: where next? International Journal of Operations & Production Management. 2015;35(9):1253-74.
15. Feldmann A, Olhager J. Plant roles: Site competence bundles and their relationships with site location factors and performance. International Journal of Operations & Production Management. 2013;33(6):722-44.
16. Goodman D. Improving Access to Maternity Care for Women with Opioid Use Disorders: Colocation of Midwifery Services at an Addiction Treatment Program. Journal of Midwifery & Women's Health. 2015;60(6):706-12.
17. Yin RK. Case study research: Design and methods: Sage publications; 2014.
18. Voss C, Johnson M, Godsell J. Revisting case research in Operations Management. 22nd EurOMA Conference; Swiss 2015.

19. Blumer H. The methodological position of symbolic interactionism. Symbolic interactionism: Perspective and method. 1969:1-60.
20. Gittell JH. Relational coordination: Guidelines for theory, measurement and analysis. Relational Coordination Research Collaborative; 2012.
21. Madill A, Sullivan PW. Mirrors, Portraits and Member Checking: Managing Difficult Moments of Knowledge Exchange in the Social Sciences. 2017.
22. Strauss A, Corbin JM. Basics of qualitative research: Grounded theory procedures and techniques: Sage Publications, Inc; 1990.
23. Hoffer Gittell J. Coordinating mechanisms in care provider groups: Relational coordination as a mediator and input uncertainty as a moderator of performance effects. Management Science. 2002;48(11):1408-26.
24. Gittell JH, Fairfield KM, Bierbaum B, Head W, Jackson R, Kelly M, et al. Impact of relational coordination on quality of care, postoperative pain and functioning, and length of stay: a nine-hospital study of surgical patients. Medical care. 2000;38(8):807-19.
25. Gittell JH. Relational coordination: Coordinating work through relationships of shared goals, shared knowledge and mutual respect. Relational perspectives in organizational studies: A research companion. 2006:74-94.
26. Gittell JH, Weinberg D, Pfefferle S, Bishop C. Impact of relational coordination on job satisfaction and quality outcomes: a study of nursing homes. Human Resource Management Journal. 2008;18(2):154-70.
27. Gittell JH, Godfrey M, Thistlethwaite J. Interprofessional collaborative practice and relational coordination: improving healthcare through relationships. Journal of Interprofessional Care. 2013;27(3):210-3.
28. Holloway I, Galvin K. Qualitative research in nursing and healthcare: John Wiley & Sons; 2016.
29. Downe S, Finlayson K, Fleming A. Creating a collaborative culture in maternity care. Journal of Midwifery & Women's Health. 2010;55(3):250-4.
30. Beasley S, Ford N, Tracy SK, Welsh AW. Collaboration in maternity care is achievable and practical. Australian and New Zealand Journal of Obstetrics and Gynaecology. 2012;52(6):576-81.
31. Wener P, Woodgate RL. Collaborating in the context of co-location: a grounded theory study. BMC family practice. 2016;17:30.
32. de Gea C, Juan M, Nicolás J, Fernández Alemán JL, Toval A, Ouhbi S, et al. Co- located and distributed natural- language requirements specification: traditional versus reuse- based techniques. Journal of Software: Evolution and Process. 2016.
33. Schottenfeld L, Petersen D, Peikes D, Ricciardi R, Burak H, McNellis R, et al. Creating patient-centered team-based primary care. Rockville: Agency for Healthcare Research and Quality. 2016.
34. O'Dwyer P, Cahalane S, Pelican-Kelly S. Evaluation of a co-location initiative: a Public Health Nurse working in a social work department to improve child protection practice. The Irish Social Worker. 2016.
35. Scheele C, Vrangbæk K. Co-location as a Driver for Cross-Sectoral Collaboration with General Practitioners as Coordinators: The Case of a Danish Municipal Health Centre. International Journal of Integrated Care. 2016;16(4).

Chapter 3

Quality improvement opportunities for handover practices in maternity care: a case-study from a process perspective

Marit Hitzert
Inge C. Boesveld
Marieke A.A. Hermus
Johanna P. de Graaf
Therese A. Wiegers
Eric A.P. Steegers
Berthold R. Meijboom
Henk A. Akkermans

Submitted

ABSTRACT

Rationale, aims and objectives: Handovers within and between health care settings are known to affect quality of care. Health care organizations, including Dutch birth centres, struggle how to guarantee best care during handovers. Adverse outcomes in Dutch maternity care were linked to poor operational processes. The aim of this paper is to evaluate handover practices in Dutch birth centres from a process perspective, to identify obstacles and opportunities for quality improvements.

Methods: This case study in seven Dutch birth centres was undertaken from a process perspective by conducting observations and using process mapping. This study is part of the Dutch Birth Centre Study.

Results: Solutions to obstacles during handovers from a birth centre to a hospital were identified in at least one of the seven birth centres. Four of the centres had agreements with a hospital for client support when a caregiver in a birth centre was absent. Face to face communication during handover was observed in six of the seven centres. An electronic health record was noted in one centre; joint training of acute situations was available in two centres with three centres indicating this was not compulsory. Continuity of caregiver was present in four birth centres with postpartum care available in three centres.

Conclusions: Ensuring quality during handovers requires a case-specific process approach. This study reveals distinctive aspects during handovers, concrete obstacles and potential solutions for quality improvements in inter-organizational networks.

INTRODUCTION

Handovers are a serious issue in healthcare as they are known to affect quality of care (1-3). Often, the organization of health care services requires the client to move between services, such as from primary care to secondary care, across team shifts and disciplines. These handovers serve as the basis for transferring *responsibility* (being in charge) and *accountability* (liability) for the care of clients (4).

One area of health care where there has long been a debate on the effectiveness and the safety of the operational set-up of the care processes is the Dutch maternity care system. The debate around the system increased after the results became known from the 2008 edition of the EURO-PERISTAT study, which put the Netherlands in terms of perinatal health outcomes close to the bottom of a ranked list of European countries (5).

The historical organization of the Dutch maternity system has a clear segmentation in primary care (community midwife-led) and secondary care (obstetrician-led). This functional set-up often requires the client to move from one type of service to another during pregnancy and birth. In 2015, about 44% of the women who started labour under supervision of a community midwife were referred to secondary care during labour and birth (mostly non-urgent referrals including pain relief) (6). Although there may be other reasons for the poor perinatal health outcomes as well, e.g. high number of very preterm births (7), the results of the EURO-PERISTAT study were directly linked to the operational set-up of the entire maternity care system. Inappropriate risk assessment, regional variations, poor communication and handover processes between community midwives and obstetricians could partly be seen as causes of these poor health outcomes (8-10).

As a result of the relatively poor perinatal outcomes, a steering committee by the Ministry of Health, Welfare and Sport made suggestions for improvements and advised better collaboration among all maternity care professionals to achieve better care during pregnancy and birth (11). In many regions, maternity care professionals and organizations implemented these suggestions. A relatively new organizational phenomenon acknowledged as birth centres was established in recent years in the Netherlands.

Birth centres are midwifery-managed locations that offer care during labour and birth to women with uncomplicated pregnancies. They have a homelike environment and provide facilities to support physiological birth. Community midwives take primary professional responsibility for care. Birth centres are often located close to the obstetric care unit of the hospital and in case of referral the obstetric caregiver takes over the professional responsibility of care (12, 13). The aim of this paper is to evaluate handover practices in Dutch birth centres from a process perspective, to identify obstacles and opportunities for quality improvements.

METHODS

Design

This study is part of the Dutch Birth Centre Study (13). The national project evaluates the effect of Dutch birth centre care on aspects such as, effectiveness, cost-effectiveness and experiences. To better understand the whole phenomenon 'birth centres', we did not look only into health outcomes, client experiences and costs, but also into the processes that lead to and, thereby, influence these outcomes. This multiple case-study was undertaken from a process perspective by conducting observations and using process mapping. A process map illustrates the workflow (interrelated work activities and resources) in organizations. The whole work process crosses several functions or other organization entities, which is illustrated on the map (14). The handover practices were evaluated in seven Dutch birth centres and possible obstacles and opportunities for quality improvements were identified.

Sample

After an initial first exploratory round of visits to 15 birth centres in the Netherlands, seven birth centres were selected with the aim to achieve a maximum variation. The main criteria for case selection included; variation in geographical location, spread in operational period and variation in type of birth centre based on location with respect to the obstetric unit. Three types of birth centres can be distinguished; 1) freestanding birth centres, 2) birth centres alongside the obstetric unit and 3) birth centres on-site the obstetric unit (13).

Three birth centres were chosen based upon whether they were freestanding, alongside or on-site. Two birth centres were chosen based upon whether they were located in a large city or rural area and two birth centres were chosen based upon the operational period (<0.5 year and >5 years).

The initiators of the seven birth centres vary and include insurance companies, boards of hospitals, a municipality and maternity care professionals. The birth centres have different reasons of establishment (e.g. capacity problems in the hospitals or enhancement of collaboration). The centres are established between 2004 and 2013. They are located in small cities (n=2), medium-size cities (n=2) and in large cities (n=3). Our sample includes a freestanding birth centre (n=1), alongside birth centres (n=3) and on-site birth centres (n=3). The number of births in 2013 varies between 113 and 1090 per year and per birth centre, see Table 1.

Table 1: *Characteristics of the cases*

Birth centre	Initiators	Reason of establishment	Since	Type of region	Location of birth centre	Number of births in 2013
A	Insurance company	Distance to a hospital for emergency care during home birth is otherwise too long	2009	Small city in a rural area with seasonal crowds (tourism) (1300 inhabitants per km^2)	Freestanding	113
B	Ten community midwifery practices	The higher demand for hospital births leaded to capacity shortfall of the obstetric care unit. An alternative birth location is needed.	2007	Large city (4888 inhabitants per km^2)	Alongside	1090
C	Community midwives	Maintenance and strengthening maternity care in order to support the physiological birth	2012	Small city (1183 inhabitants per km^2)	Alongside	235
D	Community midwives, obstetricians, organization of maternity care assistance, insurance company, the board of the hospital and the municipality	The higher demand for hospital births leaded to capacity shortfall of the obstetric care unit. An alternative birth location is needed. Reduction of perinatal mortality and morbidity	2009	Large city (2960 inhabitants per km^2)	Alongside	734
E	Community midwives	The higher demand for hospital births leaded to capacity shortfall of the obstetric care unit. An alternative birth location is needed.	2004	Large city (3481 inhabitants per km^2)	On-site	888
F	Maternity care professionals from different backgrounds	Intensive collaboration to enhance quality in maternity care	2011	Medium-size city (1794 inhabitants per km^2)	On-site	402
G	Board of the hospital, community midwives and obstetricians	Strengthening obstetric and midwifery care	2013	Medium-size city (2037 inhabitants per km^2)	On-site	264 (since May)

Data collection

The data collection is based on a triangulation of different types of data: comprehensive field notes of direct observations of the professional staff working in the seven birth centres, informal conversations with them and studying of documents, including policy documents and agreements. These documents were obtained from the managers of the birth centres. The researcher (MH) made field notes of the observations of the daily operations and informal conversations in the birth centres. To focus on the observations, sensitizing concepts are used (15). These concepts included variables related to handovers: *responsibility* (being in charge), *accountability* (liability), *information exchange* and *continuity of care* (e.g. duration, number of caregivers involved). To direct the study, these sensitizing concepts are discussed and specified during the data collection period by the researchers (MH and HA). Equally spread over the seven birth centres, the observations took in total around 1000 hours (based on saturation), during day, night, weekdays and weekend, spread over one year (April 2013 - April 2014). A high number of observation hours was needed to account for periods of low activity in the birth centre. During the first visits for observation the care providers of the seven birth centres were very conscious of the researchers' presence, but after a while this became more accepted.

Ethical Considerations

Oral informed consent was obtained from the management team and clients of the birth centres. The design and planning of the study were presented to the Medical Ethics Committee of the University Medical Centre Utrecht. They confirmed that an official ethical approval of this study is not required (16).

Data analysis

Analysis started as soon as the first data were collected and continued with each additional observation. Atlas software was used for data-management of the observations and informal conversations and analysis. The first step in the analysis was coding the transcripts of the observations and informal conversations. Codes that relate closely to the text fragments (e.g. presence of caregivers, transport, continuity of care, information exchange) were used. During the observations, the operational processes were discussed with employees of each birth centre (including community midwives, maternity care assistants, obstetricians and managers; on average 5 caregivers per birth centre). To identify possible obstacles and opportunities for quality improvement, their comments were documented in notes. As soon as these analyses were done, process mapping was used. Process mapping as a tool to analyse from a process perspective is known to be effective to understand the care process (1). Analysing from a process perspective acknowledges the importance of the context to an understanding of why interventions

and strategies work, how and under which circumstances (17). Through the use of a Business Process Management tool (BPMN 2.0 Signavio), we mapped the current processes. This was a common understanding of the process capturing the physical journey, the flows of information and responsibilities. Two of the researchers (MH and HA) compared the seven maps, and identified the differences in barriers and facilitators. As a member check to validate the qualitatively generated data, the process maps were given back to the managers of the birth centres. All the managers confirmed that the interpretation of the processes was accurate.

RESULTS

Handover practices

We observed that there were distinctive aspects about the handover practices in every birth centre. As an example of the process mapping, figure 1 provides an overview of the observed care processes in one birth centre (D), including the handovers, from the start of labour to postpartum care at home. The figure consists of three lanes that represent the organization parts: the upper lane is the client's home, the middle lane represents the birth centre and the lower lane is the hospital. The process starts upper left at the client's home.

The distinctive aspects are summarized in Table 2 for all seven birth centres. In a few birth centres, no matter if clients are present or not, the caregivers are standard present in the birth centre. In other birth centres they are not, the caregivers arrive in the birth centre when a woman in labour calls. If the client is already in the birth centre and professional help is needed while the community midwife and/or maternity care assistants is/are not there yet, the clinical midwife and/or nurse, working in the hospital, temporarily take(s) over the responsibility of care. This is not the case in all birth centres; in one birth centre there is no caregiver working in the hospital to momentarily take over the responsibility of care in the birth centre and the client who is in labour has to wait in the corridor without professional help.

In case of referral, the caregivers of the hospital are informed through face to face or telephone communication. The medical history is transferred on paper or digitally. The transfer of the client from a birth centre to hospital is done in one birth centre by ambulance/car; in some birth centres, by wheelchair or bed. In some birth centres, no transport is needed; the caregivers change room. Exceptions for transfer are locally described, and included situations as shoulder dystocia, resuscitation of the neonate and postpartum haemorrhage. In those situations, the protocol is that the secondary caregiver (clinical midwife/obstetrician or paediatrician) is called and has to come from the hospital to the birth centre for referral.

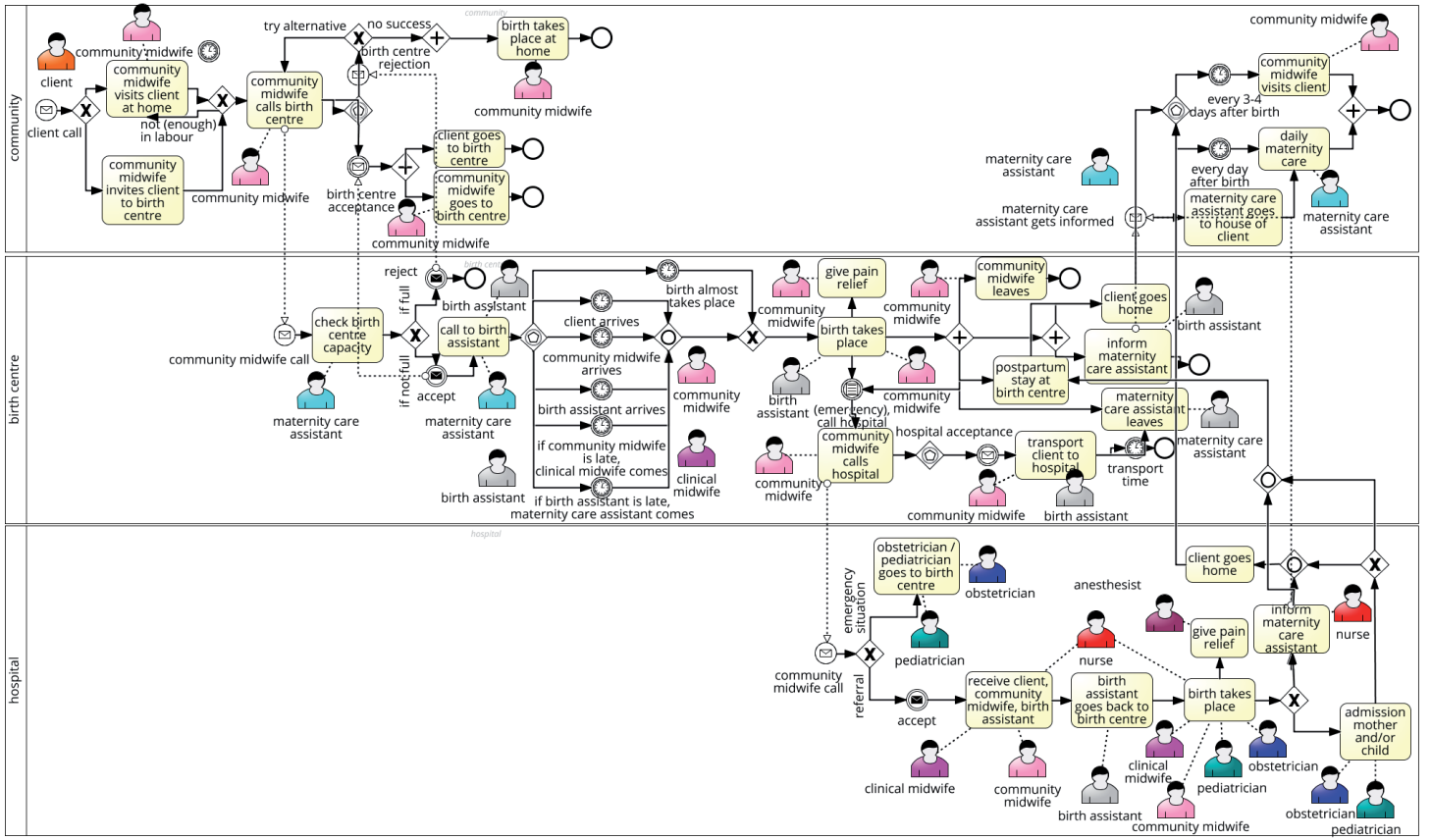


Figure 1: *The process map of birth centre D*

Table 2: *Results of the seven birth centres on handover practices from a process perspective*

Birth Centre	Progress of birth	Standard presence of caregivers in birth centre	Transfer from birth centre to the hospital	Transmission of information during referral	Possibility to stay postpartum in birth centre
A	Checked during home-visit	No No hospital support available	By ambulance or car	On paper, community midwife consults caregivers by phone	No, the client goes home, if possible with the same maternity care assistant as during birth
B	Checked during home-visit or in the birth centre	No Hospital support available	By wheelchair or bed and exceptions for transfer are locally described	On paper, community midwife consults caregivers by phone	No and no maternity care assistance at night at home
C	Checked during home-visit	No No hospital support available	By wheelchair or bed and exceptions for transfer are locally described	On paper, community midwife consults caregivers by phone	No and no maternity care assistance at night
D	Checked during home-visit or in the birth centre	Yes Hospital support available	By wheelchair or bed and exceptions for transfer are locally described	On paper, community midwife consults caregivers by phone	Yes
E	Checked in the birth centre, possible to be send back home	Yes Hospital support available	No transport needed, caregivers change room	Digitally transferred, community midwife has face-to-face contact with caregivers	Yes
F	Checked during home-visit	No Hospital support available	No transport needed, caregivers change room	Medical history on paper, community midwife has face-to-face contact with caregivers	Yes
G	Checked during home-visit	No Hospital support available	No transport needed, caregivers change room	Medical history on paper, community midwife has face-to-face contact with caregivers	No and no maternity care assistance at night at home

In some birth centres, when all birthing rooms at the hospital are occupied during a referral, the birth takes place in the birth centre. The woman does not get transferred and the obstetrician comes to the birth centre to take over the responsibility of care during birth. In other birth centres, the client and community midwife have to go by car/ambulance to another hospital. The continuity of care postpartum differs across the seven birth centres. In some birth centres, the client goes home (with her medical record on paper) a few hours after birth. The maternity care assistant who will provide care at home gets informed by phone or fax. In one birth centre, the same maternity care assistant as the one during birth joins the client at home. In a few birth centres, it is possible to stay in that birth centre a few days after birth.

Quality obstacles

Seven quality obstacles (caregiver absence on arrival, no direct contact during handover, use of multiple electronic health records, inadequate caregiver's knowledge on procedures, unfamiliarity with team members, no continuity of caregiver, no continuity of care for client) were identified and are summarized in Table 3 for all seven birth centres. The seven obstacles can interrupt the continuity of intra- and postpartum-care (in acute situations), lead to missing information during key moments and influence the collaboration.

Table 3: *Results of the seven birth centres on quality obstacles from a process perspective*

Birth centre	Caregiver presence on arrival	Contact during handover	Use of electronic health records	Caregivers knowledge on procedures	Familiarity with team members	Continuity of familiar caregiver	Continuity of care for client
A	Not present	Not direct	Multiple	Adequate	Yes	No	Yes
B	Not present	Direct	Multiple	Adequate	No	Yes	No
C	Not present	Direct	Multiple	Inadequate	No	Yes	No
D	Present	Direct	Multiple	Adequate	Yes	Yes	Yes
E	Present	Direct	Single	Adequate	No	Yes	Yes
F	Not present	Direct	Multiple	Inadequate	No	No	Yes
G	Not present	Direct	Multiple	Adequate	No	No	No

Quality improvements

Potential solutions to the afore-mentioned quality obstacles were identified. All these solutions were observed in at least one of the seven settings studied. In summary, four of the seven birth centres had agreements with the hospital for client support when a caregiver was absent. Face to face communication during handover was observed in six of the seven birth centres. An electronic health record was noted in one birth centre; joint training of acute situations was available in two birth centres (compulsory) with

three centres indicating this was not compulsory. Continuity of caregiver was present in four birth centres with postpartum care available in three centres.

DISCUSSION

In this study, our aims were (1) to evaluate handover practices in birth centres from a process perspective, (2) to identify possible obstacles and (3) opportunities for quality improvements in the practice of handovers in birth centres. There were distinctive aspects during the handovers in every birth centre. Seven obstacles and potential solutions were identified.

Strengths and limitations

To our knowledge, this is the first study that is undertaken from a process perspective to identify obstacles and facilitators of handover practices in inter-organizational networks by using observations and process mapping. Process mapping can be effective in evaluating whether or not improvements to the current operational process, including handovers, are possible and desirable (1). Until now application of process mapping in maternity care is somewhat limited (18). This perspective allowed us to explicitly analyse relationships and interactions between caregivers that are involved in the care process (17) and should therefore be used more often in health care.

Although the validity of the data was increased by our observations of the care process in the natural setting (19), all these observations were assessed by a single researcher. As a member check to validate the qualitatively generated data, the process maps were given back to the managers of the birth centres. All the managers confirmed that the interpretation of the processes was accurate. The selected seven birth centres represent a wide variation of birth centres. Only one freestanding birth centre has been included in our sample; this is in line with the low number of freestanding birth centres (3) in the Netherlands.

Birth centres have internationally been studied from the point of various domains, all focussing on *structure and performance outcomes* instead of the process (20-23). Beside this, the studies are mainly based on *quantitative* data. These studies ignore the 'black box' of how processes link structure to outcome. We focussed on the *process* instead of performance outcomes. To fully understand the nature and complexity of the complete phenomenon, we used qualitative case study research, instead of quantitative data. It is useful to have this qualitative research to provide a perspective for a larger project: the Dutch Birth Centre Study. The interest in the project was shown by the enthusiastic participation of the birth centres and professionals. Many regions are still searching for how to organize maternity care in their region and how to guarantee high quality handovers.

Interpretation of the results

Solutions to obstacles during handovers from a birth centre to a hospital were identified in at least one of the seven birth centres. Four of the centres had agreements with a hospital for client support when a caregiver in a birth centre was absent. These agreements ensure that there will always be someone to take care of the client when she arrives in the birth centre. In a freestanding birth centre, which is separated from a hospital with obstetric services, the community midwife should make sure she arrives together with the client.

Face to face communication during handover was observed in six of the seven centres. An electronic health record was noted in only one of the seven birth centres. The other six birth centres use a paper hand-held record for sharing information. The use of an electronic health record has demonstrated significant improvements to the collection of best practice variables in a maternity care setting (24). Additionally, the data in an electronic health record was more available to relevant caregivers and more easily retrieved than from a paper hand-held record. The aforementioned aspects improve efficiency and reduce errors.

Joint training of acute situations was available in two centres with three centres indicating this was not compulsory. In some situations critical communication must occur, often at potentially highly stressful times. To prevent (communication) errors, it is important to focus the training on the team as a whole. Obstetrics is a field in which several professionals has to work together under extreme time pressure (25, 26). During the training, the caregivers (obstetricians and paediatricians) who come only to the birth centre in acute situations will become more familiar with the birth centre setting and their colleagues.

Continuity of caregiver was present in four birth centres with postpartum care available in three centres. (un)Familiarity of the woman with the caregiver is an aspect that can largely explain the differences in client experiences between transferred and non-transferred women (27, 28). These experiences are an important indicator of the quality of healthcare. In the Netherlands, pregnant women are often familiar with their community midwife. In case of referral to secondary care, a pregnant woman meets new caregivers with whom she is not familiar. Due to the segmentation of primary and secondary care it is difficult to guarantee a familiar caregiver. One possible solution would be a community midwife, who continues accompanying the woman.

CONCLUSIONS

Ensuring quality during handovers requires a case-specific process approach to understand and improve care. Through analysis from a process perspective, this study reveals

distinctive aspects during handovers, identifies seven concrete obstacles and six potential solutions which might be transferrable to other settings.

IMPLICATIONS

In the last decades, many birth centres have been established in different countries, including the United States of America, the United Kingdom, Australia, Sweden and the Netherlands. Birth centres are settings that uphold the maternity care system in which community midwives take responsibility for births of women with low-risk of complications, in a non-clinical setting. This functional set-up often requires the client to move from one type of service to another. These handovers increase the opportunity for errors and have a negative effect on client experiences. They cannot always be prevented and must, therefore, be organized as optimal as possible. This study provides potential solutions for that.

REFERENCES

1. Johnson JK, Farnan JM, Barach P, Hesselink G, Wollersheim H, Pijnenborg L, et al. Searching for the missing pieces between the hospital and primary care: mapping the patient process during care transitions. BMJ Quality & Safety. 2012:bmjqs-2012-001215.
2. Wachter RM. Understanding patient safety: McGraw Hill Medical; 2012.
3. Dixon JL, Stagg HW, Wehbe-Janek H, Jo C, Culp Jr WC, Shake JG. A standard handoff improves cardiac surgical patient transfer: operating room to intensive care unit. Journal for Healthcare Quality. 2015;37:22-32.
4. Marlow C. Communication is key. Australian Nursing and Midwifery Journal. 2017;24(8):26.
5. Mohangoo AD, Buitendijk SE, Hukkelhoven CW, Ravelli AC, Rijninks-van Driel GC, Tamminga P, et al. Higher perinatal mortality in The Netherlands than in other European countries: the Peristat-II study. Nederlands tijdschrift voor geneeskunde. 2008;152(50):2718-27.
6. The Netherlands Perinatal Registry. Perinatal care in the Netherlands 2015 (in Dutch: Perinatale zorg in Nederland 2015). Utrecht: 2016.
7. de Jonge A, Mesman JA, Manniën J, Zwart JJ, van Dillen J, van Roosmalen J. Severe adverse maternal outcomes among low risk women with planned home versus hospital births in the Netherlands: nationwide cohort study. BMJ. 2013;346:f3263.
8. Evers ACC, Brouwers HAA, Hukkelhoven CWPM, Nikkels PGJ, Boon J, van Egmond-Linden A, et al. Perinatal mortality and severe morbidity in low and high risk term pregnancies in the Netherlands: prospective cohort study. BMJ. 2010;341:c5639.
9. Bonsel GJ, Birnie E, Denktas S, Poeran J, Steegers EAP. Dutch report: Lines in the perinatal mortality, signalement study of pregnancy and birth in 2010 [in Dutch: Lijnen in de perinatale sterfte, signalementstudie zwangerschap en geboorte 2010]. Rotterdam: Erasmus MC. 2010.
10. Visser GHA. Obstetric care in the Netherlands: relic or example. J Obstet Gynaecol Can. 2012;34(10):971-5.
11. Steering committee Pregnancy and Birth. A good beginning, safe care around pregnancy and birth. (in Dutch: Een goed begin, veilige zorg rond zwangerschap en geboorte). Advice steering committee Pregnancy and Birth. Utrecht 2009.
12. Wiegers T, de Graaf H, van der Pal K. The rise of birth centres and their role in health care [in Dutch: De opkomst van geboortecentra en hun rol in de zorg]. Tijdschrift voor gezondheidswetenschappen. 2012;90(8):475-8.
13. Hermus MA, Wiegers TA, Hitzert MF, Boesveld IC, van den Akker-van ME, Akkermans HA, et al. The Dutch Birth Centre Study: study design of a programmatic evaluation of the effect of birth centre care in the Netherlands. BMC pregnancy and childbirth. 2015;15:148.
14. Anjard R. Process mapping: a valuable tool for construction management and other professionals. Facilities. 1998;16(3/4):79-81.
15. Blumer H. The methodological position of symbolic interactionism. Symbolic interactionism: Perspective and method. 1969:1-60.
16. Central Committee on Research Involving Human Subjects. [cited 2015 June 13th 2015]. Available from: http://www.ccmo.nl/en/ccmo-directives.
17. Hines P, Rich N. The seven value stream mapping tools. International Journal of Operations & Production Management. 1997;17:46-64.
18. Jun GT, Ward J, Morris Z, Clarkson J. Health care process modelling: which method when? International Journal for Quality in Health Care. 2009:mzp016.
19. Holloway I, Galvin K. Qualitative research in nursing and healthcare: John Wiley & Sons; 2016.

20. Hitzert M, Hermus MA, Scheerhagen M, Boesveld IC, Wiegers TA, van den Akker-van ME, et al. Experiences of women who planned birth in a birth centre compared to alternative planned places of birth. Results of the Dutch Birth Centre Study. Midwifery. 2016;40:70-8.
21. Dahlen HG, Dowling H, Tracy M, Schmied V, Tracy S. Maternal and perinatal outcomes amongst low risk women giving birth in water compared to six birth positions on land. A descriptive cross sectional study in a birth centre over 12 years. Midwifery. 2013;29(7):759-64.
22. Li Y, Townend J, Rowe R, Knight M, Brocklehurst P, Hollowell J. The effect of maternal age and planned place of birth on intrapartum outcomes in healthy women with straightforward pregnancies: secondary analysis of the Birthplace national prospective cohort study. BMJ open. 2014;4:e004026.
23. Kuliukas L, Hauck Y, Duggan R, Lewis L. The phenomenon of intrapartum transfer from a western Australian birth centre to a tertiary maternity hospital: The overall experiences of partners. Midwifery. 2015;31(5):e87-e93.
24. Hawley G, Jackson C, Hepworth J, Wilkinson SA. Sharing of clinical data in a maternity setting: How do paper hand-held records and electronic health records compare for completeness? BMC health services research. 2014;14:650.
25. Merién A, Van de Ven J, Mol B, Houterman S, Oei S. Multidisciplinary team training in a simulation setting for acute obstetric emergencies: a systematic review. Obstetrics & Gynecology. 2010;115(5):1021-31.
26. van de Ven J, Houterman S, Steinweg RA, Scherpbier AJ, Wijers W, Mol BWJ, et al. Reducing errors in health care: cost-effectiveness of multidisciplinary team training in obstetric emergencies (TOSTI study); a randomised controlled trial. BMC pregnancy and childbirth. 2010;10:59.
27. Scheerhagen M, Van Stel HF, Birnie E, Franx A, Bonsel GJ. Measuring client experiences in maternity care under change: development of a questionnaire based on the WHO responsiveness model. PloS one. 2015;10(2):e0117031.
28. van Stenus CM, Boere-Boonekamp MM, Kerkhof EF, Need A. Client satisfaction and transfers across care levels of women with uncomplicated pregnancies at the onset of labor. Midwifery. 2017;48:11-7.

Chapter 4

Help – I need somebody!

A multiple case study on helping behaviour in birth centres

Marit Hitzert
Astrid Kramer

Submitted

ABSTRACT

Objective*:* Helping behaviour is of high importance in birth centres. When problems arise or other expertise is necessary, professionals need to ask help from each other and provide help when asked. The present study provides quantitative and qualitative insights in helping behaviour in birth centres by describing seven complex maternity care networks.

Design: The study employed a multiple case study design of seven cases with data collection from observations and a digital questionnaire. The study we report upon is part of a greater research project, the Dutch Birth Centre Study.

Setting*:* The study focuses on the helping behaviour of maternity care professionals from seven Dutch birth centres.

Participants*:* The participants were 74 maternity care professionals from seven Dutch birth centres.

Measurements and findings*:* Although some strained relations were observed, primary care professionals working in a birth centre do name secondary care professionals as helpful and vice versa. The maternity care professionals often mentioned to be receiving help from a professional belonging to another group. The birth centre is seen as a benefit, as a place where maternity care professionals from different backgrounds can meet each other. Asking help from other professions was experienced as difficult. A reduction of the self-image and self-esteem was mentioned as main reasons. The central individuals in the seven networks are often the managers and the maternity care professionals with management tasks. Other individuals with a central position in the network are often concerned with collaboration agreements or are involved with the establishment of the birth centre.

Key conclusions and implications for practice*:* Despite many publications in recent years about the poor collaboration within the Dutch maternity care, this research teaches us that professionals certainly get help from outside their own group. The presence of this helping behaviour diminished the traditional boundaries and increases collaboration. True helping behaviour fuels the highest performance. Even in settings where professionals have different backgrounds and cultures, helping behaviour takes place. Birth centres are such places where this helping behaviour takes place.

INTRODUCTION

Maternity care consists of specialized services provided by different professionals like (community) midwives, maternity care assistants, obstetricians and nurses working in different departments or organizations like midwifery practices, maternity care organizations and hospitals. Management literature shows that inter-organizational cooperation facilitates knowledge sharing (1) and organizations gain access to resources they do not have themselves (2). However, Provan and Milward (3) indicate that cooperation could also lead to problems regarding resource sharing and regulatory differences. Reiger (4) for example identified tension, mistrust and poor communication between midwives and doctors in public hospitals while Kennedy and Lyndon (5) report challenges between midwifes and nurses. Hunter (6) argues that the main source of emotions at work is related to conflicting perspectives of midwifery practice. Solutions to mitigate the tension can be found in education (5, 6), supervision (6), and better cooperation (7).

Although these solutions might improve mutual understanding and reduces tension we believe that the extent to which healthcare professional are willing to help each other is an underemphasized, but very important factor in providing high quality maternity care. Therefore, helping behaviour is important in execution of the work that needs to be done (8) and is by definition collaborative behaviour (9, 10) in which one party (the help giver) allocates time and attention to a second party (the help seeker) with the intent to benefit the second party (11, 12). Helping behaviour does not arise automatically among colleagues and is thereby associated with costs (10, 13) like time and effort from the help giver (10, 14), possible decrease of reputation and status (15), power (10, 13, 16), and reduction of the self-image and self-esteem (10, 15, 17) of the help seeker. The help seeker must figure out whom to ask for help. DePaulo and Fisher (18) and Hofmann, Lei (14) indicate that the person with the most expertise would be a logical option. However, in the perception of the help seeker he or she might have strong reluctance to ask an expert since it could signal incompetence (10, 13, 16). Findings show that the best helpers in an organization are not those individuals with most expertise but those experts who are also trusted and accessible (8, 14).

The Dutch maternity care system is an excellent setting to study te helping behaviour of professionals, since the rivalry between the different professions working in maternity care settings is mentioned as one of the reasons for the poor perinatal outcomes (19, 20). The system is based on primary care provided by independently operating community midwives giving care for what are assumed low-risk pregnant women. Obstetricians provide in-hospital care for high-risk women (secondary care). To improve maternity care, a large number of birth centres have been established in recent years in the Netherlands (21) where primary care and secondary care cooperate. Birth centres are regarded as settings where women with uncomplicated pregnancies can give birth,

supervised by an independently operating community midwife and a maternity care assistant who works under supervision of the community midwife. Birth centres are often located close to the obstetric unit of an hospital. If complications occur or medical assistance for pharmacologic pain relief is requested the community midwife refers to an obstetrician or paediatrician (22). Not all midwives in the Netherlands are independent practitioners; some are employed in the hospital setting. These clinical midwives function semi-autonomously within the hospital setting under the responsibility of and together with obstetricians (23). Next to these healthcare professionals, each birth centre has a manager who is responsible for the management of the birth centre.

In this paper, we view birth centres as a network of organizations from primary and secondary care like 1) maternity care organizations, 2) midwifery practices, and 3) the hospital. Each of these organizations represents a profession in the network and these different professions have their own tasks and responsibilities in a birth centre, but in achieving their goals and the goals of the network, they are dependent on each other. By using social network analysis, we identify the most helpful professionals in the birth centres. The most central professionals have greater access to resources and receive more and new information (24-26) and they are highly involved in the network (26). This study provides quantitative and qualitative insights in helping behaviour in seven birth centres in the Netherlands.

METHODS

Design

A multiple case study approach is used since it allows answering questions regarding the 'how', 'what' and 'why' aspects with a full understanding of the nature and complexity of the phenomenon (27-30). Case study research is particularly appropriate for early, exploratory investigations (28), like this study is. This study is part of a wider study on the evaluation of Dutch birth centres, the Dutch Birth Centre Study (31). Oral informed consent was obtained from the management team and clients of the birth centres. Design and planning of the study were presented to the Medical Ethics Committee of the University Medical Centre Utrecht. They confirmed that an official ethical approval of this study is not required.

Data collection

The goal of case research is to understand as fully as possible the phenomenon being studied through triangulation (28). The data collection is based on a triangulation of different types of data, both qualitative (personal observations and informal conversations), quantitative (survey administrated with the organization) and a member check.

The first author made comprehensive field notes of direct observations in the birth centres' offices, birthing rooms, corridors, during meetings, and informal conversations. These observations allow for a deeper understanding of birth centres, and the chance to have informal conversations with many professionals involved in birth centre care. To focus on the observations sensitizing concepts are used (32). Equally spread over the seven birth centres, the observations took in total around 1000 hours (based on saturation), during day, night, weekdays and weekend, spread over one year (April 2013 - April 2014). This high number of hours was needed, because sometimes there was hardly any activity in a birth centre. Apart from the observations we used also quantitative research methods. In every birth centre at least four maternity care assistants, four community midwives, an obstetrician and paediatrician were asked to digitally fill out a questionnaire and name their five most helpful colleagues including their position in or around the birth centre.

Sample

Selection of birth centres

Birth centres are selected with the aim to achieve maximum variation. In multiple case study research, one uses theory-driven case selection (28), rather than statistical sampling. In this study, the main criteria for case selection included:

- Type of birth centre based on location with respect to the obstetric unit. Three types of birth centres can be distinguished; 1) freestanding birth centres, 2) birth centres alongside the obstetric unit and 3) birth centres on-site the obstetric unit (31, 33, 34).
- Geographical location
- Operational period

All birth centres in the Netherlands are identified during the overall Dutch Birth Centre Study (31). After an exploratory round of visits seven of the 23 birth centres were selected based on above mentioned criteria. The initiators of the seven birth centres vary and include insurance companies, the board of the hospital, the municipality and maternity care professionals. Reasons of establishment of the birth centres are often related to improvement of collaboration and thereby improvement of quality of care. They are established between 2004 and 2013 and are located in small cities (n=2), medium-size cities (n=2) and in large cities (n=3). Our sample includes a freestanding birth centre (n=1), alongside birth centres (n=3) and on-site birth centres (n=3). The number of births in 2013 varies between 113 and 1090 per year per birth centre, see Table 1.

Table 1: *Characteristics of the cases*

Birth centre	Initiators	Reason of establishment	Since	Type of region	Location of birth centre	Number of births in 2013
A	Insurance company	Distance to a hospital for emergency care during home birth is otherwise too long	2009	Small city in a rural area with seasonal crowds (1300 inhabitants per km^2)	Freestanding	113
B	Ten community midwifery practices	The higher demand for hospital births leaded to capacity shortfall of the obstetric care unit. An alternative birth location is needed.	2007	Large city (4888 inhabitants per km^2)	Alongside	1090
C	Community midwives	Maintenance and strengthening maternity care in order to support the physiological birth	2012	Small city (1183 inhabitants per km^2)	Alongside	235
D	Community midwives, obstetricians, organization of maternity care assistance, insurance company, the board of the hospital and the municipality	The higher demand for hospital births leaded to capacity shortfall of the obstetric care unit. An alternative birth location is needed. Reduction of perinatal mortality and morbidity	2009	Large city (2960 inhabitants per km^2)	Alongside	734
E	Community midwives	The higher demand for hospital births leaded to capacity shortfall of the obstetric care unit. An alternative birth location is needed.	2004	Large city (3481 inhabitants per km^2)	On-site	888
F	Maternity care professionals from different backgrounds	Intensive collaboration to enhance quality in maternity care	2011	Medium-size city (1794 inhabitants per km^2)	On-site	402
G	Board of the hospital, community midwives and obstetricians	Strengthening obstetric and midwifery care	2013	Medium-size city (2037 inhabitants per km^2)	On-site	264 (since May)

Selection of professionals

The manager of each birth centre has selected respondents based on their involvement in the birth centre (policy). In most birth centres there is a fixed pool of maternity care assistants (about 15), a group of midwifery practices (about 10) and a smaller number of doctors involved. In case A there are no obstetricians and paediatricians working. Since obstetric nurses and clinical midwives work on more distance from the birth centre and are not responsible for the care given in birth centres, we did not ask them to answer the question. Besides, the obstetric nurses and clinical midwives make part of the study since they were named as helpful. The sample size of the professionals that filled out the questionnaire (n=74) is shown in Table 2.

Table 2: *Sample size - questionnaires*

	Maternity care assistants	Community midwives	Obstetrician	Paediatrician
Case A	6	4	0	0
Case B	4	4	1	1
Case C	4	4	1	1
Case D	4	4	1	1
Case E	4	4	1	1
Case F	7	4	1	1
Case G	4	4	2	1
Total	33	28	7	6

Data analysis

The first step in the analysis of the observations was coding the transcripts. Codes that relate closely to the text fragments are used and discussed by the researchers. The coded transcripts are then analysed to identify returning topics of which helping behaviour is one. We investigated this topic in more detail by using three different levels of abstraction:

1) primary (maternity care assistant, community midwife), secondary care (obstetric nurse, clinical midwife/obstetrician, paediatrician) and management
2) profession (maternity care assistant, community midwife, obstetric nurse, clinical midwife/obstetrician, paediatrician, manager)
3) professional

The answers from obstetricians and paediatricians are pooled and analysed as doctors. On the first level we calculated the number of helpful colleagues per primary care, secondary care and management. On the level of the professions we calculated the number of helpful colleagues per profession.

Social Network Analysis is used to graph the helping network and to quantitatively measure the degree centrality of the professionals in the helping network. Social Network Analysis combines the concept of the sociogram (a visual representation of relationships in a social group) with elements of graph theory (mathematical structures to model pair wise relations between objects) (35). Degree centrality is the number of other professionals to which an professional is connected (36). Degree centrality can be divided into out-degree and in-degree centrality. The out degree is the number of ties initiated by the node (37) and was in this study always five for the respondents, since each respondent mentioned the five most helpful individuals in and around the birth centre. Therefore, we only focussed on the in-degree centrality, which is the number of ties received by the node (37). We calculated the in-degree per professional. We used Microsoft Excel software for data-management and UCINET 6 (37) for social network analysis. Findings of the study were discussed with professionals of the birth centres during a member check meeting.

FINDINGS

Primary and secondary care level

Table 3 shows that 27% of the primary maternity care professionals mentioned a colleague from secondary care as helpful and 45% of the secondary maternity care professionals mentioned a colleague from primary care as helpful. Mixed ideas about helping behaviour on the work floor were found between a manager and a maternity care professional. A manager said: *"When it is busy in the birth centre* [primary care] *an obstetric nurse or clinical midwife from the hospital* [secondary care] *goes to the birth centre to help. On the other hand, the maternity care assistant and community midwife go to the hospital to help when it is busy there. That is something we strive for".* While a community midwife mentioned: *"Some nurses from the hospital* [secondary care] *do not help in the birth centre* [primary care] *when it is busy, but on the other hand some community midwives do not go to the hospital as well".* Maternity care professionals from primary and secondary care equally mentioned the manager as being helpful.

Maternity care assistants mainly mentioned colleagues within primary care (67%) as being helpful. A maternity care assistant said: *"I love to work in a team of maternity care assistants. Here in the birth centre we help each other, much better than working on my own in a home-setting."* However, during observations professional jealousy between primary and secondary care was observed. A maternity care assistant said: *"Professionals of the secondary care often walk around with a grumpy head. The nurses* [secondary care] *say that the birth centre will not be successful, it will end. They say that they will be fired because we are here".* Community midwives mentioned most often colleagues from

primary care (49%) as being helpful, followed with a marginal difference by colleagues from secondary care (38%). A community midwife mentioned the short distance from the birth centre to the hospital as a great advantage to ask for help. She said: *"Because I often see the obstetrician, I ask a lot easier for help, just for consultation for example"*. We observe a similar pattern for the doctors meaning that doctors mentioned colleagues form primary care as helpful (49%), while doctors belong to secondary care. An obstetrician said: *"It is nice that all midwifery practices and maternity care organizations* [primary care] *of this region are united in the birth centre, we* [secondary care] *are able to find them much easier now and that improves the collaboration"*.

Table 3: *Helping behaviour in primary and secondary care and management in seven birth centres (five most helpful colleagues per professional)*

	Named as helpful a colleague from							
	Primary care		Secondary care		Management		Total	
	N	%	N	%	N	%	N	%
Primary care (n=61x5)	180	59	83	27	42	14	305	100
Secondary care (n=13x5)	32	45	22	34	11	17	65	100
Maternity care assistants (n=33x5)	111	67	30	18	24	15	165	100
Community midwives (n=28x5)	69	49	53	38	18	13	140	100
Doctors (n=13x5)	32	49	22	34	11	17	65	100

Profession level

Table 4 shows that maternity care assistants mainly identify colleagues from their own profession (44%) and community midwives (24%) as being helpful. During observations it appeared that asking someone outside the own profession for help is sometimes difficult. A maternity care assistant said: "*I asked community midwife X for help, but she just made a joke that I did not know it. I will not ask her for help anymore*". However, it might also depend on the attitude of the help giver. Another maternity care assistant who does not understand the medical information from the hospital asked a community midwife "*It is a little silly, but can you explain this?*". The community midwife replied "*Asking something is never silly*". It is more often observed that maternity care assistants did not want to seem 'stupid' by asking something. A maternity care assistant asked the first author during the observations: "*Do you know what abstinence is, the nurse was talking about it, but I did not want to look foolish and say that I not know what it is*".

Community midwives mentioned both maternity care assistants (31%) and clinical midwives/obstetricians (31%) as being helpful whereas doctors mainly mentioned community midwives (46%) as being helpful. A community midwife indicated that helping

behaviour was used to be different, when the birth centre did not exist yet. She said: "*If I wanted to consult an obstetrician at night I rang the doorman first to ask which obstetrician was in charge. Then I knew if I could call the obstetrician and ask for help or that I would be snubbed".* The position of the clinical midwives was often topic of conversation during the observations. Several community midwives emphasised that the clinical midwives working in the hospital do not have a higher degree or better knowledge than the community midwives do. A community midwife said: *"Is it not strange that community midwife X suddenly went to work in the hospital as a clinical midwife. She has the same knowledge as we have, but she is now allowed to do much more. All supposed under the responsibility of the obstetrician, although he is never there."*

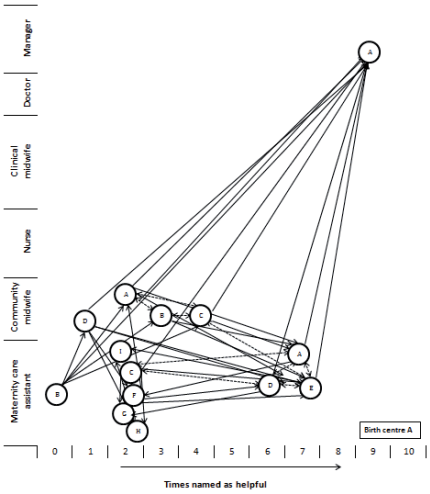
All professions equally mentioned (around 15%) the management as being helpful. A community midwife said: *"The manager of our birth centre is doing so well, she is involved with everyone; from the clients to the professionals, including the cleaners. She also plays an important role in the collaboration with the hospital."*

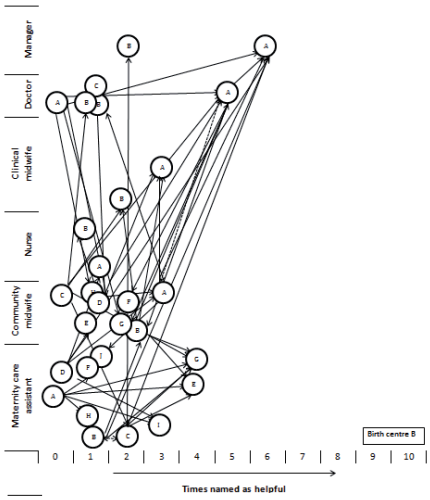
Table 4: *The helping behaviour by profession in seven birth centres (five most helpful colleagues per professional)*

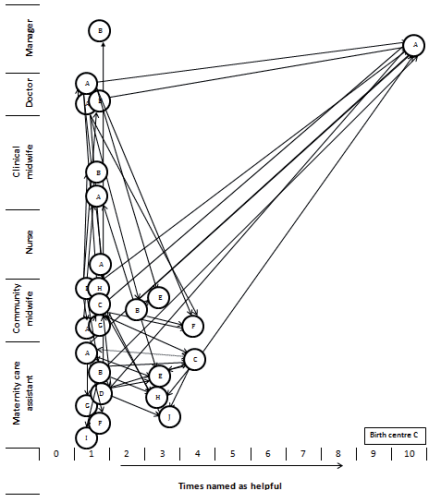
	Named as helpful a													
	Maternity care assistant		**Community midwife**		**Nurse**		**Clinical midwife/ obstetrician**		**Paedia-trician**		**Manager**		**Total**	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Maternity care assistants (n=33x5)	72	44	39	24	14	8	11	7	5	3	24	14	165	100
Community midwives (n=28x5)	44	31	25	18	4	3	44	31	5	4	18	13	140	100
Doctors (n=13x5)	2	3	30	46	4	6	18	28	0	0	11	17	65	100

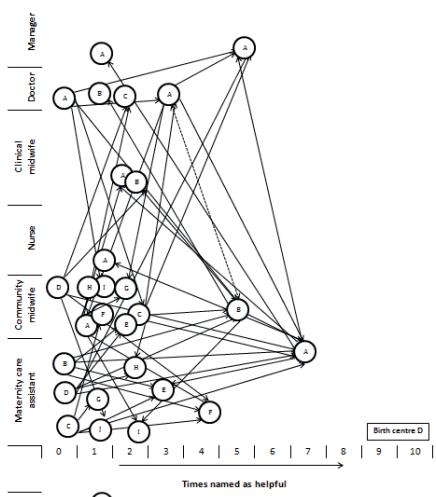
Professional level

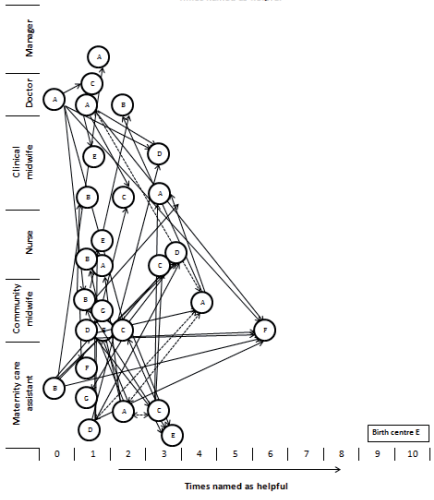
In figure 1, the circles in the seven graphs of helping networks represent professionals and the x-axis shows the times a professional is named as helpful. The y-axis shows the profession of the individual. Every individual within the professions is labelled with a different character. The lines signify the helping connection: a one-way arrow points toward a person named as a helper and a square dotted line with a two-way arrow indicates that the people named each other as helpers. Looking at the seven networks, we observe that in six of the seven networks a manager (case A, B, C and G) or an obstetric professional with management tasks (case D and E) has the highest in-degree centrality. In other words, these individuals are most commonly named as helper. Only in birth centre F this seems not be the case. Other individuals with a high in-degree (e.g.

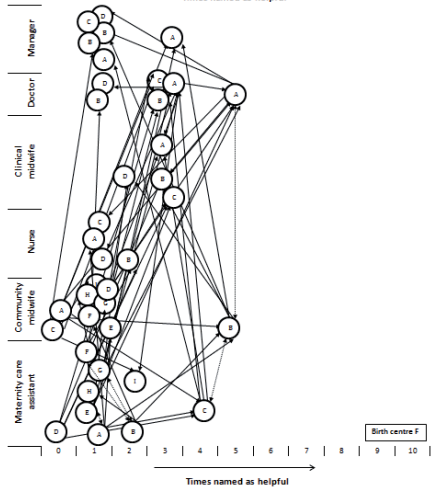

Manager
Doctor
Clinical midwife
Nurse
Community midwife
Maternity care assistant
Birth centre A
0 1 2 3 4 5 6 7 8 9 10
Times named as helpful

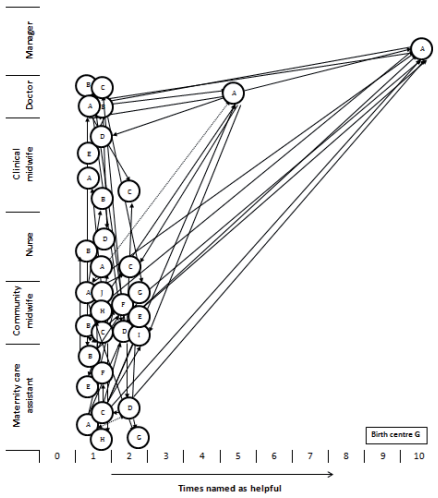

Manager
Doctor
Clinical midwife
Nurse
Community midwife
Maternity care assistant
Birth centre B
0 1 2 3 4 5 6 7 8 9 10
Times named as helpful


Manager
Doctor
Clinical midwife
Nurse
Community midwife
Maternity care assistant
Birth centre C
0 1 2 3 4 5 6 7 8 9 10
Times named as helpful


Manager
Doctor
Clinical midwife
Nurse
Community midwife
Maternity care assistant
Birth centre D
0 1 2 3 4 5 6 7 8 9 10
Times named as helpful


Manager
Doctor
Clinical midwife
Nurse
Community midwife
Maternity care assistant
Birth centre E
0 1 2 3 4 5 6 7 8 9 10
Times named as helpful


Manager
Doctor
Clinical midwife
Nurse
Community midwife
Maternity care assistant
Birth centre F
0 1 2 3 4 5 6 7 8 9 10
Times named as helpful



Figures 1a-g: *The helping networks of the seven birth centres*

obstetrician in case B and F and community midwife in case D) are often concerned with collaboration agreements or involved with the establishment of the birth centre. In all network, community midwives make the connection between maternity care assistants and secondary care professionals.

DISCUSSION

In this paper, we used a multiple case study approach to provide quantitative and qualitative insights in helping behaviour in seven Dutch birth centres. Overall the results show some strained relations, but primary care professionals working in a birth centre do name secondary care professionals as helpful and vice versa. The maternity care professionals often mentioned to receive help from a professional belonging to another group. The birth centre is seen as a benefit, as a place where maternity care professionals from different backgrounds can meet each other and improve maternity care which is an important goal of the birth centres. A request for help to another profession was experienced as difficult. A reduction of the self-image and self-esteem were mentioned as the main reason for not asking for help. The central individuals in the seven networks are often the managers and the maternity care professionals with management tasks. Other individuals with a central position in the network are often concerned with collaboration agreements or are involved with the establishment of the birth centre.

Strengths and limitations

To the best of our knowledge this is the first study that quantitative and qualitative provides insight in helping behaviour in inter-organizational care settings. Previous studies on this theme focused often only on quantitative outcomes like the centrality and density of a network (e.g. (38-41)) and such studies have never been carried out within birth centres. Although the validity of the data increased, because our observations were in the natural setting of the respondents (42), all observations were assessed by a single researcher. This may have led to observer bias and can limit the study's internal validity. This study is by definition based on a non-complete network. We did not include all maternity care professionals working around birth centres. Since obstetric nurses and clinical midwives work on more distance from the birth centre and are not responsible for the care given in birth centres, it was not relevant that they completed the questionnaire and only maternity care professionals who are common in the birth centre were requested. Besides, the obstetric nurses and clinical midwives are part of our study when they were named as helpful.

Interpreting the results

Our results show that the maternity care professionals receive help from colleagues with another profession and even from other echelons. Although literature (4, 19, 43) and our own observations show that there are tensions between different professions (e.g. maternity care assistants and nurses) it does not result in avoiding to ask help from other professions. Community midwives were often mentioned as being helpful, both by maternity care assistants and doctors (obstetricians/paediatricians). This is an important finding since community midwives take primary professional responsibility for care in birth centres and the other professions are dependent on them.

Birth centres, like other health care settings, consist of different maternity care professionals, with different expertise and status differences (44, 45). Research shows that these are important determinants of the help giver for the likelihood that a help seeker will ask for help (14, 18). It is evident that help seekers search for individuals who possess the knowledge and expertise that contribute to the solution of the problem. Experts have this knowledge and sharing it with the knowledge seeker promotes learning and is beneficial for the organization. However, asking an expert for help is not so easy because experts are expected to have little time (14). Our study shows that managers have a central position in the helping network and are by definition not the ones with the most expertise, but are accessible and trusted which is also important in the quest for help (8, 14). This may be precisely the point at which birth centres contribute to helping behavior. Community midwives, normally working in small offices in a community setting, and maternity care assistants are united in an organization (birth centre), often close to a hospital which may increase their accessibility. Thereby, trust increases by habituation

and habituation can occur more when you see each other (46), for example in a birth centre. Future research may focus on the comparison of helping behavior networks in birth centres and in usual care settings (home and hospital).

Implications for practice

Many kinds of organizations with more helping behaviour have better performances: lower employee turnovers, greater customer satisfaction, and they are more profitable (8). Truly helping behaviour in maternity care, in and outside the Netherlands, fuels the best performance. Birth centres are such places where this helping behaviour takes place.

There is an ongoing trend towards self-managing teams in birth centres, where a manager's function disappears. Based on this study, which shows that managers play a central role in the helping network, it must be questioned whether this trend is a right one. The managers, as central individuals, are important for a well-functioning helping network in birth centres. This should be taken into account in the development of birth centres.

Even though this study is carried out within the Dutch maternity care, the findings can contribute internationally to the broader themes of helping behaviour, collaboration, and the effect of birth centres in countries like the United Kingdom and the United States and other inter-organizational care settings.

CONCLUSIONS

Despite many publications in recent years about the poor collaboration within the Dutch maternity care, this research shows that maternity care professionals in birth centres certainly get help from outside their own group. The presence of this helping behaviour of everyone involved in the birth centres diminished the traditional boundaries and increases collaboration.

REFERENCES

1. Uzzi B. Social structure and competition in interfirm networks: The paradox of embeddedness. Administrative science quarterly. 1997:35-67.
2. Dyer JH, Singh H. The relational view: Cooperative strategy and sources of interorganizational competitive advantage. Academy of management review. 1998;23(4):660-79.
3. Provan KG, Milward HB, editors. Do networks really work?: a framework for evaluating public-sector organizational networks. Academy of Management Proceedings; 1999: Academy of Management.
4. Reiger K. Domination or mutual recognition? Professional subjectivity in midwifery and obstetrics. Social Theory & Health. 2008;6(2):132-47.
5. Kennedy HP, Lyndon A. Tensions and teamwork in nursing and midwifery relationships. Journal of Obstetric, Gynecologic, & Neonatal Nursing. 2008;37(4):426-35.
6. Hunter B. Conflicting ideologies as a source of emotion work in midwifery. Midwifery. 2004;20(3):261-72.
7. Reiger KM, Lane KL. Working together: collaboration between midwives and doctors in public hospitals. Australian Health Review. 2009;33(2):315-24.
8. Amabile T, Fisher CM, Pillemer J. IDEO's Culture of Helping. Harvard Business Review. 2014;92:54-61.
9. Van Dyne L, LePine JA. Helping and voice extra-role behaviors: Evidence of construct and predictive validity. Academy of Management journal. 1998;41:108-19.
10. Lee F. When the going gets tough, do the tough ask for help? Help seeking and power motivation in organizations. Organizational behavior and human decision processes. 1997;72(3):336-63.
11. Bamberger PA, Levi R. Team-based reward allocation structures and the helping behaviors of outcome-interdependent team members. Journal of Managerial Psychology. 2009;24(4):300-27.
12. Grant AM, Patil SV. Challenging the norm of self-interest: Minority influence and transitions to helping norms in work units. Academy of Management Review. 2012;37(4):547-68.
13. Lee F. The social costs of seeking help. The Journal of Applied Behavioral Science. 2002;38:17-35.
14. Hofmann DA, Lei Z, Grant AM. Seeking help in the shadow of doubt: the sensemaking processes underlying how nurses decide whom to ask for advice. Journal of Applied Psychology. 2009;94(5):1261.
15. Borgatti SP, Cross R. A relational view of information seeking and learning in social networks. Management science. 2003;49(4):432-45.
16. Anderson SE, Williams LJ. Interpersonal, job, and individual factors related to helping processes at work. Journal of Applied Psychology. 1996;81(3):282.
17. Williams LJ, Anderson SE. Job satisfaction and organizational commitment as predictors of organizational citizenship and in-role behaviors. Journal of management. 1991;17(3):601-17.
18. DePaulo BM, Fisher JD. The costs of asking for help. Basic and Applied Social Psychology. 1980;1:23-35.
19. van der Lee N, Driessen EW, Houwaart ES, Caccia NC, Scheele F. An examination of the historical context of interprofessional collaboration in Dutch obstetrical care. Journal of interprofessional care. 2014;28(2):123-7.
20. Bonsel GJ, Birnie E, Denktas S, Poeran J, Steegers EAP. Dutch report:Lines in the perinatal mortality, Signalement Study of Pregnancy and Birth in 2010 [in Dutch: Lijnen in de perinatale sterfte, signalementstudie zwangerschap en geboorte 2010]. Rotterdam: Erasmus MC. 2010.

21. Wiegers T, de Graaf H, van der Pal K. The rise of birth centres and their role in health care [in Dutch: De opkomst van geboortecentra en hun rol in de zorg]. Tijdschrift voor gezondheidswetenschappen. 2012;90(8):475-8.
22. Vademecum O. Final report of the Maternity Care Committee of the College of health insurance companies.Verloskundig Vademecum 2003. Eindrapport van de Commissie Verloskunde van het College voor zorgverzekeringen. Diemen, the Netherlands: College voor Zorgverzekeringen. 2003.
23. Wiegers TA, Hukkelhoven CWPM. The role of hospital midwives in the Netherlands. BMC pregnancy and childbirth. 2010;10:80.
24. Gnyawali DR, Madhavan R. Cooperative networks and competitive dynamics: A structural embeddedness perspective. Academy of Management review. 2001;26(3):431-45.
25. Lipparini A, Lomi A. Interorganizational relations in the Modena biomedical industry: A case study in local economic development. Interfirm networks: Organization and industrial competitiveness. 1999:120-50.
26. Provan KG, Harvey J, Guernsey de Zapien J. Network structure and attitudes toward collaboration in a community partnership for diabetes control on the US-Mexican border. Journal of Health Organization and Management. 2005;19(6):504-18.
27. Eisenhardt KM. Building theories from case study research. Academy of management review. 1989;14(4):532-50.
28. Yin RK. Case study research: Design and methods: Sage publications; 2014.
29. Siggelkow N. Persuasion with case studies. Academy of management journal. 2007;50:20.
30. Meredith J. Building operations management theory through case and field research. Journal of operations management. 1998;16(4):441-54.
31. Hermus M, Wiegers T, Hitzert M, Boesveld I, van den Akker-van Marle E, Akkermans H, et al. The Dutch Birth Centre Study: a programmatic evaluation of the effect of birth centre care in the Netherlands. BMC pregnancy and childbirth, 2015, 15.1: 148.
32. Blumer H. The methodological position of symbolic interactionism. Symbolic interactionism: Perspective and method. 1969:1-60.
33. Rooks JP, Weatherby NL, Ernst EKM. The National Birth Center Study: part I—methodology and prenatal care and referrals. Journal of Nurse-Midwifery. 1992;37(4):222-53.
34. Laws PJ, Lim C, Tracy S, Sullivan EA. Characteristics and practices of birth centres in Australia. Australian and New Zealand Journal of Obstetrics and Gynaecology. 2009;49(3):290-5.
35. Hanneman RA, Riddle M. Introduction to social network methods. University of California Riverside; 2005.
36. Scott J. Social network analysis: Sage; 2012.
37. Borgatti SP, Everett MG, Freeman LC. Ucinet for Windows: Software for social network analysis. 2002.
38. Groenen CJM, van Duijnhoven NTL, Faber MJ, Koetsenruijter J, Kremer JAM, Vandenbussche FPHA. Use of social network analysis in maternity care to identify the profession most suited for case manager role. Midwifery. 2016.
39. Keating NL, Ayanian JZ, Cleary PD, Marsden PV. Factors affecting influential discussions among physicians: a social network analysis of a primary care practice. Journal of general internal medicine. 2007;22(6):794-8.
40. Wensing M, Van Lieshout J, Koetsenruiter J, Reeves D. Information exchange networks for chronic illness care in primary care practices: an observational study. Implementation Science. 2010;5:3.

41. Weenink J-W, Van Lieshout J, Jung HP, Wensing M. Patient Care Teams in treatment of diabetes and chronic heart failure in primary care: an observational networks study. Implementation Science. 2011;6:66.
42. Greenhalgh T, Taylor R. How to read a paper: Papers that go beyond numbers (qualitative research). BMJ. 1997;315(7110):740-3.
43. De Vries R, Nieuwenhuijze M, Buitendijk SE, Members of Midwifery Science Work G. What does it take to have a strong and independent profession of midwifery? Lessons from the Netherlands. Midwifery. 2013;29(10):1122-8.
44. West E, Barron DN, Dowsett J, Newton JN. Hierarchies and cliques in the social networks of health care professionals: implications for the design of dissemination strategies. Social science & medicine. 1999;48(5):633-46.
45. Reeves S, Lewin S. Interprofessional collaboration in the hospital: strategies and meanings. Journal of Health Services Research & Policy. 2004;9(4):218-25.
46. Nooteboom B, Stam E. Collaboration, trust and the structure of relationships. Microfoundations for innovation policy. 2008:199-218.

Chapter 5

Differences in optimality index between planned place of birth in a birth centre and alternative planned places of birth, a nationwide prospective cohort study in the Netherlands

Results of the Dutch Birth Centre Study

Marieke A.A. Hermus
Marit Hitzert
Inge C. Boesveld
M. Elske van den Akker-van Marle
Paula van Dommelen
Arie Franx
Johanna P. de Graaf
Jan M.M. van Lith
Nathalie Luurssen-Masurel
Eric A.P. Steegers
Therese A. Wiegers
Karin M. Van der Pal-de Bruin

BMJ open, 2017, 7.11: e016958

ABSTRACT

Objectives: To compare the optimality index of planned birth in a birth centre to planned birth in a hospital and planned home birth for low-risk term pregnant women who start labour under the responsibility of a community midwife.

Design: Prospective cohort study.

Setting: Low-risk pregnant women under care of a community midwife and living in a region with one of the 21 participating Dutch birth centres or in a region with the possibility for midwife-led hospital birth. Home birth was commonly available in all regions included in the study.

Participants: 3455 low-risk term pregnant women (1686 nulliparous and 1769 multiparous) who gave birth between 1st July 2013 and 31 December 2013: 1668 planned birth centre births, 701 planned midwife-led hospital births and 1086 planned home births.

Main outcome measurements: The Optimality Index-NL2015, a tool to measure 'maximum outcome with minimal intervention', was assessed by planned place of birth being a birth centre, a hospital setting or at home. Also a composite maternal and perinatal adverse outcome score was calculated for the different planned places of birth.

Results: There were no differences in Optimality Index-NL2015 for pregnant women who planned to give birth in a birth centre compared to women who planned to give birth in a hospital. Although effect sizes were small, women who planned to give birth at home had a higher Optimality Index-NL2015 than women who planned to give birth in a birth centre. The differences were larger for multiparous than for nulliparous women.

Conclusion: The Optimality Index-NL2015 for women with planned birth centre births was comparable to planned midwife-led hospital births. Women with planned home births had a higher Optimality Index-NL2015, i.e. a higher sum score of evidence based items with an optimal value, than women with planned birth centre births.

INTRODUCTION

In the Netherlands, low-risk pregnant women who start labour at or after 37 weeks gestation and are under care of a community midwife can choose whether they want to give birth at home, in a primary care level midwife-led birth centre or in the hospital. Most Dutch community midwives work in group practices with other midwives in their own premises. They are autonomous in their actions and decisions during prenatal, natal and postnatal care (1). When a complication occurs or medical assistance for pharmacologic pain relief is requested, the woman will be referred to a secondary care obstetric hospital unit. Depending on the reason for referral, either the obstetrician or the neonatologist takes over responsibility of care from the community midwife. Reasons for referral are defined in the so called List of Obstetric Indications. This is a multidisciplinary guideline in which all professionals involved in perinatal care have reached agreement on the indications for consultation and referral during labour and birth (2).

For low-risk women who are planning to give birth out of home there are two options i.e. in a birth centre or in a hospital setting (3). Birth centres are a relatively new development in most Dutch regions and the number of birth centres has increased in recent years (4,5). Recently a Dutch birth centre was defined as: "a midwifery-managed location that offers care to low-risk women during labour and birth. They have a homelike environment and provide facilities to support physiological birth. Community midwives take primary professional responsibility for care. In case of referral the obstetric caregiver takes over the professional responsibility of care"(5). Birth centres can be freestanding (outside the hospital), alongside (in the hospital but not in the obstetric unit) or on-site of the hospital (within the obstetric unit). The other option for low-risk women is to give birth in a conventional labour setting in a hospital room under care of a community midwife (midwife-led hospital birth). These rooms are often located in the obstetric unit and differ from the rooms in the birth centre: at this location the community midwife does not participate in the organization of the location, protocols and birth environment. And although the community midwife is the one responsible for the care during labour and birth, this room is otherwise managed by obstetricians. In case of referral, the secondary care giver will enter the birthing room and takes over the professional responsibility from the community midwife.

Although a woman is free to choose her preferred planned place of birth, in some occasions not all birth locations are available within her close neighbourhood, so some women have a birth centre in their neighbourhood, some a hospital and some both. In September 2013 there were 23 birth centres and 70 conventional hospital labour settings in the Netherlands (5). It is unknown what percentage of women planned birth in a birth centre or in conventional hospital labour setting, because birth centres were not yet as such identified nor included in the standard perinatal registration.

In the Netherlands, no research on the perinatal outcomes of planned birth centre births has been undertaken before. In other countries, studies on birth centre care have shown that low-risk women who planned to give birth in a birth centre experienced fewer interventions compared to women who planned birth in a conventional labour setting in a hospital. This included fewer intrapartum caesarean sections and lower use of obstetric analgesia and augmentation of labour (6–10). The Birthplace study in England showed that adverse perinatal outcomes (intrapartum stillbirth, early neonatal death, neonatal encephalopathy, meconium aspiration syndrome, and specified birth related injuries including brachial plexus injury) were not significantly different for low-risk nulliparous women who planned birth in freestanding midwifery units and alongside midwifery units compared with planned birth in an obstetric unit. For multiparous women, birth in freestanding and alongside midwifery units significantly and substantially reduced the odds of experiencing an unplanned caesarean section, instrumental birth or episiotomy. No significant differences in adverse perinatal outcomes were found between planned home births or midwifery unit births and planned births in obstetric units for multiparous women (8). Earlier research on the effect of planned place of birth in the Netherlands focused on the evaluation of planned birth in a conventional labour setting in a hospital and planned home birth (11,12). The national effect of planned birth in a birth centre in the Netherlands is still unknown.

In 2009 a ministerial steering committee published a report that recommended 'among other things' an investigation of the use of birth centres to improve perinatal outcomes. This was based on an assumption that birth centres might provide a higher quality of care because they offer a better opportunity for more integrated care (13,14). The essence of integrated care is a continuum of care for service users, crossing the boundaries of public health, primary, secondary, and tertiary care (15–17). The increase in the number of birth centres and its unknown effect in the Dutch maternity care system, as well as the assumption that birth centres might offer more integrated care led in 2013 to a nationwide study: the Dutch Birth Centre Study (DBC study). Aim of that study was to evaluate birth centre care by investigating perinatal outcomes, experiences of clients and caregivers as well as economic outcomes (18). The aim of the present study, part of the DBC study, is to assess the differences in Optimality Index-NL2015 between a planned birth in a birth centre compared to planned birth in a hospital and at home for low-risk term women who start labour under the care of a community midwife. In addition, differences in the outcomes of a planned birth in different types of birth centres based on location and level of integration were studied.

METHODS

A prospective cohort study was designed to compare the Optimality Index-NL2015 of planned birth in a birth centre compared to planned midwife-led hospital birth or planned home birth. Design and planning of the study were presented to the Medical Ethics Committee of the University Medical Centre Utrecht. They confirmed that this study agrees with Dutch legal regulations for the methods used. Because of this further formal ethical approval of this study was not required (19).

Setting and participants

Within the study period 1 July 2013 to 31 December 2013 community midwives were asked to record data for each birth that started under their care regardless of the planned place of birth. Recruitment of the midwives was done by three researchers (MHe, MHi and IB) two of whom are community midwives (one practising). In September 2013 there were 23 birth centres in the Netherlands according to the definition above (5). Condition for participation in this study was that the birth centre was in service for more than half a year before the start of the study period, leading to the exclusion of two birth centres. A minimum of three midwifery practices working in the area of each birth centre in the Netherlands were randomly recruited to collect data for a minimum period of three months. After the midwifery practice agreed on participation, the number of expected births for the next three months was asked to calculate the number of expected planned birth centre births. If after the recruitment of three practices this was expected to be too low, a fourth or even fifth midwifery practice was approached to participate in the study. Midwifery practices in areas where there was the possibility for midwifery led hospital birth were randomly recruited based on their geographical location and level of urbanization to collect data from planned midwife-led hospital births. Some midwifery practices had both options for an out-of-home birth as option for planned place of birth. Planned birth at home was an option for women in all participating midwifery practices. In total, data were obtained by 110 midwifery practices (127 were approached). In our study 21 birth centres out of the 23 birth centres that were present in the Netherlands at that time participated as well as 46 hospital locations where midwife-led birth was possible.

Birth centres can be distinguished based on their location in relation to the obstetric unit and based on their level of integration of care. Based on location there were three types i.e. 1) *freestanding* (not on hospital grounds), 2) *alongside* (separate from an obstetric unit but in a hospital or on hospital grounds) or 3) *on-site* (within an obstetric unit of a hospital). In case of referral, physical transfer to secondary care is needed for the freestanding and alongside birth centres (resp. by car or ambulance, or by wheelchair or bed). In case a referral is needed at the on-site birth centre, the secondary caregiver

enters the birthing room of the birth centre. In the Netherlands in September 2013 there were three freestanding birth centres, fourteen alongside and six on-site birth centres (5).

Boesveld et al classified birth centres into different types with distinctive characteristics. This classification was done according to their integration profile of maternity care:1) *mono-disciplinary-oriented birth centres* (MOBC). MOBCs are more focused on being a facility to give birth in than on improving collaboration between maternity care providers or realizing integration of care. The MOBCs are mainly owned by primary-care organisations. 2) *Multi-disciplinary-oriented birth centres* (MUBC). MUBCs can be regarded as facilities to give birth in with a focus on integrated (birth) care. They have governance structures consisting of both primary and secondary care organisations. The disciplines involved have formulated a joint vision on birth care. The community midwife is still the person who is responsible for the care of low-risk pregnant women.3) *Birth centres with a mixed profile* (MIBC). MIBCs are a mixed group. They differ more from each other in their organisation than birth centres in the other groups. Compared to MUBCs these centres had higher scores on clinical integration (the coordination of person-focused care in a single process across time, place and discipline) and lower scores on the other dimensions (professional, organisational, system, functional and normative integration). In September 2013 there were ten MOBCs, six MUBCs and seven MIBCs in the Netherlands (13).

Data collection

In the Netherlands individual baseline and perinatal outcome data are electronically collected in one national database: The Netherlands Perinatal Registry (Perined) (20). To collect additional and more detailed data about process indicators and outcomes a case report form (CRF) was developed for this study (18). For each pregnancy, the obtained data of the CRF were linked to data from the Netherlands Perinatal Registry by means of unique anonymous identifiers for the client and midwifery practice. Linkage between these data was obtained at the office of Perined and the key with unique identifiers stayed there at that location, as it was proposed in the design of this study and accepted by the ethics committee. If linkage was not completed because of lacking data in Netherlands Perinatal Registry the missing information was manually obtained from the client record in the midwifery practice and linked. Cases in which linkage between data from the CRF and data from the Netherlands Perinatal Registry was not established, were excluded. Processes and outcomes were considered as non-existing if there was no registration of them in the Netherlands Perinatal Registry.

Data were collected for all term (>= 37 weeks gestational age) women at the start of labour under care of a community midwife, regardless their planned place of birth. Excluded were women with a medium-risk situation (D-indications according to the List

of Obstetric Indications, i.e. an obstetric history of postpartum heamorrhage or manual removal of the placenta (2). Also women with no specific choice for planned place of birth at the onset of labour were excluded.

Our primary main outcome measure was the Optimality Index-NL2015(OI-NL2015), a tool to measure 'maximum outcome with minimal intervention'(21). It emphasizes that in general childbirth is a normal physiologic process with high numbers of optimal processes and outcomes rather than a pathological process of disease. The OI-NL2015 is specifically useful to measure quality of obstetric care for women with low-risk pregnancies in which cases adverse perinatal outcomes are rare (22). The adoption of the 'optimality concept' avoids the problem of defining what is normal or abnormal in obstetrical care, and it shifts the focus from rare adverse events, i.e. perinatal mortality, to evidence-based optimal events. The optimality index is designed to yield a summary score reflective of processes of care and clinical outcomes in relation to the background risk (21,23,24). The OI-NL2015 has 31 items distributed over three clinical perinatal domains: intrapartum, postpartum and neonatal; each item meeting the criteria for optimality is scored "1". It includes conditions (e.g. preeclampsia) and interventions (e.g. amniotomy, episiotomy, referral and epidural analgesia). Its reliability is demonstrated in earlier research (21). The OI-NL2015 is based on items that were included in the national perinatal database. The former version of a Dutch optimality index included a perinatal background index to adjust for differences in maternal background (22). Because almost none of these items are included in the national perinatal database the new version of the optimality index has to be adjusted, after calculating the sum score, for ethnicity, maternal age, social economic status and urbanization level (21).

Our secondary outcome measure was a description of a maternal and perinatal composite adverse outcome score (CAO). Adverse maternal and neonatal outcomes were used to assess the effect of a planned birth in a birth centre compared to alternative settings on adverse outcomes. The CAO is a percentage based on the presence of at least one of the following adverse outcomes: maternal death (within 42 days of giving birth), third or fourth degree of perineal tear, postpartum haemorrhage (>1000 ml in 24 hours), stillbirth diagnosed after presentation in labour, early neonatal death (<7 days), Apgar score <7 after 5 min and admission to a neonatal unit within 48 hours after birth (25).

Data analysis

To determine whether there was a difference in optimality index between subgroups the sum scores of the 31 items of the OI-NL2015 were analysed. Both outcome measures were adjusted for background variables (maternal age (mean), social economic status (SES) (high/medium/low), urbanization (<500 addresses per km^2/500-< 1500 addresses per km^2/≥1500 addresses per km^2) and ethnicity (Dutch/non-Dutch)) because other studies have shown that they may vary among women with different planned places of

birth and not all birth locations were available within a women's close neighbourhood (21,26). Urbanization and SES were based on the characteristics of the four digital postal code area in which the participants live (level of income, educational level, position in the labour market) (27). Because of the large differences in interventions and outcomes between nulliparous and multiparous women, analyses were performed separately (28).

To answer the research question, planned place of birth in a birth centre (reference group) was compared with planned place of birth in a hospital and home. To find out if location or level of integration of a birth centre would affect the outcome, we performed subgroup analyses between the different types of birth centres based on location and on integration level. Planned place of birth in an alongside birth centre (reference group) was compared to planned place of birth in a freestanding and an on-site birth centre (5). Planned place of birth in a multi-disciplinary-oriented birth centre (MUBC; reference group) was compared to planned place of birth in mono-disciplinary-oriented birth centres (MOBC) and with birth centres with a mixed integration profile (MIBC) (13). The sample size for this study was calculated to detect differences between the different types of birth centres on the OI-NL2015. A sample size of nine birth centres per level of integration with 66 women per centre would achieve 80% power to detect an effect size of 0.2 (ICC=0.005, alpha=0.05) for the OI-NL2015 between the three levels of integration (11). Midwifery practises working with all eligible birth centres were asked to participate in this study to avoid clustering of birth centres. Based on this assumption, the power of this study would be enough to detect differences for our primary outcome measurement. All analyses were performed according to the intention-to-treat principle: data for women were analysed as belonging to the group of planned place of birth in which they were originally included.

Chi-square tests were conducted within the nulliparous and multiparous group to compare the general characteristics and frequencies of optimality between planned places of birth (19). Logistic regression analyses were performed to adjust the frequencies of optimality and composite adverse outcome score for the general characteristics (maternal background, social economic status and urbanization). Linear regression analyses were performed within the nulliparous and multiparous group to compare maternal age and the optimality index between all different planned places of birth. Effect sizes (Cohen's d) were calculated to examine the magnitude of the differences in OI-NL2015 between groups. It was interpreted as proposed by Cohen: small (0.2), medium (0.5) and large (0.8) (29).

Although we only performed statistical tests to answer the research questions, multiple test were performed. To take this into account, it was decided to show three levels of significance (p-values: <0.05, <0.005, <0.001) for correct interpretation of the results.

All analyses were performed in the Statistical Package for Social Sciences (SPSS) version 22.0 (SPSS Inc., Chicago, IL, USA).

Women's involvement

Representatives of pregnant women, organized in 'het Ouderschap' took place in the Advisory committee of the Dutch Birth Centre Study to advise on the set up, planning and interpretation of the results.

Women were involved by asking for their experiences at another study that was also part of the Dutch Birth Centre Study (30). We are planning to disseminate the results of this study by means of infographics for use in the midwifery practices as a tool to inform women and their partners on the effect of planned place of birth. Results of this study will also be presented to midwives in structured peer reviewed group sessions where the topic planned place of birth will be critically appraised.

RESULTS

After applying our exclusion criteria 3455 women were included in the study as shown in Figure 1: 1668 planned birth centre births, 701 planned hospital births and 1086 planned home births.

Table 1 shows the characteristics of the study population by planned place of birth. Nulliparous women who planned birth in a birth centre lived in more densely populated areas compared to nulliparous women who planned birth in a hospital (respectively 45.0% and 30.8%; $p<0.05$). Compared to women with a planned home birth, women with a planned birth centre birth were more often non-Dutch of origin, had a lower social economic status and lived in more densely populated areas.

Individual items of the Optimality Index-NL2015

Planned place of birth in a birth centre compared to alternative places

The frequency of optimality for the items of the Optimality Index-NL2015 are listed in Table 2 for the different planned places of birth. Interventions as epidural analgesia and episiotomy were less common in multiparous women confirming the need to consider these women separately. For 31.8% nulliparous and 64.4% multiparous women who planned birth in a birth centre, the final place of birth was the same as the planned place of birth. Of the women who planned a midwife-led hospital or a home birth respectively 40.2% and 45.6% of nulliparous women and respectively 59.5% and 84.6% of the multiparous women succeeded in this intention.

For nulliparous women the individual items of the OI-NL2015 demonstrated a few differences between planned place of birth in a birth centre and in a hospital i.e. 'no referral during labour or within 2 hours postpartum' and 'no use of oxytocin for augmentation of labour'.

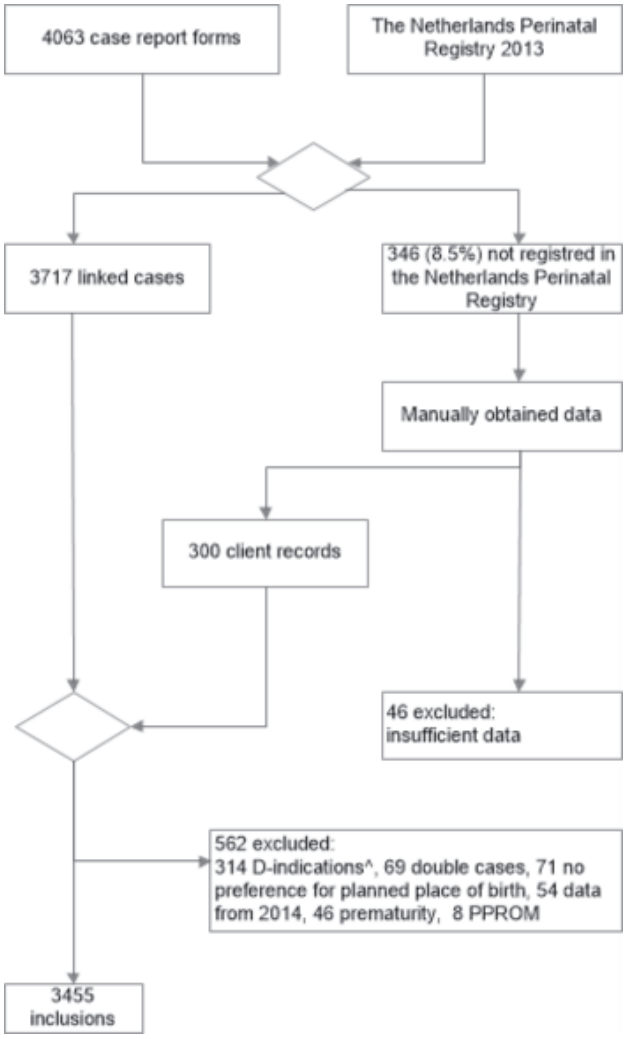


Figure 1: *Flow diagram of study selection for inclusion*
^ D-indications according to the List of Obstetric indications: due to medium risk situation birth on obstetric unit

For multiparous women there were no differences in the proportion of any of the items of the OI-NL2015 between women who planned birth in a birth centre compared to women who planned to give birth in a hospital.

Higher proportions of optimal items were found for women who planned to give birth at home than for those who planned birth in a birth centre on the items 'no referral during labour or within 2 hours postpartum', 'no use of oxytocin for augmentation of labour', 'no injectable medication for pain relief during first or second stage of labour' and 'no epidural analgesia for labour and/or birth'.

Table 1: *Characteristics of women with low-risk pregnancies by planned place of birth at start of labour*

	NULLIPAROUS			MULTIPAROUS		
	birth centre (reference)	**hospital[1]**	**home**	**birth centre (reference)**	**hospital[1]**	**home**
	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)
	939	348	399	729	353	687
Maternal background						
Dutch	750 (79.9)	270 (77.6)	386 (96.7)***	524 (71.9)	261 (73.9)	649 (94.5)***
Non Dutch	189 (20.1)	78 (22.4)	13 (3.3)	205 (28.1)	92 (26.1)	38 (5.5)
Social Economic Status						
Low	123 (13.3)	36 (10.9)	25 (6.3)***	121 (17.0)	44 (12.9)	28 (4.1)***
Medium	637 (68.9)	243 (73.4)	330 (83.3)	476 (67.0)	239 (70.3)	558 (81.9)
High	165 (17.8)	52 (15.7)	41 (10.4)	113 (15.9)	57 (16.8)	95 (14.0)
Urbanization						
Densely populated areas (=> 1500 /km^2)	412 (45.0)	101 (30.8)***	80 (20.4)***	293 (42.0)	127 (38.3)	132 (19.5)***
Intermediate density areas (500 - 1500 / km^2)	215 (23.5)	87 (26.5)	120 (30.5)	188 (26.9)	80 (24.1)	185 (27.4)
Thinly populated areas (<500 / km^2)	288 (31.5)	140 (42.7)	193 (49.1)	217 (31.1)	125 (37.7)	359 (53.1)
Maternal age (Mean in years) (SD)	29.6 (4.5)	28.9 (4.2)*	28.3 (4.2)	32.2 (4.3)	32.1 (4.0)	32.4 (4.6)
Gestation (Mean in days) (SD)	280 (7.4)	279 (7.3)	280 (7.6)	281 (6.4)	280 (6.6)	281 (6.8)

[1] = community midwife-led
SD = standard deviation
* p< 0.05
*** p< 0.001

Table 2: *Frequency of optimality by planned place of birth*

	NULLIPAROUS			MULTIPAROUS		
	birth centre (reference)	**hospital[2]**	**home**	**birth centre (reference)**	**hospital[2]**	**home**
	n=939 (%)	n=348 (%)	n=399 (%)	n=729 (%)	n=353 (%)	n=687 (%)
time between rupture of membranes and birth <= 24u	861 (91.7)	321 (92.2)	367 (92.0)	706 (96.8)	345 (97.7)	669 (97.4)
duration first stage <= 12 hr	927 (98.7)	344 (98.9)	394 (98.7)	729 (100)	353 (100)	686 (99.9)
duration second stage <= 120 min	932 (99.3)	346 (99.4)	394 (98.7)	728 (99.9)	353 (100)	687 (100)
amniotic fluid is clear	766 (81.6)	286 (82.2)	337 (84.5)	607 (83.3)	293 (83.0)	597 (86.9)
no use of oxytocin for augmentation of labour	470 (50.1)	**208 (59.8)****	**248 (62.2)*****	619 (84.9)	314 (89.0)	**634 (92.3)*****
no amniotomy	496 (52.8)	167 (48.0)	204 (51.1)	290 (39.8)	132 (37.4)	299 (43.5)
no injectable medication for pain relief during first or second stage of labour	563 (60.0)	215 (61.8)	**281 (70.4)*****	631 (86.6)	302 (85.6)	**661 (96.2)*****
no epidural analgesia for labour and/or birth	670 (71.4)	257 (73.9)	**320 (80.2)****	685 (94.0)	327 (92.6)	**677 (98.5)*****
birth occurred in the place originally planned at the onset of labour	299 (31.8)	**140 (40.2)****	**182 (45.6)*****	477 (65.4)	210 (59.5)	**581 (84.6)*****
fetal presentation at birth was cephalic	938 (99.9)	348 (100)	399 (100)	729 (100)	352 (99.7)	687 (100)
occipital foetal presentation	932 (99.3)	345 (99.1)	393 (98.5)	728 (99.9)	350 (99.2)	682 (99.3)
no instrumental (vaginal) birth	730 (77.7)	279 (80.2)	314 (78.7)	709 (97.3)	337 (95.5)	674 (98.1)
birth was vaginal not caesarean	864 (92.0)	330 (94.8)	377 (94.5)	722 (99.0)	347 (98.3)	684 (99.6)
no episiotomy	569 (60.6)	191 (54.9)	244 (61.2)	645 (88.5)	313 (88.7)	**634 (92.3)***
no 1st or 2nd degree laceration of perineum or perineal tissue requiring sutures (including sulcus and cervical lacerations)	158 (16.8)	55 (15.8)	59 (14.8)	221 (30.3)	111 (31.4)	**272 (39.6)*****
no blood transfusion	925 (98.5)	343 (98.6)	390 (97.7)	725 (99.5)	347 (98.3)	682 (99.3)
no other serious intrapartum complications[2]	939 (100)	348 (100)	399 (100)	729 (100)	353 (100)	687 (100)
no referral during labour or within 2 hours postpartum	281 (29.9)	**127 (36,5)***	**167 (41.9)*****	497 (68.2)	233 (66.0)	**558 (81.2)*****
no urgent referral	893 (95.1)	332 (95.4)	381 (95.5)	709 (97.3)	336 (95.2)	668 (97.2)

Table 2: *Frequency of optimality by planned place of birth (continued)*

	NULLIPAROUS			MULTIPAROUS		
	birth centre (reference)	**hospital[2]**	**home**	**birth centre (reference)**	**hospital[2]**	**home**
	n=939 (%)	n=348 (%)	n=399 (%)	n=729 (%)	n=353 (%)	n=687 (%)
no manual placental removal	912 (97.1)	341 (98.0)	393 (98.5)	718 (98.5)	350 (99.2)	681 (99.1)
duration of gestation 37-42 weeks	937 (99.8)	348 (100)	398 (99.7)	729 (100)	353 (100)	683 (99.4)
birth weight P10-P90	850 (90.5)	317 (91.1)	349 (87.5)	664 (91.1)	325 (92.1)	608 (88.5)
Apgar score at 5 minutes ≥ 9	925 (98.5)	342 (98.3)	396 (99.2)	726 (99.6)	351 (99.4)	687 (100)
no congenital anomalies	932 (99.3)	344 (98.9)	397 (99.5)	724 (99.3)	350 (99.2)	683 (99.4)
no birth trauma within 24 hours postpartum[3]	939 (100)	348 (100)	398 (99.7)	729 (100)	352 (99.7)	686 (99.9)
no serious maternal postpartum complications[4]	939 (100)	348 (100)	399 (100)	729 (100)	353 (100)	687 (100)
no 3rd or 4th degree extension of either an episiotomy or a 1st or 2nd degree laceration	901 (96.0)	**345 (99.1)****	381 (95.5)	716 (98.2)	346 (98.0)	676 (98.4)
loss of blood < 1000 ml	877 (93.4)	322 (92.5)	371 (93.0)	706 (96.8)	339 (96.0)	666 (98.9)
no transfer to high risk neonatal care setting within 24 hours postpartum	934 (99.5)	346 (99.4)	396 (99.2)	725 (99.5)	353 (100)	687 (100)
no perinatal death within 24 hours postpartum	939 (100)	347 (99.7)	399 (100)	729 (100)	353 (100)	687 (100)
no maternal mortality within 24 hours after birth	939 (100)	348 (100)	399 (100)	729 (100)	353 (100)	687 (100)

[1] community midwife-led,
[2] this includes (pre-) eclampsia or HELLP syndrome present during intrapartum period, placental abruption, placenta preavia discovered during intrapartum period, infected uterus before birth, uterine rupture,
[3] this includes (eclampsia, deep venous thrombosis, pre-eclampsia or HELLP syndrome present during postpartum period, pulmonary embolism
[4] this includes Erb's palsy, clavicular fracture and cephalo hematoma
postpartum),
* after adjusted for maternal age, maternal background, urbanization and social economic status p< 0.05,
** after adjusted for maternal age, maternal background, urbanization and social economic status p< 0.01,
*** after adjusted for maternal age, maternal background, urbanization and social economic status p< 0.001

Location of birth centre in relation to the obstetric unit

The final place of birth was less often in the planned place of birth for women who planned birth in an alongside birth centre (reference group) compared to women who planned birth in a freestanding birth centre (nulliparous: alongside 30.6%, freestanding 69.7%; multiparous: alongside 62.0%, freestanding 81.3%). Multiparous women who planned birth in an on-site birth centre were also more likely to give birth at their planned place (71.6%) compared to the reference group (62.0%).

For nulliparous women who planned to give birth in an alongside birth centre 'no referral' occurred less often (29.3%) compared to nulliparous women who planned to give birth in a freestanding birth centre (57.6%). For multiparous women with planned birth in an alongside birth centre 'no referral' was less common (66.2%) compared to planned births in a freestanding birth centre (87.5%).

'No amniotomy' and 'no episiotomy' occurred more often in women who planned to give birth in an on-site birth centre compared to women who planned to give birth in an alongside birth centre ('no amniotomy': nulliparous: on-site 64.3%, alongside 49.9%; multiparous: on-site 54.6%, alongside 35.0% ; 'No episiotomy': nulliparous: on-site 69.6%, alongside 57.7%; multiparous: on-site 92.8%, alongside 87.5%). In the comparison between these two locations the item 'no manual placental removal' occurred more often for the women who planned to give birth in an alongside birth centre (nulliparous: alongside 97.7%, on-site 94.7%; multiparous: alongside 99.0%, on-site 96.9%).

No other differences were seen between the different planned locations of birth centres in relation to the obstetric unit on the items of the OI-NL2015.

Integration profiles of the birth centre

'No urgent referral' was more likely for nulliparous women who planned birth in MUBCs (the multi-disciplinary oriented group) (95.9%) compared to MIBCs (the mixed group) (90.9%). Also 'blood loss < 1000 ml' was less likely for women planning birth in MIBCs (87.4%) compared to those planning birth in the other birth centres. (MOBCs 94.4% (the monodisciplinary oriented group) and MUBCs 96.3%)). 'Apgar score >= 9 after 5 minutes' was less likely in MUBCs (91.8%) compared to MOBCs (95.6%) for nulliparous women.

A higher proportion of women with planned birth in a birth centre within the group of multi-disciplinary oriented birth centres had 'no amniotomy' compared to women with planned birth in a mono-disciplinary oriented birth centre or a birth centre from the mixed group (nulliparous: MUBCs 63.9%, MOBCs 50.2% MIBCs 47.5%; multiparous: MUBCs 53.7%, MOBCs 34.2% MIBCs 38.4%).

Optimality Index-NL2015

Multiparous women had a higher mean sum score (28.3) (a more favourable outcome) on the OI-NL2015 than nulliparous women (26.0).

Birth centre compared to alternative places

As shown in Table 3a, nulliparous women who planned birth in a birth centre had a lower mean score on the OI-NL2015 (25.8) compared to nulliparous women who planned birth in a hospital (26.0, p< 0.05). The effect size of this difference was 0.07 (non-trivial). There was no significant difference between multiparous women who planned birth in a birth centre or in a hospital. Both nulliparous and multiparous women who planned birth in a birth centre had lower scores on the OI-NL2015 compared to women with the same parity that planned birth home (nulliparous: birth centre 25.8, home 26.3; p<0.005; multiparous: birth centre 28.1, home 28.8; p< 0.001). The effect size for this difference was 0.18 for nulliparous women (small) and 0.36 for multiparous women (small to medium).

Table 3a: *Optimality Index-NL2015 for women with low-risk pregnancies by their planned place of birth at start of labour*

	NULLIPAROUS			MULTIPAROUS		
Planned place of birth	**n**	**Mean (SD)**	**Adj. B (95% CI)‡**	**n**	**Mean (SD)**	**Adj. B (95% CI)‡**
Birth centre	939	25.8 (2.68)	reference	729	28.1 (2.17)	reference
Hospital (midwife-led)	348	26.0 (2.71)	0.40 (0.05 , 0.74)*	353	28.0 (2.14)	-0.05 (-0.31 , 0.21)
Home	399	26.3 (2.80)	0.53 (0.19 , 0.86)**	687	28.8 (1.70)	0.85 (0.63 , 1.07)***
Birth centre by location						
Free standing	33	27.4 (2.60)	1.69 (0.75 , 2.62)**	32	28.6 (1.60)	0.75 (-0.05 , 1.54)
Alongside	699	25.7 (2.66)	reference	503	27.9 (2.24)	reference
On-site	207	25.8 (2.67)	0.08 (-0.35 , 0.52)	194	28.4 (2.03)	0.48 (0.10 , 0.84)*
Birth centre by integration profile						
MOBC	522	25.7 (2.67)	-0,29 (-0.72 , 0.15)	401	27.9 (2.30)	-0.55 (-0.95 , -0.15)**
MIBC	198	25.7 (2.75)	-0.32 (-0.84 , 0.20)	151	28.0 (2.08)	-0.09 (-0.57 , 0.39)
MUBC	219	26.0 (2.64)	reference	177	28.5 (1.85)	reference

‡ = adjusted for maternal age, ethnicity, urbanization and social economic status

* p < 0.05

** p < 0.01

*** p < 0.001

SD = Standard Deviation

MOBC = mono-disciplinary oriented birth centre; MIBC = the mixed group of birth centres; MUBC = the multi-disciplinary oriented birth centre

Location of the birth centre in relation to the obstetric unit

Nulliparous women with planned place of birth in an alongside birth centre had a lower score on the OI-NL2015 than those with planned place of birth in a freestanding birth centre (25.7 vs. 27.4, p<0.005). The effect size of this difference was 0.64 (medium to high). Multiparous women who planned birth in an on-site birth centre had a higher score on the OI-NL2015 compared to those who planned birth in an alongside birth centre (28.4 vs. 27.9, p<0.05). The effect size of this difference was 0.24 (small).

Integration profiles of the birth centre

For nulliparous no differences were found between the different types of birth centres based on their integration profile. Multiparous women who planned birth in a MUBC (multi-disciplinary oriented birth centre) had a higher mean score on the OI-NL2015 compared to the women who planned birth in a MOBC (mono-disciplinary oriented birth centre (28.5 vs. 27.9, p<0.005)). The effect size of this difference was 0.28 (small).

Composite adverse outcome score

Table 3b demonstrates the frequencies of the CAO between the different planned places of birth. Overall, an adverse perinatal outcome was rare. On average, multiparous women had an adverse outcome less frequent than nulliparous women.

Table 3b: *Composite adverse outcome score for women with low-risk pregnancies by their planned place of birth at start of labour*

	NULLIPAROUS		MULTIPAROUS	
Planned place of birth	**n**	**Mean (SD)**	**n**	**Mean (SD)**
Birth centre	939	12.1	729	5.5
Hospital (midwife-led)	348	10.3	353	6.2
Home	399	11.8	687	4.5
Birth centre by location				
Free standing	33	9.1	32	3.1
Alongside	699	11.9	503	5.6
On-site	207	13.5	194	5.7
Birth centre by integration profile				
MOBC	522	10.7	401	5.2
MIBC	198	18.7	151	5.3
MUBC	219	9.6	177	6.2

SD = Standard Deviation

MOBC = mono-disciplinary oriented birth centre; MIBC = the mixed group of birth centres; MUBC = the multi-disciplinary oriented birth centre

DISCUSSION

Summary of main findings

Our study demonstrated that clinically, there was no relevant difference in scores on the Optimality Index-NL2015 (OI-NL2015) for women who planned to give birth in a birth centre compared to women who planned to give birth in a hospital. Only the difference between planned birth centre birth and planned home birth had a small to medium effect size: a higher score on the OI-NL2015 for women with planned home birth compared to planned birth in a birth centre.

Strengths and limitations

This was the first prospective cohort study of perinatal outcomes of planned birth in a birth centre compared to a planned birth in a hospital or at home in the Netherlands.

The OI-NL2015 focused on an evidence-based optimal approach of maternity care instead of a focus on serious adverse outcomes. Comparing groups on OI-NL2015 may show differences in processes during labour, birth and the postpartum period. Improvement of these processes could directly lead to less interventions potentially leading to better perinatal care. Although the optimality index is not a commonly used outcome measure it has been shown to be valuable over a decade in distinguishing processes of maternity care across and within various groups (31). The second approach for outcomes (CAO) is more commonly used and focused on serious adverse perinatal outcomes (32,33).

Data from the Netherlands Perinatal Registry are more often used for perinatal research in the Netherlands. It is unclear if not registered data in this database are not registered because they did not happen or that they are missing. In line with other research that uses these data we considered them as not happened. It is possible that this assumption has led to a higher sum score of the OI-NL2015 (more optimal result) and an underestimation of the composite adverse outcome score.

In our study there was an unexpected 8.5% missing of data from the Netherlands Perinatal Registry. Besides a random single missing case, complete periods with data were missing from some community midwife practices. The information on missings was shared with Perined in order to identify the cause and make it possible to solve this problem.

This study ensured comparability of the subgroups by adjusting for confounding baseline characteristics. However, women's choice for planned place of birth often reflects their underlying perception of pregnancy and childbirth. These differences have not been quantified in our previous study (34,35). Although we adjusted for common baseline characteristics, adjusting for attitude (e.g. anxiety towards birth) and lifestyle (e.g. smoking) was not possible in the current study. The differences in outcomes may

therefore partly be a result of these confounders instead of the differences in planned location of birth.

We found that nulliparous women who planned birth in a freestanding birth centre had a higher mean score on the OI-NL2015 compared to those who planned birth in an alongside birth centre. The effect size of this difference was 0.64 (medium). Also, almost all inclusions of women with planned place of birth in a freestanding birth centre originated from one region in the Netherlands. This region is known for its conservative attitude towards health care in general which may have its reflection on the perception of care of pregnant women as well as on the professional attitude of the community midwives working there. Therefore we want to be prudent to generalize our results of planned births in a freestanding birth centre to the rest of the Dutch population. Although all women who planned birth out of home are free to choose the specific location they plan to give birth in, regional circumstances may influence their final choice e.g. facility nearest to their home available.

The enthusiastic participation of the community midwives showed the involvement and interest in this research. Their high participation rate reduced the selection bias on variation in practice among community midwives. With regard to participation of the birth centres: all eligible Dutch birth centres participated in this prospective national cohort study. The number of inclusions of planned births in the freestanding birth centres were low but in line with their annually reported low numbers of births and the number of freestanding birth centres (3) in the Netherlands.

Interpretation of the results

The difference in OI-NL2015 for women who planned birth in a birth centre compared to home was mostly due to a lower proportions of 'non referrals'. Referral had a direct effect on the score of the individual items of the OI-NL2015, as referral often leads to the start of a cascade of interventions (36). Further analyses showed that the most important reason for this difference in number of referrals was found in referrals for failure to progress in first stage and a need for pain relief. This result was also demonstrated in earlier research on this subject (37). In July 2014 the Dutch Minister of Health, Welfare and Sports included the use of nitrous oxide as an alternative analgesia for use during labour on the list of medications to be used in primary led midwifery care. Nitrous oxide is allowed under strict requirements for ventilation of the environment and source extraction (38,39). It is shown to be beneficial as analgesia during labour and can be used in primary midwifery-led care in case all conditions for safety are fulfilled (40). Although it is not possible to fulfil these conditions in case of home births, birth centres can be a suitable place to offer this method for pain relief (29). Reduction of the number of referrals to secondary care could be the result.

Comparisons between birth centres distinguished by location or integration profile demonstrated that in cases of a difference in the OI-NL2015 , this was only a (very) small effect size. This effect was not homogenous across the different parities and therefore no conclusions can be made between the different types of birth centres. A significant difference in the numbers of 'no amniotomy' was found between women with planned birth in an alongside birth centre and planned birth in an on-site birth centre. In case of meconium stained liquor women in an alongside birth centre need to be transferred to another room in the same hospital after referral, in contrast to women in an on-site birth centre. As it did not contribute to more referral for meconium stained liquor, the need for amniotomy in this group should be studied in further research.

Birth centres offer facilities that may improve the chances on physiological childbirth like a birthing chair, a bath and continuous one to one support from a maternity care assistant (5). The actual use of these facilities and the choice of birthing position depends among other things on the perception of childbirth and the acquaintance of these facilities by the expecting woman and her partner. Also the preferences and attitude of the attending community midwife are factors that co-influence these choices (41). Evidence-based information about factors that make a physiological birth more or less likely, should be presented antenatally to all women. The effect of the different options for planned place of birth should be included.

A clear comparison of the findings from this study to those of other birth centre studies is hard to make because the primary outcome measurement tool (OI-NL 2015) was not used before in this type of research. Other studies often focus on the prevalence of adverse outcomes and interventions instead of optimal outcomes (6-9). The birth place study in England found that women who planned birth in a midwifery unit (alongside or freestanding) had significantly fewer interventions, including substantially fewer intrapartum caesarean sections, and more spontaneous vaginal births than women who planned birth in an obstetric unit (6). That difference was not found in this study. The birthplace study as well as this study showed that home birth is a good option for low-risk women to give birth under the care of a midwife. For women who do not want to give birth at home, birth centres are an alternative option to give birth in a homelike environment.

Personal preferences and attitude toward defining the boundaries of physiological birth may also play an important role in the use of facilities by the attending midwife to support physiological birth . In general there is a considerable variation among this (42). Offerhaus showed 2 contrasting attitudes: 1) community midwives who 'emphasize physiology', focused on expectant management and tailor made decisions and 2) community midwives 'Operating on the safe side', characterised by early anticipation on risks and adherence to protocols, leading to higher referral rates. As this attitude influences the whole process of care, planned place of birth is potentially co-influenced by this.

Awareness of a community midwife's personal attitude and monitoring personal referral behaviour can help to maintain high quality midwifery care. Being aware of a high referral rate can stimulate community midwives to reflect critically on what circumstances effects this rate and whether they personally can improve their care in supporting and promoting physiological childbirth, as described in the recent Lancet series (36,43). A birth centre, with its homelike atmosphere and facilities to promote physiological childbirth could be a suitable place for women who do not want to give birth at home.

CONCLUSION

This study showed that birth centres are a good alternative to give birth for the increasing number of women who do not want to give birth at home. Perinatal outcomes of planned birth centre births are comparable to planned midwife-led hospital births. Women with planned home birth had a higher OI-NL2015 compared to women with planned births in a birth centre. The pros and cons of the different places of birth should be clearly explained to women and their partners to make an informed choice on their planned place of birth.

REFERENCES

1 KNOV. Midwifery in the Netherlands. 2016. http://www.knov.nl/samenwerken/tekstpagina/489/midwifery-in-the-netherlands/ (accessed 15 Jul2016).

2 College voor Zorgverzekeringen. Verloskundig vademecum. Eindrapport van de Commissie Verloskunde van het College voor Zorgverzekeringen. [Obstetrical manual Final report of the Obstetric working Group of the National Health Insurance Board CVZ]. Diemen: 2003.

3 Stichting Perinatale Registratie Nederland. Perinatale Zorg in Nederland 2013. Utrecht, the Netherlands: 2014.

4 Wiegers T, de Graaf H, van der Pal K. De opkomst van geboortecentra en hun rol in de zorg. Tijdschr voor gezondheidswetenschappen 2012;90:475–8. doi:10.1007/s12508-012-0162-1

5 Hermus MAA, Boesveld IC, Hitzert M, et al. Defining and describing birth centres in the Netherlands - a component study of the Dutch Birth Centre Study. BMC Pregnancy Childbirth 2017;17. doi:10.1186/s12884-017-1375-8

6 Stewart M, Mccandlish R, Henderson J, et al. Review of evidence about clinical , psychosocial and economic outcomes for women with straightforward pregnancies who plan to give birth in a midwife-led birth centre , and outcomes for their babies . Report of a structured review of birth centre outcomes. Oxford: 2005.

7 Brocklehurst P, Hardy P, Hollowell J, et al. Perinatal and maternal outcomes by planned place of birth for healthy women with low-risk pregnancies: the Birthplace in England national prospective cohort study. BMJ 2011;343:d7400. doi:10.1136/bmj.d7400

8 Laws PJ, Tracy SK, Sullivan E a. Perinatal outcomes of women intending to give birth in birth centers in Australia. Birth 2010;37:28–36. doi:10.1111/j.1523-536X.2009.00375.x

9 Waldenström U. The Stockholm Birth Centre Trial: maternal and infant outcome. J Nurse Midwifery 1997;44:159–62.http://www.ncbi.nlm.nih.gov/pubmed/10328692

10 Hodnett ED, Downe S, Walsh D. Alternative versus conventional institutional settings for birth. Cochrane database Syst Rev 2012;8:CD000012. doi:10.1002/14651858.CD000012.pub4

11 Wiegers TA, Keirse MJ, van der Zee J, et al. Outcome of planned home and planned hospital births in low risk pregnancies: Prospective study in midwifery practices in the Netherlands. BMJ 1996;313:1309–13. doi:10.1136/bmj.313.7068.1309

12 De Jonge A, Van Der Goes BY, Ravelli ACJ, et al. Perinatal mortality and morbidity in a nationwide cohort of 529 688 low-risk planned home and hospital births. BJOG An Int J Obstet Gynaecol 2009;116:1177–84. doi:10.1111/j.1471-0528.2009.02175.x

13 Boesveld IC, Bruijnzeels MA, Hitzert M, et al. Typology of birth centres in the Netherlands using the Rainbow model of integrated care: Results of the Dutch Birth Centre Study. BMC Health Serv Res 2017;17. doi:10.1186/s12913-017-2350-9

14 Steering committee Pregnancy and Birth. A good beginning, safe care around pregnancy and birth [in Dutch: Een goed begin, veilige zorg rond zwangerschap en geboorte]. Advice steering committee pregnancy and birth. Utrecht 2009.

15 Goodwin N, 6 P, Peck E, et al. Managing Across Diverse Networks of Care: Lessons from Other Sectors. London: 2004.

16 Kodner D. All To GETHER Now : a conceptual exploration of intergrated care. Healthc Q 2009;13:6–15. doi:10.12927/hcq.2009.21091

17 Valentijn PP, Boesveld IC, Van Der Klauw DM, et al. Towards a taxonomy for integrated care: a mixed-methods study. Int J Integr Care 2015;15:1–18. doi:10.5334/ijic.1513

18 Hermus MAA, Wiegers TA, Hitzert MF, et al. The Dutch Birth Centre Study: study design of a programmatic evaluation of the effect of birth centre care in the Netherlands. BMC Pregnancy Childbirth 2015;15:148. doi:10.1186/s12884-015-0585-1

19 CCMO (central committee on research involving human subjects). http://www.ccmo.nl/en/ccmo-directives (accessed 8 Jul2015).

20 Perined. https://www.perined.nl/ (accessed 25 Apr2016).

21 Hermus MAA, Boesveld IC, van der Pal–de Bruin KM, et al. Development of the Optimality Index-NL2015, an instrument to measure outcomes of maternity care. J Midwifery Womens Health Published Online First: 2017. doi:10.111/jmwh.12650

22 Wiegers T A, Keirse MJ, Berghs G a, et al. An approach to measuring quality of midwifery care. J Clin Epidemiol 1996;49:319–25. doi:10.1016/0895-4356(95)00549-8

23 Low LK, Miller J. A clinical evaluation of evidence-based maternity care using the Optimality Index. J Obstet Gynecol Neonatal Nurs 2006;35:786–93. doi:10.1111/j.1552-6909.2006.00107.x

24 Sheridan M, Sandall J. Measuring the best outcome for the least intervention: can the Optimality Index-US be applied in the UK? Midwifery 2010;26:e9-15. doi:10.1016/j.midw.2009.09.002

25 Brunings P, Laar L van de, Galien O van der, Kool H, Bonsel G, Westert G et al. . Evaluation of an adverse outcome index for the quality of obstetric care delivered by multidisciplinary care chains. Int J Integr Care 2013;13. doi:10.5334/ijic.1261

26 Anthony S, Buitendijk SE, Offerhaus PM, et al. Maternal factors and the probability of a planned home birth. Br J Obs Gyn 2004;112. doi:10.1111/j.1471-0528.2004.00520.x

27 The Netherlands Institute for Social Research. http://www.scp.nl/english/ (accessed 1 Jan2015).

28 Bai J, Wong FWS, Bauman A, et al. Parity and pregnancy outcomes. Am J Obstet Gynecol 2002;186:274–8. doi:10.1067/mob.2002.119639

29 Cohen J. Statistical power analysis for the behavioral sciences. second. Hillsdale NJ: 1988.

30 Hitzert M, Hermus MAA, Scheerhagen M, et al. Experiences of women who planned birth in a birth centre compared to alternative planned places of birth.Results of the Dutch Birth Centre Study. Midwifery 2016;0:339–47. doi:10.1016/j.midw.2016.06.004

31 Fullerton JT, Low LK, Shaw-Battista J, et al. Measurement of Perinatal Outcomes: A Decade of Experience and a Future Vision for the Optimality Index-US. Int J Childbirth 2011;1:171–8. doi:10.1891/2156-5287.1.3.171

32 Boers KE, Vijgen SMC, Bijlenga D, et al. Induction versus expectant monitoring for intrauterine growth restriction at term: randomised equivalence trial (DIGITAT). BMJ 2010;341:c7087–c7087. doi:10.1136/bmj.c7087

33 Koopmans CM, Bijlenga D, Groen H, et al. Induction of labour versus expectant monitoring for gestational hypertension or mild pre-eclampsia after 36 weeks' gestation (HYPITAT): a multicentre, open-label randomised controlled trial. Lancet 2009;374:979–88. doi:10.1016/S0140-6736(09)60736-4

34 Kleiverda G, Steen AM, Andersen I, et al. Place of delivery in the Netherlands: maternal motives and background variables related to preferences for home or hospital confinement. Eur. J. Obstet. Gynecol. Reprod. Biol. 1990;36:1–9. doi:10.1016/0028-2243(90)90043-Z

35 Wiegers TA, Van Der Zee J, Kerssens JJ, et al. Home birth or short-stay hospital birth in a low risk population in the Netherlands. Soc Sci Med 1998;46:1505–11. doi:10.1016/S0277-9536(98)00021-5

36 Offerhaus PM, Geerts C, de Jonge A, et al. Variation in referrals to secondary obstetrician-led care among primary midwifery care practices in the Netherlands: a nationwide cohort study. BMC Pregnancy Childbirth 2015;15:42. doi:10.1186/s12884-015-0471-x

37 Offerhaus PM, Hukkelhoven CWPM, de Jonge A, et al. Persisting rise in referrals during labor in primary midwife-led care in the Netherlands. Birth 2013;40:192–201. doi:10.1111/birt.12055
38 Schippers EI. Regulation of the Minister of Health, Welfare and Sport. [In Dutch:Regeling van de Minister van Volksgezondheid, Welzijn en Sport 28 juli 2014, kenmerk 642455-123513-MEVA, houdende aanwijzing van apparatuur, geneesmiddelen, medische hulpmiddelen en middelen, behorende tot het deskundigheidsgebied van de verloskundige]. Staatscourant. 2014.https://zoek.officielebekendmakingen.nl/stcrt-2014-23083.html (accessed 15 Jul2016).
39 van der Kooy J, De Graaf JP, Kolder ZM, et al. A newly developed scavenging system for administration of nitrous oxide during labour: safe occupational use. Acta Anaesthesiol Scand 2012;56:920–5. doi:10.1111/j.1399-6576.2012.02668.x
40 Klomp T, van Poppel M, Jones L, et al. Inhaled analgesia for pain management in labour. Cochrane database Syst Rev 2012;:CD009351. doi:10.1002/14651858.CD009351.pub2
41 de Jonge A, Rijnders MEB, van Diem MT, et al. Are there inequalities in choice of birthing position? Midwifery 2009;25:439–48. doi:10.1016/j.midw.2007.07.013
42 Offerhaus PM, Korfker D, de Jonge A, et al. submitted: Midwives and variation in referral decisions during labour.
43 Renfrew MJ, Mcfadden A, Bastos MH, et al. Midwifery and quality care: findings from a new evidence- informed framework for maternal and newborn care. Lancet 2014;384:1129–45. doi:10.1016/S0140-6736(14)60789-3

Chapter 6

Cost-effectiveness of planned birth in a birth centre compared with alternative planned places of birth

Results of the Dutch Birth Centre Study

Marit Hitzert
Marieke A.A. Hermus
Inge C. Boesveld
Arie Franx
Karin M. van der Pal-de Bruin
Eric A.P.Steegers
M. Elske van den Akker-van Marle

BMJ Open 2017;7:e016960.

ABSTRACT

Objectives: To estimate the cost-effectiveness of a planned birth in a birth centre compared with alternative planned places of birth for low-risk women. In addition, a distinction has been made between different types of locations and integration profiles of birth centres.

Design Economic evaluation based on a prospective cohort study.

Setting: 21 Dutch birth centres, 46 hospital locations where midwife-led birth was possible and 110 midwifery practices where home birth was possible.

Participants: 3455 low-risk women under the care of a community midwife at the start of labour in the Netherlands within the study period 1 July 2013 - 31 December 2013.

Main outcome measures: Costs and health outcomes of birth for different planned places of birth. Health care costs were measured from start of labour until seven days after birth. The health outcomes were assessed by the Optimality Index-NL2015 (OI) and a composite adverse outcome (CAO) score.

Results: The total adjusted mean costs for births planned in a birth centre, in a hospital and at home under the care of a community midwife were €3.327, €3.330 and €2.998 respectively. There was no difference between the score on the OI for women who planned to give birth in a birth centre and that of women who planned to give birth in a hospital. Women who planned to give birth at home had better outcomes on the OI (higher score on the OI).

Conclusions: We found no differences in costs and health outcomes for low-risk women under the care of a community midwife with a planned birth in a birth centre and in a hospital. For nulliparous and multiparous low-risk women, planned birth at home was the most cost-effective option compared with planned birth in a birth centre.

INTRODUCTION

The Dutch maternity care system is based on risk attribution: independent community midwives providing care for low-risk pregnant women (primary care) and obstetricians providing in-hospital care for high-risk women (secondary care). The risk attribution with reasons for consultation and referral are set out in a multidisciplinary guideline: the List of Obstetric Indications (1). Low-risk pregnant women can choose where they want to give birth: at home, in a hospital or in a birth centre. The community midwife assists them during natal care, pregnancy and the postpartum period. Most midwives work in group practices in the community and they are autonomous as regards their actions and decisions (2). If a pregnant woman's risk status changes during her pregnancy or labour or she requests pharmacological pain relief, she will be referred from primary care to secondary care.

Over the past decade fewer women planned to give birth at home. In 2004 around 48% of all low-risk births in the Netherlands were planned at home; in 2014 this number fell to 24% (3). As most low-risk women in the Netherlands are now planning to give birth outside their home, it is necessary to offer these women a good alternative. Birth centres are a relatively new phenomenon in the Netherlands and most of them have been established in the last decade. Birth centres are regarded as settings where women with low-risk pregnancies can give birth in a homelike environment, supervised by a community midwife. When complications arise or pharmacological pain relief is requested, referral to an obstetrician/paediatrician is needed (4-6). During birth the community midwife is assisted by a maternity care assistant. This assistant provides care and support for the mother and her baby for up to eight days after birth, in a birth centre or at home.

The costs and health outcomes of the different birth settings in the Netherlands (i.e. hospital and home) for low-risk women have been widely discussed in recent years (7-11), especially since the national perinatal mortality rate was shown to be one of the highest in Europe (12). The results of the studies were linked directly to the operational set-up of the Dutch maternity care system, with it's clear segmentation of primary (community midwife-led) and secondary care (obstetrician-led) and lack of collaboration. It is, however, assumed that birth centres provide a better quality of care when compared to the existing system of primary and secondary care. One reason for this may be that co-location of birth centres and obstetric units is an enabler for better collaboration (13). At present, there is no evidence for this assumption.

A Dutch study found that the total costs associated with pregnancy, childbirth and postpartum care are comparable for home birth and hospital birth under the care of a community midwife (14). Evidence relating to costs and health outcomes of all Dutch low-risk birth settings, including birth centres, is still lacking. The costs and health out-

comes of birth-centre care have been studied internationally. In England planned birth at home is the most cost-effective option compared with planned birth in an alongside or freestanding midwifery unit and an obstetric unit (15). The results of other studies on costs and health outcomes of midwifery-attended births in England, the United States of America and Australia were comparable to the British study (16-21).

However, the outcomes of these studies cannot easily be generalised to the Netherlands, since the Dutch system is different, with a relatively high rate of home births and a low rate of medical interventions compared to other developed countries (7). We therefore studied the costs and health outcomes of Dutch birth-centre care as part of the Dutch Birth Centre Study, a national project evaluating the outcomes of Dutch birth centres on aspects such as client and professional experiences, effectiveness and costs (4). The aim of this study is to estimate the cost-effectiveness of planned birth in a birth centre compared with alternative planned places of birth for low-risk women who start labour under the care of a community midwife. In addition, a distinction has been made between different types of locations and integration profiles of birth centres.

METHODS

The cohort study included 3,455 term low-risk women under the care of a community midwife at the start of labour. The characteristics of these women, the exclusion criteria and the analyses on the health outcomes have been reported in detail elsewhere (22).A minimum of three midwifery practices located near a birth centre (n=23) were randomly recruited to collect data. A condition for participation was that the birth centre had been operating for over six months before the study period, leading to the exclusion of two birth centres. Midwifery practices in regions where there was the possibility of a midwifery-led hospital birth were recruited to collect data relating to planned midwife-led hospital births. Planned birth at home was an option for women in all participating midwifery practices. The women were recruited from 110 midwifery practices (127 were approached) within the study period 1 July 2013 - 31 December 2013. 21 birth centres and 46 hospital locations where midwife-led birth was possible participated in this study (22).

The cohort study compared perinatal and maternal outcomes, according to the intention-to-treat method, by planned place of birth: in a birth centre, in a hospital or at home. The intention-to-treat method is used to prevent distortion in outcomes resulting from selective drop-out in the groups to be investigated. In maternity care research the place of birth is a variable where selective drop-out occurs as a result of referrals to secondary care during childbirth. By analysing the outcomes based on the planned place of birth, the groups remain comparable (23). Separate analyses were performed

for different types of birth centres, based on location and based on integration profile. Three types of birth-centre locations can be distinguished: 1) freestanding from a hospital, 2) alongside an obstetric unit and 3) on-site at an obstetric unit (24).

We also distinguished three integration profiles: mono-disciplinary-oriented birth centres (MOBC), multi-disciplinary-oriented birth centres (MUBC) and a mixed group of birth centres (MIBC). Integrated care is increasingly encouraged in maternity care systems (25). The essence of integrated care is a continuum of care for service users, crossing the boundaries of public health, primary, secondary, and tertiary care (25-27). The focus of MOBCs is to act as a facility for giving birth rather than to improve collaboration between care providers or to realise integration of care, and MOBCs are mainly owned by primary-care organisations. MUBCs can be regarded as facilities for giving birth with a focus on integrated birth care. They have governance structures consisting of both primary and secondary care organisations. The disciplines involved have formulated a joint vision on birth care. The community midwife is still the person who takes care of low-risk pregnant women. MIBCs are a mixed group. They differ more from each other in their organisation than centres in the other groups. Compared with MUBCs these centres had higher scores on clinical integration (the coordination of person-focused care in a single process across time, place and discipline) and lower scores on the other dimensions (professional, organisational, system, functional and normative integration) (28).

The primary clinical outcomes were measured by an Optimality Index-NL2015 (OI) (29) and a composite adverse outcome score (CAO) was used as a secondary outcome measure (30). The OI is a tool used to measure 'maximum outcome with minimal intervention', based on the principle of optimality. It contains both process and outcome items and background characteristics are taken into account. The tool is used to compare the extent to which different low-risk groups, with few adverse outcomes, achieve an optimal situation. An optimal situation is a situation that every woman would wish for: a spontaneous, uncomplicated birth after a full-term pregnancy, without interventions, resulting in a healthy mother and baby (31-33). The tool was revised for use in Dutch obstetric research (29). It contains 31 process and outcome items with evidence-based criteria relating to optimality (e.g. duration of first and second stage, instrumental (vaginal) birth, loss of blood during birth, referral during labour or within 2 hours postpartum and birth weight). Each item meeting the criteria for optimality was scored as "1". Those considered non-optimal were scored as "0". In this way a sum score of all 31 items per woman was calculated (31-33). In addition, the composite adverse outcome score (CAO), a combined measure of six distinct adverse outcomes (maternal mortality within 42 days of birth, (sub) total rupture, blood loss of more than one litre, perinatal mortality within 7 days of birth, Apgar score below 7 at 5 minutes after birth, admission to the neonatal intensive care unit within 48 hours of birth), was used. This measure is based on the

occurrence of at least one of these six adverse outcomes and is thereby a dichotomous variable with the value 0 or 1 (29).

Type of economic evaluation, study perspective, and time horizon

The economic evaluation took the form of a cost-effectiveness analysis in which we estimated the costs and health outcomes for a planned birth in a birth centre, in a hospital or at home. The economic evaluation was performed from a health care perspective. The time horizon of the economic evaluation was from the start of labour until seven days after birth (end of maternity care period). Because of this short time frame no discounting took place. Costs were in 2015 euro; cost prices from earlier years were converted to 2015 euro using the consumer price index (34).

Measurement of resource use

Volume of health care resource use was collected prospectively by the attending community midwives using a case record form which was designed to complement the data from the Netherlands Perinatal Registry (3). The case record form included additional process indicators and volumes such as the time of the first physical contact between the client and the community midwife after a call at the start of labour, the planned place of birth at the start of labour, time of arrival at the birth centre or hospital, referral to the hospital, use of pain relief, use of transport during referral and maternity care assistance. Information on health outcomes and the use of other medications then pain relief was extracted from the Netherlands Perinatal Registry.

Unit cost estimation

All birth centres (n=23) were asked to send their financial details, including overheads, materials and staff costs, and 16 birth centres sent useable information. These total costs were divided by the total number of births and the total number of postpartum days to calculate unit costs (35). Dutch reference prices were used for consultation costs, blood transfusion and ambulance transport(36, 37). These reference prices include personnel costs, material costs, costs of medical equipment and supporting departments, accommodation, and overhead costs. For additional costs of interventions after referral and interventions in the third stage (delivery of the placenta) unit costs estimates were obtained from the Dutch Healthcare Authority (NZA) (38). These costs are based on the unit cost of an intervention in a representative selection of Dutch hospitals, weighted by the number of this particular intervention performed in the different hospitals. Unit costs of a birth at a hospital and maternity care assistance were also obtained from the NZA (39). Twenty community midwives were asked about the duration of home-visits between the start of labour and birth and the duration of consultations during and after birth by a gynaecologist and paediatrician. Their mean estimates (respectively 50, 15

and 12 minutes) were converted into cost prices of consultation using gross salaries. The duration of postpartum consultations by a community midwife and the gross salaries of community midwives were provided by the Royal Dutch Organisation of Midwives (KNOV) (40, 41), and Dutch reference prices were used for the gross salaries of gynaecologists and paediatricians. Admission costs were based on a Dutch obstetric study (42). Medication costs were obtained from the website of the National Health Care Institute, which calculates costs for the Dutch situation based on doses and amounts of drugs (43). The cost of medication – which included not only the drugs but also the materials and/or equipment needed for their administration – was based on other studies (44-46). The values obtained as described above were used for the base case analysis (the model with the values that are assumed most likely). Additionally, sensitivity analyses were undertaken on variables with a great diversity in cost prices across the sources, including: epidural, general anaesthesia, birth at hospital with referral, additional costs after referral (spontaneous birth, vacuum extraction, forceps extraction and caesarean section), repair of perineal tear in operating theatre and manual placenta removal. By repeating our analysis with different cost estimates for variables with a great diversity in cost prices among sources, the implications of uncertainty in costs were explored. These sensitivity analyses included an analysis in which the maximum cost found in literature was used and a bottom-up calculation (assigning a value to each of the resources used during an intervention and summing these values) based on resource use estimates of five hospitals (two teaching hospitals and three general hospitals), see Table 1.

Analytical methods

Total costs per birth were calculated after multiplying resource use per woman and unit costs.

A decision rule was used for missing values that were needed to calculate the outcome scores (OI and CAO): not registered was considered as not happened (since some items did not need to be filled in). Multiple imputation (20 datasets) was used to correct for other missing data. Missing values that were imputed for the cost analysis were: ambulance use (missing 0.2%), place of admission of the child (missing 1.7%), duration of admission of the child (missing 11.0%), duration of post-partum stay at the birth centre (missing 3.7%) and maternity care assistance during birth (missing 5.0%). The variables of the OI, age, parity and maternal background were used as predictors. An iterative Markov chain Monte Carlo method was used in which, for each iteration and for each variable, the fully conditional specification method is in keeping with a univariate model using the other variables as predictors; this then imputes missing values for the relevant variable. Rubin's rules were used for combining the 20 imputed datasets (49).

We estimated differences in costs using the one-way analysis of variance (ANOVA). Although the cost data were skewed, the arithmetic mean is the informative measure for

cost data in cost-effective analysis. Analyses other than the arithmetic mean can produce misleading conclusions. Therefore, ANOVA is appropriate for costs where untransformed data are concerned (50, 51). Multiple regression was used to estimate the differences in total cost and to adjust for potential confounders including parity (nulliparous/multiparous), mean maternal age, maternal background (Dutch/non-Dutch), urbanisation and socio-economic status (SES). Urbanisation (<500 addresses per km^2/500-< 1,500 addresses per km^2/≥1500 addresses per km^2) and SES (high/medium/low) were based on the characteristics of the four-digit postal code area in which the participants live (level of income, educational level, labour market situation) (52).

Non-parametric bootstrapping was used, involving 1,000 replications, to calculate uncertainty around all cost and health outcomes estimates. The net benefit regression framework was used to construct the cost-effectiveness acceptability curve (CEAC) comparing a planned birth in a hospital or at home to a planned birth in a birth centre (53). Net benefit regression uses net benefit, defined as $nb = \lambda \bullet effect - cost$ for each individual patient as dependent variable, where λ is the maximum willingness to pay for a point improvement on the OI. Using the regression equation $nb = \alpha + \beta BC + \gamma X + \varepsilon$ with BC the indicator variable for a planned birth in a birth centre, e.g. BC= 1 if the planned birth was in a birth centre and BC = 0 if the planned place of birth was in a hospital or at home respectively, and X the potentially confounding variable (parity, maternal age, maternal background, urbanisation and socioeconomic status) results in estimation of β and its p-value, with the latter being used to construct the CEAC. The CEAC for comparing the different types of birth centres was based on bootstrapping the adjusted costs and health outcomes and plotting the proportion of births with the highest net benefit for the different types of birth centres (with respect to location and integration profile) for a range of values relating to the willingness to pay for a point improvement on the OI.

Since it is known that parity highly influences the progress and outcomes of childbirth (54), all analyses were repeated by parity subgroup (nulliparous vs. multiparous women). Analyses were performed using SPSS version 21 (SPSS, Chicago, IL) and Microsoft Excel (Microsoft, Seattle, WA) 2010 software.

RESULTS

Health outcomes

The characteristics of the participating women and the analyses of the health outcomes are reported in detail elsewhere (22). Overall, no differences on the OI were found in the cohort study between a planned birth in a birth centre (nulliparous OI=25.8 and multiparous OI=28.1) and a planned birth in a hospital (nulliparous OI=26.0 and multiparous OI=28.0). Women who planned to give birth at home had better outcomes (higher score

Table 1: *Unit cost (2015, €) in base case analysis, and sensitivity analysis using maximum cost prices and cost prices resulting from bottom up calculation*

			Base case analysis	Sensivity analysis	
		Unit		Maximum cost in literature	Bottom up calculation
Consultation and medication during first and second stage	Home-visit by a midwife	visit	49 (47)		
	Gynaecological consultation	visit	20 (37)		
	Oxytocin	dose	0.60 (43)		
	Epidural	procedure	185 (44)	526 (38)	252
	Remifentanil	procedure	86 (46)		
	Morphine	procedure	0.60 (43)		
	Pethidine	procedure	0.62 (43)		
	Nalbuphine	procedure	3.25 (43)		
	Nitrous Oxide	procedure	422 (45)		
	General anaesthesia	procedure	391 (39)	713 (39)	713
	Cardiotocography	procedure	151 (38)		
Birth (staffing, overhead and referral) and intervention during second stage	Birth at birth centre	procedure	980		
	Birth at birth centre with referral	procedure	725		
	Birth at home	procedure	604 (47)		
	Birth at home with referral	procedure	598 (47)		
	Birth at hospital	procedure	1136 (39)		
	Birth at hospital with referral	procedure	1130 (39)	1130 (39)	916
	Additional costs after referral				
	sponteanous birth	procedure	677 (38)	1223 (42)	209
	vacuum extraction	procedure	637 (38)	1445 (48)	418
	forceps extraction	procedure	637 (38)	1445 (48)	516
	caesarean section	procedure	868 (38)	2157 (48)	1403
Intervention and consultation during third stage	Blood transfusion	procedure	446 (37)	578	578
	Oxytocin	dose	0.60 (43)		
	Repair perineal tear	procedure	15 (43)		
	Repair perineal tear in operating theatre	procedure	678 (38)	1057	957
	Manual removal of placenta	procedure	746 (38)	746 (38)	1059
	Paediatric consultation	visit	16 (37)		
	Gynaecological consultation	visit	20 (37)		
Admission and transport	Admission mother and child				
	hospital stay - ward	day	398 (42)		
	hospital stay - medium care	day	605 (42)		
	NICU-stay	day	1679 (42)		
	Ambulance transport - urgent	procedure	559 (37)		

Table 1: *Unit cost (2015, €) in base case analysis, and sensitivity analysis using maximum cost prices and cost prices resulting from bottom up calculation (continued)*

			Base case analysis	Sensivity analysis	
		Unit		Maximum cost in literature	Bottom up calculation
Postnatal care	Ambulance transport - non urgent	procedure	270 (37)		
	Postpartum consultation by a midwife	visit	33 (47)		
	Birth centre stay	day	372		
	Maternity care assistance	hour	45 (39)		
	Maternity care assistance	once	84 (39)		

on the OI) on the OI (nulliparous OI=26.3 and multiparous OI=28.8) compared with a planned birth in a birth centre; the effect size is small for nulliparous and medium for multiparous. Within the three types of birth centres based on location only the OI score of nulliparous women with a planned birth in a freestanding birth centre (27.4) was better ($p<0.001$) compared with a planned birth in an alongside birth centre (OI=25.7). No statistical differences in the OI were found for the three different integration profiles, either for nulliparous (MOBC OI=25.7, MIBC OI=25.7 and MUBC OI=26.0) or for multiparous women (MOBC OI=27.9, MIBC OI=28.0 and MUBC OI=28.5).

Overall, an adverse perinatal outcome was rare. No differences were found in the total number of women with one or more adverse outcomes (CAO) between planned births in a birth centre, in a hospital or at home (22).

Unadjusted costs in categories

The total unadjusted mean costs per low-risk woman for births planned in a birth centre (€3.361) are almost the same as those in a hospital (€3.354) and significantly ($p<0.001$) higher than those at home (€2.942). The significant difference in total costs between a planned birth in a birth centre and a planned birth at home is mainly due to: 1) the fact that more women with a planned birth in a birth centre received an epidural and a cardiotocography, 2) the higher overhead costs of the birth centre itself and 3) more mothers and children with a planned birth in a birth centre being admitted to a clinical ward. With regard to the different types of birth centres (based on location and integration profile) there were no differences in unadjusted mean costs, see Table 2.

Adjusted total costs

The general linear model on costs showed that, after adjustment for confounders, the costs of a planned birth in a birth centre (€3.327) remained the same as in a hospital

Table 2: *Unadjusted mean (SD) costs (2015, €) in categories per woman according to planned place of birth*

Planned place of birth		Consultation and medication during first and second stage[a]	Birth and intervention during second stage[b]	Intervention and consultation during third stage[c]	Admission and transport[d]	Postnatal care[e]	Total
Birth centre (n=1668)	**REF**	155 (140)	1074 (321)	55 (179)	254 (858)	1823 (311)	3361 (1015)
Hospital^ (n=701)		148 (134)	1015 (327)***	39 (145)*	288 (1013)	1863 (269)**	3354 (1143)
Home (n=1086)		105 (106)***	696 (286)***	43 (157)	201 (845)*	1898 (215)***	2942 (892)***
Birth centre - location							
Freestanding (n=65)		98 (109)***	1280 (260)***	32 (116)	193 (558)	1884 (288)	3487 (641)
Alongside (n=1202)	**REF**	163 (143)	1061 (307)	51 (172)	260 (860)	1827 (304)	3362 (976)
On-site (n=401)		141 (132)**	1078 (358)	71 (205)	245 (947)	1804 (331)	3338 (1164)
Birth centre - integration profile							
MOBC[1] (n=923)		163 (136)*	1112 (290)	48 (162)	231 (770)	1841 (289)	3394 (867)
MIBC[2] (n=349)		147 (138)	961 (332)***	70 (220)	327 (1046)	1763 (348)**	3268 (1225)
MUBC[3] (n=396)	**REF**	144 (149)	1085 (356)	57 (176)	244 (929)	1835 (318)	3366 (1118)

^ community midwife led

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[1] Mono-disciplinary-oriented, [2] Mixed group of birth centres, [3] Multi-disciplinary-oriented

[a] *Consultation and medication includes: home-visit by a midwife, gynaecological consultation, pain relief and cardiotocography during first and second stage*

[b] *Birth and intervention includes: community midwife, maternity care assistance, overhead costs and additional costs after referral during second stage*

[c] *Intervention and consultation includes: blood transfusion, oxytocin, repair perineal tear, manual removal of placenta, consultation by paediatrician/gynaecologist during third stage*

[d] *Admission and transport includes: admission mother and/or child to hospital and ambulance transport*

[e] *Postnatal care includes: consultation by a midwife, birth centre stay, maternity care assistance*

(€3.330) and were significantly (p<0.001) higher than a planned birth at home (€2.998). With regard to the different types of birth centres (based on location and integration profile) the adjusted mean costs did not vary significantly either.

Restriction of the analyses to nulliparous women showed overall higher mean costs per woman. The costs of a planned birth in a birth centre (€3.653) and at home (€3.397) differed significantly (p<0.001). With regard to the different types of birth centres (based on location and integration profile) there were no differences in adjusted mean costs.

Restriction of the analyses to multiparous women showed overall lower mean costs per woman and significantly (p<0.001) lower costs for women with a planned place of birth at home (€2.639), compared with a birth planned in a birth centre (€3.018). The adjusted mean costs of a planned birth in a freestanding birth centre (€3.278) were significantly (p<0.05) higher than in an alongside birth centre (€3.003). The adjusted mean costs of a planned birth in a birth centre in MIBC (€2.839) were significantly (p<0.01) lower than MUBC (€3.098), see Table 3.

Mean costs and health outcomes (OI)

Uncertainty around costs and health outcomes (OI) obtained by bootstrapping are plotted in Figure 1a (total group) and Figure 1b (nulliparous and multiparous women).

Mean costs and health outcomes (CAO)

The total adjusted composite adverse outcome score (CAO) and the adjusted total mean costs per woman were similar for women with a planned birth in a birth centre and in a hospital. The CAO was also similar for women with a planned birth in a birth centre and at home, but a planned birth at home resulted in lower costs, see Figure 2a. With regard to the parity subgroups, multiparous women had more favourable health outcomes and lower adjusted total mean costs than nulliparous women, see Figure 2b.

Table 3: *(Adjusted) Mean (SD) of total costs (2015, €) per woman according to planned place of birth*

		Total costs			Total costs	
	n	Mean (SD)	B (95% CI)	n	Mean (SD)	B (95% CI)
ALL LOW-RISK WOMEN	Unadjusted			Adjusted#		
Birth centre	1668	3361 (1015)	ref	1610	3327 (6194)	ref
Hospital^	701	3354 (1143)	-7.4 (-99.4 - 84.6)	659	3330 (1158)	3.9 (-84.5 - 92.3)
Home	1086	2942 (892)	-418.8 (-501.0 - -336.7)***	1067	2998 (1414)	-328.6 (-413.6 - -243.7) ***
Birth centre - location						
Freestanding	65	3487 (641)	124.6 (-139.3 - 388.5)	65	3469 (1026)	162.7 (-86.8 - 412.2)
Alongside	1202	3362 (976)	ref	1158	3306 (5215)	ref
On-site	401	3338 (1164)	-23.6 (-142.7 - 95.6)	387	3364 (1142)	57.6 (-56.1 - 171.4)
Birth centre - integration profile						
MOBC[1]	923	3394 (867)	28.5 (-94.4 - 151.3)	889	3342 (1783)	-14.8 (-132.0 - 102.5)
MIBC[2]	349	3268 (1225)	-97.6 (-250.9 - 55.8)	338	3250 (1377)	-107.3 (-254.2 - 39.6)
MUBC[3]	396	3366 (1118)	ref	383	3357 (3094)	ref
NULLIPAROUS	Unadjusted			Adjusted##		
Birth centre	939	3655 (1114)	ref	913	3653 (7276)	ref
Hospital^	348	3644 (1356)	-11.5 (-160.3 - 137.3)	328	3607 (1397)	-45.8 (-196.9 - 105.4)
Home	399	3390 (1084)	-265.7 (-415.6 - -115.9)***	392	3397 (1584)	-255.6 (-412.7 - -98.5)***
Birth centre - location						
Freestanding	33	3691 (673)	56.1 (-361.7 - 474.0)	33	3680 (1262)	51.2 (-379.8 - 482.2)
Alongside	699	3635 (1061)	ref	680	3629 (6317)	ref
On-site	207	3720 (1319)	84.7 (-97.0 - 266.5)	200	3730 (1378)	100.8 (-90.2 - 291.9)

Table 3: *(Adjusted) Mean (SD) of total costs (2015, €) per woman according to planned place of birth (continued)*

	Total costs			Total costs		
	n	Mean (SD)	B (95% CI)	n	Mean (SD)	B (95% CI)
Birth centre - integration profile						
MOBC[1]	522	3666 (954)	19.9 (-162.9 - 202.7)	507	3657 (2199)	10.8 (-180.6 - 202.2)
MIBC[2]	198	3636 (1243)	-10.4 (-238.0 - 217.1)	193	3649 (1694)	3.4 (-235.8 - 242.6)
MUBC[3]	219	3647 (1319)	ref	213	3646 (3664)	ref
MULTIPAROUS	Unadjusted			Adjusted##		
Birth centre	729	2982 (709)	ref	697	3018 (3977)	ref
Hospital^	353	3068 (788)	85.6 (-6.3 - 177.5)	331	3074 (860)	56.2 (-36.4 - 148.9)
Home	687	2683 (623)	-299.7 (-374.0 - -225.4)***	675	2638 (1040)	-379.5 (-457.9 - -301.1)***
Birth centre - location						
Freestanding	32	3276 (526)	293.0 (37.8 - 548.3)*	32	3278 (726)	275.8 (24.2 - 527.5)
Alongside	503	2983 (681)	ref	478	3003 (3323)	ref
On-site	194	2932 (792)	-51.0 (-171.0 - 69.0)	187	3012 (838)	9.3 (-110.8 - 129.4)
Birth centre - integration profile						
MOBC[1]	401	3040 (565)	21.6 (-107.8 - 151.0)	382	3049 (1302)	-48.5 (-179.1 - 82.0)
MIBC[2]	151	2786 (1017)	-232.6 (-388.4 - -76.8)**	145	2839 (955)	-259.2 (-414.7 - -103.7) **
MUBC[3]	177	3019 (654)	ref	170	3098 (2082)	ref

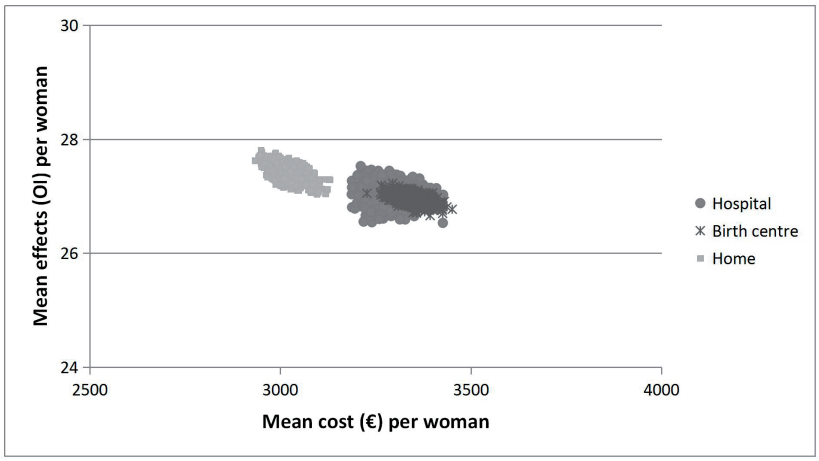
^ community midwife led

 # adjusted for parity, maternal age, maternal background, urbanisation and social economic status

adjusted for maternal age, maternal background, urbanisation and social economic status

** p < 0.05, ** p < 0.01, *** p < 0.001*

[1] Mono-disciplinary-oriented, [2] Mixed group of birth centres, [3] Multi-disciplinary-oriented



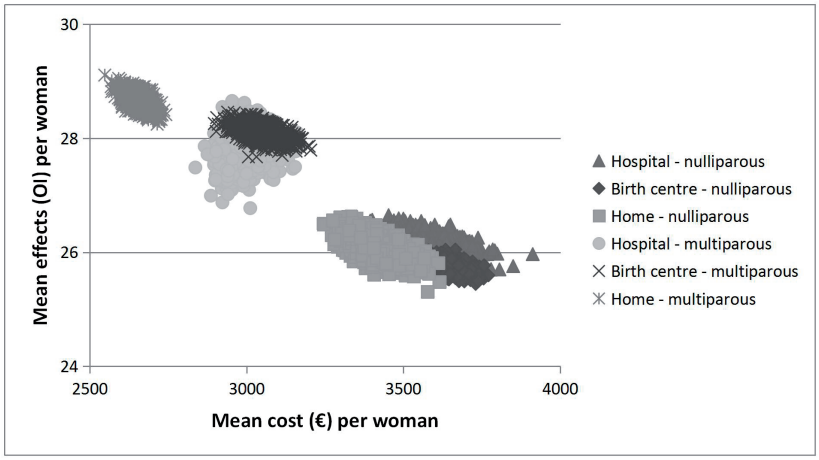
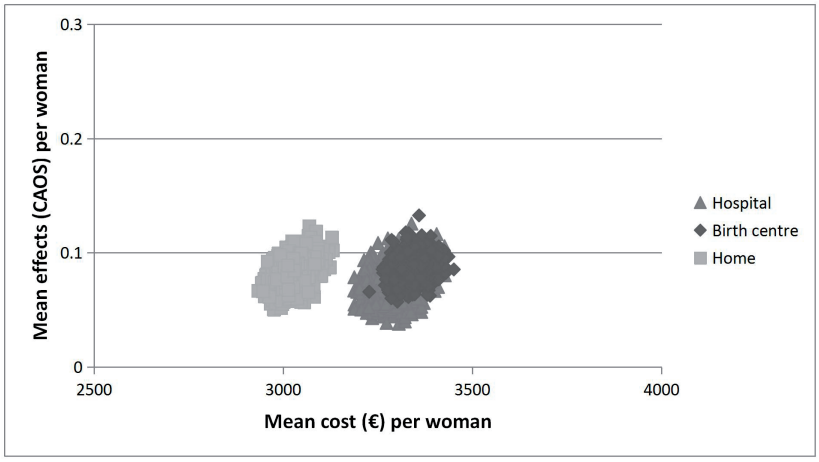


Figure 1a and b: *Mean cost (2015, €) and health outcomes (optimality index) of planned birth in a birth centre, hospital and at home under the supervision of a community midwife*



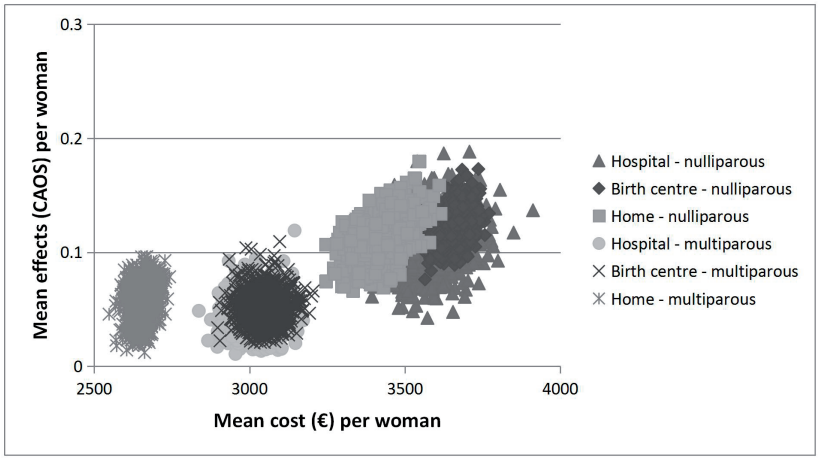


Figure 2a and b: *Mean cost (2015, €) and health outcomes (composite adverse outcome score) of planned birth in a birth centre, hospital and at home under the supervision of a community midwife*

Cost-effectiveness acceptability curves

Figure 3 shows the probability that a planned birth in a hospital or at home is cost-effective, compared with a planned birth in a birth centre, for different willingness-to-pay values (€ 0 - € 2.000) for an improvement of one point on the OI. Regardless of the level of willingness to pay, a planned birth at home was likely to be cost-effective compared with a planned birth in a birth centre. A planned birth at home had more favourable health outcomes (higher score on the OI) and lower costs compared with a planned birth in a birth centre. The probability that a birth planned in a hospital is cost-effective increased with a higher willingness to pay, compared with a planned birth in a birth

centre. A planned birth in a hospital had more favourable health outcomes (higher score on the OI) but also higher costs compared with a planned birth in a birth centre.

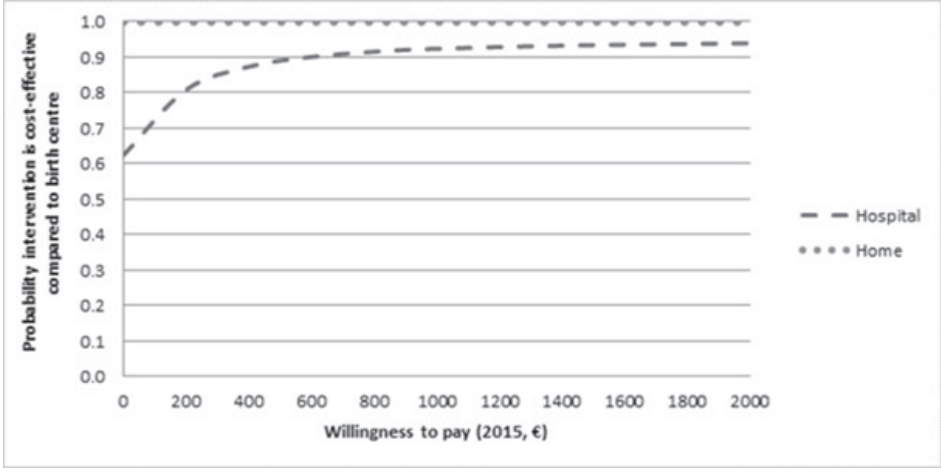


Figure 3: *Cost-effectiveness acceptability curves, graphing the probability to be cost-effective for planned birth at the hospital and at home compared with the birth centre, for different values of the willingness to pay for an additional point on the optimality index*

Cost-effectiveness acceptability curves - location type of birth centre

Figure 4 shows the probability that a planned birth in a particular type of birth centre based on location is cost-effective, compared with a planned birth in the two other location types, for different willingness-to-pay values (€ 0 - € 1.000). If the willingness to pay for an extra point on the OI (health benefits) is € 0, the probability that a planned birth in an alongside birth centre is cost-effective is highest. The higher the willingness to pay, the higher the probability that a planned birth in a freestanding birth centre is cost-effective, compared with the two other types (alongside and on-site). A planned birth in a freestanding birth centre had more favourable health outcomes (higher score on the OI), but higher costs, compared with the two other types.

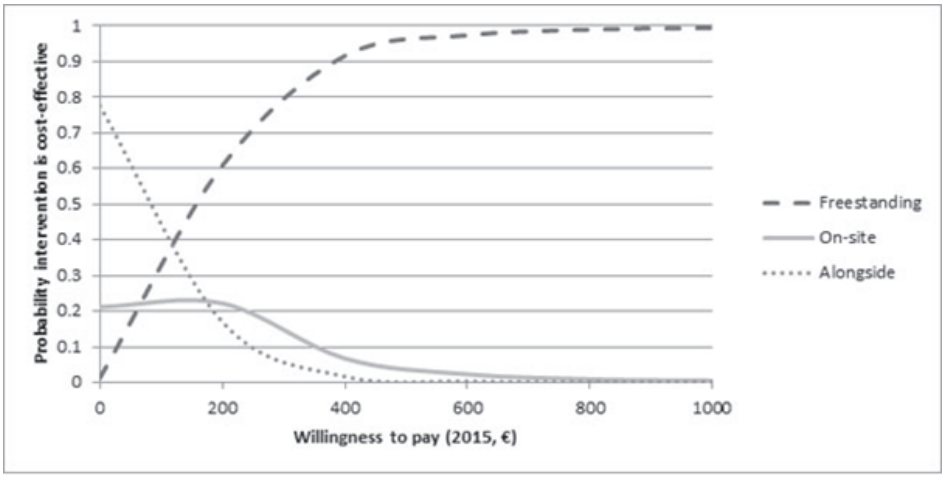


Figure 4: *Cost-effectiveness acceptability curves, graphing the probability to be cost-effective for planned birth in a freestanding, alongside and on-site birth centre, for different values of the willingness to pay for an additional point on the optimality index*

Cost-effectiveness acceptability curves - integration profile of birth centre

Figure 5 shows the probability that a planned birth in a particular type of birth centre based on integration profiles is cost-effective, compared with a planned birth in the two other types, for different willingness-to pay-values (€ 0 - € 1,000). If the willingness to

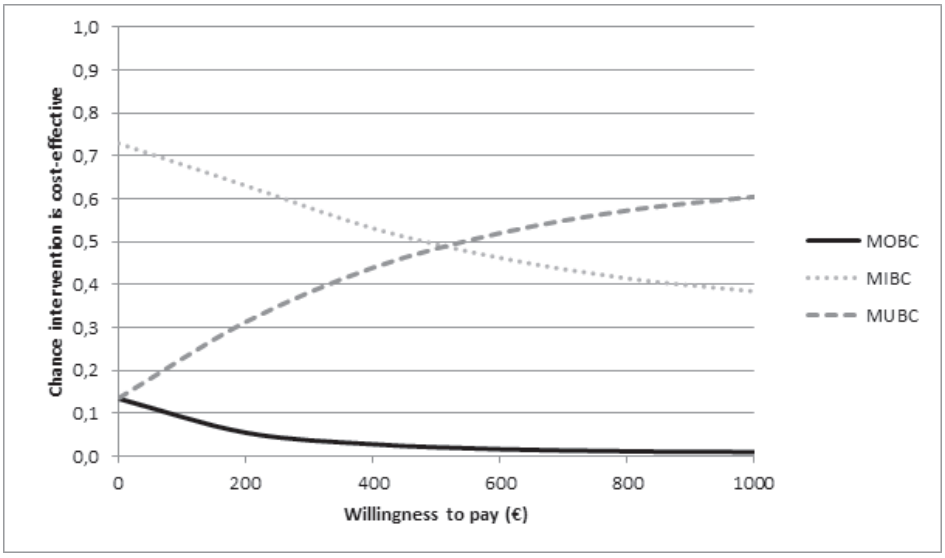


Figure 5: *Cost-effectiveness acceptability curves, graphing the probability to be cost-effective for planned birth in a MOBC, MIBC and MUBC, for different values of the willingness to pay for an additional point on the optimality index*

pay for an extra point on the OI (health benefits) is € 0, the probability that a planned birth in a MIBC is cost-effective is highest. The higher the willingness to pay, the higher the probability that a planned birth in an MUBC is cost-effective, compared with the two other types (MOBC and MIBC). A planned birth in an MUBC has more favourable health outcomes (higher score on the OI), but higher costs, compared with the two other types.

Adjusted total mean costs with varying costs prices

Finally, sensitivity analyses produced similar results as the original generalised linear model on costs: no cost differences between planned birth in a birth centre and in a hospital; planned birth at home had significantly ($p<0.001$) lower costs than planned birth in a birth centre; and no cost differences between the different types (based on location and integration profiles) of birth centres, see Table 4.

DISCUSSION

Summary of main findings

No differences were found in costs for birth if planned either in a birth centre or in a hospital. The costs of a planned birth at home are significantly lower compared with a planned birth in a birth centre. The total adjusted mean costs for births planned in a birth centre, in a hospital and at home were €3.327, €3.330 and €2.998 respectively. There was no difference in the score on the OI for women who planned to give birth in a birth centre compared with women who planned to give birth in a hospital. Women who planned to give birth at home had better outcomes on the OI (higher score on the OI). No differences were found for the CAO by planned place of birth. For nulliparous and multiparous low-risk women, a planned birth at home was the most cost-effective option compared with a planned birth in a birth centre.

No differences were found in the total adjusted mean costs for planned births for the different types of birth centres (based on location and integration profiles). The respective total adjusted mean costs for a birth planned in a freestanding, alongside and on-site birth centre were €3.469, €3.306 and €3.364. The respective total adjusted mean costs for births planned in a birth centre were €3.342, €3.250 and €3.357, when divided by the integration profile a) mono-disciplinary-oriented, b) mixed group of birth centres and c) multi-disciplinary-oriented). Within the three types of birth centres based on location the OI score for nulliparous women with a planned birth in a freestanding birth centre was significantly higher compared with a planned birth in an alongside birth centre. No big differences on the OI were found for the three different integration profiles. The CAO of nulliparous women with a planned birth in an MIMC was significantly more unfavourable than a planned birth in an MUBC.

Table 4: *Adjusted mean (SD) of total cost (2015, €) per woman according to planned place of birth in sensitivity analyses using maximum cost prices and cost prices resulting from a bottom up calculation with five hospitals.*

	Maximum cost		**Bottom-up calculation**	
	Adjusted#		Adjusted#	
ALL LOW-RISK WOMEN	Mean (SD)	B (95% CI)	Mean (SD)	B (95% CI)
Birth centre (n=1610)	3696 (7601)	ref	3206 (6103)	ref
Hospital^ (n=659)	3643 (1456)	-53.5 (-164.7 - 57.7)	3182 (1157)	-24.3 (-112.6 - 64.1)
Home (n=1067)	3271 (1742)	-425.4 (-530.0 - -320.8)***	2919 (1413)	-287.1 (-372.0 - -202.2)***
Birth centre - location				
Freestanding (n=65)	3638 (1281)	-50.5 (-362.0 - 261.0)	3397 (1025)	219.4 (-29.9 - 468.7)
Alongside (n=1158)	3689 (6490)	ref	3178 (5211)	ref
On-site (n=387)	3729 (1433)	39.9 (-102.9 - 182.7)	3260 (1141)	82.4 (-31.3 - 196.1)
Birth Centre - integration profile				
MOBC[1] (n=889)	3730 (2246)	36.0 (-111.7 - 183.7)	3201 (1783)	-54.9 (-172.1 - 62.4)
MIBC[2] (n=338)	3604 (1712)	-89.9 (-272.4 - 92.7)	3165 (1376)	-90.3 (-237.1 - 56.5)
MUBC[3] (n=383)	3694 (3866)	ref	3256 (3093)	ref

^ community midwife led

 # adjusted for parity, maternal age, maternal background, urbanisation and social economic status

**** $p < 0.001$*

[1] Mono-disciplinary-oriented, [2] Mixed group of birth centres, [3] Multi-disciplinary-oriented

Strengths and weaknesses

This study is an initial attempt to expand the net benefit regression framework from two to three treatments. In the literature on cost-effectiveness analyses only two treatments have to date been compared using the net benefit regression approach. This study has a high participation rate as regards midwifery practices (110 of the 127 approached) and birth centres (21 out of 23), which reduces the chance of bias. Sensitivity analyses, using different prices, produced similar results and conclusions to those of the original generalised linear model on costs, in other words: the impact of systematic errors (bias) was low.

The limited time horizon of the study meant that the registration of outcomes for mother and child did not extend beyond one week postpartum. Perinatal events (such as a low Apgar score) can result in associated longer-term costs, which are not covered in this study. As serious perinatal events were rare in this low-risk group, this would not have changed the results (22). As usual in economic evaluations we had to deal with missing data. However, the magnitude of missing data was limited and multiple imputation (20 datasets) was used to impute the missing data.

A problem of all (Dutch) studies comparing places of birth is that women in these places are all different. Although this is taken into account in the statistical analyses by adjusting for SES, maternal background, parity, age and urbanisation, it is not possible to adjust completely. For example, women who planned to give birth in a birth centre or hospital may have a different view on childbirth and are perhaps more anxious than women who planned to give birth at home (55-58). In addition, there may be differences between the groups as regards lifestyle, such as smoking, and obstetric history, including the number of miscarriages. Therefore, the minor differences found in this study may be the result of differences between the women rather than between the settings.

Interpretation of the results

This study is part of the Dutch Birth Centre study (30). The motive for this national study was the strong increase in the number of birth centres in the Netherlands over the last few decades and the unknown effect on outcomes such as costs, medical outcomes and client experiences.

We found comparable costs for a planned birth supervised by a community midwife in a birth centre and in a hospital and significantly lower costs for a planned birth at home. Another Dutch study found that the total costs associated with pregnancy, childbirth, and postpartum care are comparable for home birth and hospital birth. That study found lower costs during childbirth and postpartum care for maternity care assistance, admission and travelling costs for the home birth group compared with the hospital group (14). Our study showed lower costs for maternity care assistance for the birth centre group compared with the hospital and home birth group. In line with that study

the admission and transport costs were lower for the home birth group. The other study was based on actual births and not, as in our study, on planned place of birth (intention to treat) and did not include the birth centre setting. We did not include pregnancy costs since this is not part of birth centre care in the Netherlands. Our results are in line with a study in England where a planned birth at home is cost-effective compared with a planned birth in alongside or freestanding midwifery units and obstetric units. However, we did not find increased adverse perinatal outcomes for nulliparous women planning to give birth at home (15).

One of the aims of this study is to provide objective, reliable and valid information to support decision-making and policy-making in healthcare. As most low-risk women in the Netherlands are now planning to give birth outside their home, it is necessary to offer these women a good alternative. Birth centres offer a more homelike environment and are based on the philosophy of physiological birth. To know whether birth centres are a good alternative, policy makers, health insurers and managers want information on the cost-effectiveness of birth centres versus alternative places of birth. We conclude that for nulliparous and multiparous low-risk women a planned birth at home was the most cost-effective option compared with a planned birth in a birth centre. Planned births in birth centres have similar health outcomes and costs as hospital births for low-risk women.

REFERENCES

1. College voor Zorgverzekeringen. Verloskundig Vademecum 2003. Diemen: College voor Zorgverzekeringen. Diemen, 2003.
2. KNOV. Midwifery in the Netherlands. 2016 [Available from: http://www.knov.nl/samenwerken/tekstpagina/489/midwifery-in-the526 accessed 12 May 2017.
3. The Netherlands Perinatal Registry. Perinatal care in the Netherlands 2013 (in Dutch: Perinatale zorg in Nederland 2013). Utrecht, 2014.
4. Hermus M, Wiegers T, Hitzert M, et al. The Dutch Birth Centre Study: study design of a programmatic evaluation of the effect of birth centre care in the Netherlands. BMC pregnancy and childbirth 2015;15:148.
5. Rooks JP, Weatherby NL, Ernst EKM. The National Birth Center Study: part I—methodology and prenatal care and referrals. Journal of Nurse-Midwifery 1992;37(4):222-53.
6. Laws PJ, Lim C, Tracy S, et al. Characteristics and practices of birth centres in Australia. Australian and New Zealand Journal of Obstetrics and Gynaecology 2009;49(3):290-95.
7. De Vries R, Wiegers TA, Smulders B, et al. The Dutch Obstetrical System. Birth models that work 2009:31.
8. Johnson TR, Callister LC, Freeborn DS, et al. Dutch women's perceptions of childbirth in the Netherlands. MCN: The American Journal of Maternal/Child Nursing 2007;32(3):170-77.
9. Wagner M. Born in the USA: How a broken maternity system must be fixed to put women and children first: University of California Press Berkeley 2006.
10. Mander R. The relevance of the Dutch system of maternity care to the United Kingdom. Journal of advanced nursing 1995;22(6):1023-26.
11. Oppenheimer C. Organising midwifery led care in The Netherlands. BMJ 1993;307(6916):1400-02.
12. Mohangoo AD, Buitendijk SE, Hukkelhoven CW, et al. Higher perinatal mortality in the Netherlands than in other European countries: the Peristat-II study. Nederlands tijdschrift voor geneeskunde 2008;152(50):2718-27.
13. Bonsel GJ, Birnie E, Denktas S, et al. Dutch report:Lines in the perinatal mortality, Signalement study of pregnancy and birth in 2010 [in Dutch: Lijnen in de perinatale sterfte, signalementstudie zwangerschap en geboorte 2010]. Rotterdam: Erasmus MC 2010.
14. Hendrix MJC, Evers SMAA, Basten MCM, et al. Cost Analysis of the Dutch Obstetric System: low-risk nulliparous women preferring home or short-stay hospital birth-a prospective non-randomised controlled study. BMC health services research 2009;9:211.
15. Schroeder E, Petrou S, Patel N, et al. Cost effectiveness of alternative planned places of birth in woman at low risk of complications: evidence from the Birthplace in England national prospective cohort study. BMJ 2012;344
16. Stone PW, Zwanziger J, Walker PH, et al. Economic analysis of two models of low- risk maternity care: A freestanding birth center compared to traditional care. Research in nursing & health 2000;23(4):279-89.
17. Hundley VA, Donaldson C, Lang GD, et al. Costs of intrapartum care in a midwife-managed delivery unit and a consultant-led labour ward. Midwifery 1995;11(3):103-09.
18. Henderson J, Petrou S. Economic implications of home births and birth centers: a structured review. Birth 2008;35(2):136-46.
19. Spitzer MC. Birth centers; Economy, Safety, and Empowerment. Journal of Nurse-Midwifery 1995;40(4):371-75.

20. Janssen PA, Mitton C, Aghajanian J. Costs of planned home vs. hospital birth in British Columbia attended by registered midwives and physicians. PloS one 2015;10(7):e0133524.
21. Tracy SK, Welsh A, Hall B, et al. Caseload midwifery compared to standard or private obstetric care for first time mothers in a public teaching hospital in Australia: a cross sectional study of cost and birth outcomes. BMC pregnancy and childbirth 2014;14:46.
22. Hermus MAA, Hitzert M, Boesveld IC, et al. Differences in optimality index between planned place of birth in a birth centre and alternative planned places of birth, a nationwide prospective cohort study in the Netherlands, BMJ Open 2017.
23. Hollis S, Campbell F. What is meant by intention to treat analysis? Survey of published randomised controlled trials. BMJ 1999;319(7211):670-74.
24. Hermus M, Boesveld I, Hitzert M, et al. Defining and describing birth centres in the Netherlands - a component study of the Dutch Birth Centre Study. BMC Pregnancy & Childbirth 2017 2017, 17.1: 210.
25. Valentijn P, Boesveld I, van der Klauw D, et al. Towards a taxonomy for integrated care: a mixed-methods study. International Journal of Integrated Care 2015;15
26. Kodner D. All together now: a conceptual exploration of integrated care. Healthcare Quarterly (Toronto, Ont) 2008;13:6-15.
27. Goodwin N, Peck E, Freeman T, et al. Managing across diverse networks of care: lessons from other sectors. Report to the NHS SDO R&D Programme Birmingham: Health Services Management Centre, University of Birmingham 2004
28. Boesveld IC, Bruijnzeels MA, Hitzert M, et al. Typology of birth centres in the Netherlands using the Rainbow model of integrated care: results of the Dutch Birth Centre Study. BMC Health Services Research 2017;17:426. doi: 10.1186/s12913-017-2350-9
29. Hermus MAA, Boesveld IC, van der Pal-de Bruin KM, et al. Development of the Optimality Index-NL2015, an instrument to measure outcomes of maternity care. Journal of Midwifery and Women's Health 2017.
30. Hermus MAA, Wiegers TA, Hitzert MF, et al. The Dutch Birth Centre Study: study design of a programmatic evaluation of the effect of birth centre care in the Netherlands. BMC pregnancy and childbirth 2015;15:148.
31. Wiegers TA, Keirse M, Berghs GAH, et al. An approach to measuring quality of midwifery care. Journal of clinical epidemiology 1996;49(3):319-25.
32. Murphy PA, Fullerton JT. Development of the optimality index as a new approach to evaluating outcomes of maternity care. Journal of Obstetric, Gynecologic, & Neonatal Nursing 2006;35(6):770-78.
33. Murphy PA, Fullerton JT. Measuring outcomes of midwifery care: Development of an instrument to assess optimality. Journal of Midwifery & Women's Health 2001;46(5):274-81.
34. StatisticNetherlands. Consumer price index [Available from: statline.cbs.nl accessed April 2015.
35. Tan SS, Rutten F, Van Ineveld B, et al. Comparing methodologies for the cost estimation of hospital services. The European Journal of Health Economics 2009;10:39-45.
36. Tan SS, Bouwmans CA, Rutten FF, et al. Update of the Dutch manual for costing in economic evaluations. International journal of technology assessment in health care 2012;28(02):152-58.
37. Hakkaart-van R, Tan S, Bouwmans C. Manual for costing research: methods and cost prices for economic evaluation in health care, update 2010 [in Dutch]. Diemen: College voor zorgverzekeringen, 2010.
38. The Dutch Healthcare Authority. Dataset cost care activities of the Dutch Healthcare Authority. Utrecht, the Netherlands, 2015.

39. The Dutch Healthcare Authority. Working with the casemix system (DBC) [in Dutch] [website]. The Dutch Healthcare Authority,; 2015 [Available from: http://www.dbconderhoud.nl/zz-releases/rz15b-update-tarieventabel2015.
40. The Royal Dutch Organization of Midwives (KNOV). Duties in obstetrics. Research on tasks, time-management and production of community midwives [In Dutch]. 2015
41. The Royal Dutch Organization of Midwives (KNOV). Tariff and cost information [In Dutch], 2015.
42. Liem SMS, van Baaren GJ, Delemarre FMC, et al. Economic analysis of use of pessary to prevent preterm birth in women with multiple pregnancy (ProTWIN trial). Ultrasound in Obstetrics & Gynecology 2014;44(3):338-45.
43. The National Health Care Institute. Medicine costs [in Dutch] [Available from: www.medicijnkosten.nl accessed March 2015.
44. Baaren GJ, Jozwiak M, Opmeer BC, et al. Cost- effectiveness of induction of labour at term with a Foley catheter compared to vaginal prostaglandin E2 gel (PROBAAT trial). BJOG: An International Journal of Obstetrics & Gynaecology 2013;120(8):987-95.
45. de Graaf JP, Huizer M. Request regular price Nitroux Oxide at the Dutch Healthcare Authority and health insurers [in Dutch]: Geboortecentrum Sophia, Erasmus MC, Kraamzorg Rotterdam.
46. The RAVEL study group. Remifentanil patient controlled analgesia versus epidural analgesia during labor. submitted.
47. The Royal Dutch Organization of Midwives (KNOV). Tariff and cost information, 2015.
48. Vijgen S, Westerhuis MEMH, Opmeer BC, et al. Cost- effectiveness of cardiotocography plus ST analysis of the fetal electrocardiogram compared with cardiotocography only. Acta obstetricia et gynecologica Scandinavica 2011;90(7):772-78.
49. Little R, Rubin D. Multiple Imputation for Nonresponse in Surveys: New York: John Wiley & Sons, 1987.
50. Briggs A, Clark T, Wolstenholme J, et al. Missing.... presumed at random: cost- analysis of incomplete data. Health economics 2003;12(5):377-92.
51. Thompson SG, Barber JA. How should cost data in pragmatic randomised trials be analysed? BMJ: British Medical Journal 2000;320(7243):1197.
52. The Netherlands Institute for Social Research. [Available from: http://www.scp.nl/english/ accessed August 18th 2015 2015.
53. Hoch JS, Rockx MA, Krahn AD. Using the net benefit regression framework to construct cost-effectiveness acceptability curves: an example using data from a trial of external loop recorders versus Holter monitoring for ambulatory monitoring of. BMC Health Services Research 2006;6:68.
54. Bai J, Wong FWS, Bauman A, et al. Parity and pregnancy outcomes. American journal of obstetrics and gynecology 2002;186:274-78.
55. Kleiverda G, Steen A, Andersen I, et al. Place of delivery in The Netherlands: maternal motives and background variables related to preferences for home or hospital confinement. European Journal of Obstetrics & Gynecology and Reproductive Biology 1990;36:1-9.
56. Wiegers TA, van der Zee J, Kerssens JJ, et al. Home birth or short-stay hospital birth in a low risk population in the Netherlands. Social Science & Medicine 1998;46(11):1505-11.
57. van Haaren-ten Haken T, Hendrix M, Nieuwenhuijze M, et al. Preferred place of birth: characteristics and motives of low-risk nulliparous women in the Netherlands. Midwifery 2012;28(5):609-18.
58. Van Der Hulst LA, Van Teijlingen ER, Bonsel GJ, et al. Does a pregnant woman's intended place of birth influence her attitudes toward and occurrence of obstetric interventions? Birth 2004;31:28-33.

Chapter 7

Experiences of women who planned birth in a birth centre compared to alternative planned places of birth.

Results of the Dutch Birth Centre Study

Marit Hitzert
Marieke A.A. Hermus
Marisja Scheerhagen
Inge C. Boesveld
Therese A. Wiegers
M. Elske van den Akker-van Marle
Paula van Dommelen
Karin M. van der Pal-de Bruin
Johanna P. de Graaf

Midwifery, 2016, 40: 70-78

ABSTRACT

Objective: To assess the experiences with maternity care of women who planned birth in a birth centre and to compare them to alternative planned places of birth, by using the responsiveness concept of the World Health Organization.

Design: This study is a cross-sectional study using the ReproQ questionnaire filled out eight to ten weeks after birth. The primary outcome was responsiveness of birth care. Secondary outcomes included overall grades for birth care and experiences with the birth centre services. Regression analyses were performed to compare experiences among the planned places of birth. The study is part of the Dutch Birth Centre Study.

Setting: The women were recruited by 82 midwifery practices in the Netherlands, within the study period 1 August 2013 and 31 December 2013.

Participants: A total of 2162 women gave written consent to receive the questionnaire and 1181 (54.6%) women completed the questionnaire.

Measurements and findings: Women who planned to give birth in a birth centre:

1) had similar experiences as the women who planned to give birth in a hospital receiving care of a community midwife.
2) had significantly less favourable experiences than the women who planned to give birth at home. Differences during birth were seen on the domains dignity (OR=1.58, 95% CI=1.09-2.27) and autonomy (OR=1.77, 95% CI=1.25-2.51), during the postpartum period on the domains social considerations (OR=1.54, 95% CI=1.06-2.25) and choice and continuity (OR=1.43, 95% CI=1.00-2.03).
3) had significantly better experiences than the women who planned to give birth in a hospital under supervision of an obstetrician. Differences during birth were seen on the domains dignity (OR=0.51, 95% CI=0.31-0.81), autonomy (OR=0.59, 95% CI=0.35-1.00), confidentiality (OR=0.57, 95% CI=0.36-0.92) and social considerations (OR=0.47, 95% CI=0.28-0.79). During the postpartum period differences were seen on the domains dignity (OR=0.61, 95% CI=0.38-0.98), autonomy (OR=0.52, 95% CI=0.31-0.85) and basic amenities (OR=0.52, 95% CI=0.30-0.88). More than 80% of the women who received care in a birth centre rated the facilities, the moment of arrival/departure and the continuity in the birth centre as good.

Key conclusions and implications for practice: In the last decades, many birth centres have been established in different countries, including the United Kingdom, Australia, Sweden and the Netherlands. For women who do not want to give birth at home a birth centre is a good choice: it leads to similar experiences as a planned hospital birth. Emphasis should be placed on ways to improve autonomy and prompt attention for women who plan to give birth in a birth centre as well as on the improvement of care in case of a referral.

INTRODUCTION

Traditionally, the quality of maternity care is described in terms of perinatal morbidity and mortality outcomes. Currently, other aspects of health care, such as client experiences, are important as well, also in terms of their potential to affect clinical outcomes (1-4). The Dutch maternity care system is often set as an example to learn from, because of its high home birth rate, its low number of obstetric interventions and a consequence, low cost and yet high assumed health outcomes (5-9). In the Netherlands, the quality of care experienced by women during the maternity care process in general is high (10).

The Dutch maternity care system is based on primary care provided by independent community midwives caring for women with a 'normal', uncomplicated, or low-risk pregnancy. Obstetricians provide in-hospital secondary care for women with a complicated, or high-risk pregnancy or birth. When a complication occurs or the risk of a complication increases substantially during pregnancy or during labour, or when pharmacological pain relief is requested, a woman will be referred from primary to secondary care. For women who were referred to secondary care before the 36th week of pregnancy, their planned place of birth will by necessity be in a hospital, under supervision of an obstetrician. Low-risk women can choose where they want to give birth: in a birth centre, in hospital or at home, all receiving care from a community midwife. Dutch birth centres have been established in the last decade to accommodate the growing number of low-risk women who do not want to give birth at home. A birth centre is a setting where women with uncomplicated pregnancies can give birth in a home-like environment (11).

Several international studies have explored the influences of the birth settings on the experience of women. A randomized, controlled trial in Sweden showed that low-risk women giving birth in a birth centre expressed greater satisfaction with care than women who gave birth in a hospital (12). A study in Australia showed that a birth centre setting ensured that women received personalised, genuine care that transcended the entire childbearing continuum (13). Differences in philosophy between hospital and birth centre settings is seen as an important component of care experiences (14). It is also known that women who have given birth in a specific birth centre were less satisfied than those who have given birth at home (15). In Australia, women giving birth at home rated their midwives higher than women giving birth at a hospital, with women giving birth in a birth centre generally scoring between the other two groups (16).

Currently we know very little of how women who planned to give birth in a birth centre experienced their care in the Netherlands. There is no study available that compares the experiences in birth centres with other birth settings in the Netherlands. Therefore, the aim of this study was to assess the experiences with maternity care of women who planned birth in a birth centre and to compare them to alternative planned places of birth, by using the responsiveness concept of the World Health Organization. The World

Health Organization introduced the concept of responsiveness as one of the available approaches to address service quality in an internationally comparable way (17). The concept offers the opportunity to capture client's experiences on eight predefined domains. Responsiveness is defined as aspects of the way individuals are treated and the environment in which they are treated during health system interactions (18, 19). The concept has been applied in the Dutch maternity care a few times before (20, 21).

This research is part of the Dutch Birth Centre Study (22). This national project evaluates the effect of Dutch birth centres on aspects such as client and partner experiences, process and outcome variables, costs and professional experiences.

METHODS

Setting

The study was designed as a cross-sectional study. A minimum of three midwifery practices working in the area of each of the 23 birth centres included in the Dutch Birth Centre Study, were randomly recruited. This resulted in the participation of 82 midwifery practices. During the study period from 1 August to 31 December 2013 these 82 midwifery practices recruited women for participation. The midwifery practices varied in size and were located all over the country.

Data collection

Almost all women in the Netherlands, including women who gave birth under responsibility of an obstetrician, receive postpartum care from community midwives. During the data collection period, the community midwives of the 82 practices asked the women who received postpartum care for permission to send them a questionnaire. In this way, data were obtained from women with different planned places of birth: in a birth centre, in a hospital, or at home and under care of a midwife or an obstetrician. Excluded were women who could not read or speak Dutch and women with no specific preference for a place of birth.

A total of 2162 women gave written consent either to receive the questionnaire through e-mail, as a hard-copy or to have an interview by phone. We explicitly tried to include women from different backgrounds, by giving the choice of an interview by phone. The women completed the questionnaire around eight to ten weeks after birth. A reminder was sent two weeks later, when needed.

Questionnaire

The ReproQ is a two-part questionnaire (part 1 prenatal, part 2 postnatal) and was developed to assess the responsiveness of the maternity care system in the Netherlands by

evaluating client experiences. Responsiveness is defined as 'aspects of the way individuals are treated and the environment in which they are treated during health system interactions' (21). The postnatal part of the ReproQ was used in this study and includes two reference periods: the event of labour and birth and the subsequent postpartum week. The questionnaire consists of the following components: 1) questions about the process of care, including referral or emergency situations, 2) a question about the grade of overall experience during birth and the postpartum period, 3) questions about the eight domains of the WHO concept of responsiveness, 4) questions including experienced health outcomes, 5) the individual ranking of the various domains of responsiveness according to their importance and 6) the respondent's socio-demographic characteristics. For this study, questions about facilities (e.g. homelike environment, hotel service and bath) and transfers (e.g. change of caregiver and change of room) were included for women who received care in a birth centre.

The responsiveness concept is described to consist of eight domains: 1) dignity, 2) autonomy, 3) confidentiality, 4) communication, 5) prompt attention), 6) social consideration, 7) basic amenities and 8) choice and continuity. Each domain consists of several items, see Table 1.

The questions could be answered on a four-point scale with the values: always (4), mostly (3), sometimes (2) and never (1) (17). An average score per domain was computed this way. The questionnaire avoids any implicit or explicit preference towards the providers or the organizational structures, leaving room to compare different organizational structures and different levels of care (21).

Data handling

Questionnaires were excluded if more than 50% of the answers were missing in two or more domains. The client experiences were compared according to the women's planned place of birth. The information was based on the place of birth as it was planned one month before the birth, as recorded in the questionnaire. Subgroup analyses were performed for women referred to secondary care during birth and women who were not referred.

Data analysis

The basic characteristics of our respondents were compared with the characteristics of all the women receiving postpartum care of a participating midwife, the reference group. Therefore, data of all births occurring in the midwifery practices that participated in our study between August 2013 and December 2013 were derived from the Netherlands Perinatal Registry (PRN-foundation). This PRN-foundation is a joint effort of four professions (midwives, general practitioners, obstetricians and paediatricians) that provide

perinatal care in the Netherlands. All these professions have their own volunteer-based medical registries, which are linked to one combined PRN-registry (23).

Univariate analyses were carried out using the chi-square test and the Fisher's exact test for categorical factors and a one-way analysis of variance was carried out for

Table 1: *Items covered by the eight responsiveness domains*

Domain	Item
Dignity	Respecting privacy
	Treating with respect
	Giving personal attention
	Treating with kindness
	Considering personal wishes regarding birth
	Trustworthy as health professional
Autonomy	Involving client in decision-making
	Acceptance of treatment refusal
	Involving client in decision-making on pain relief
	Involving client in decision-making on setting of birth
Confidentiality	Providing medical information to family members after consent
	Discussing the medical situation without others hearing it
	Secured provision of medical information to others
Communication	Responsive to client questions
	Consistency of advice across professionals
	Comprehensibility of explanation
	Provision of information while treated
Prompt attention	Access for contact in urgent situations
	Access for contact without urgency
	Waiting time for service
	Availability of maternity care assistance
	Physical accessibility of setting
	Prompt phone response of health professional
Social consideration	Involvement of the partner or family in care provision
	Attention for family and household
	Support from partner or family
Basic amenities	Comfort of setting
	Hygiene of setting
	Physical accessibility of places (e.g. room and bathroom)
Choice and continuity	Continuity of care provision when change of individual professional (same discipline)
	Continuity of care provision when change professional (across disciplines)
	Allowance for selecting a preferred type of health professional
	Being explicit on which health professional is actual in charge

continuous-characteristics. The mean and median grade (on a 10-point scale), including the 25th and 75th percentile, of the experience of overall care were calculated according to the planned place of birth.

Logistic regression analyses were performed with the responsiveness outcomes as dependent variables (optimal=4 and non-optimal<4) and with the planned place of birth as independent variable. We adjusted for the basic characteristics that differed among the groups: parity, education and ethnicity. The birth centre group was used as reference. *P* values less than 0.05 (two-sided) were considered statistically significant.

Descriptive analyses were performed on the additional questions about the birth centre services. The questions were filled out only by women who received care in a birth centre. The analyses were performed with SPSS 21.0 (24).

Ethical considerations

The design and planning of the study were presented to the Medical Ethics Committee of the University Medical Centre Utrecht. They confirmed that this study agrees with the Dutch legal regulations in terms of the methods used in this study and, therefore, an official ethical approval is not required (25). To invite the clients for participation in this study, permission from the midwifery practices was obtained. Informative letters to the clients were given by the midwifery practices directly. The letter clearly explained that if a client did not want to participate, she was not obligated to do so and this would not affect her care process. By signing the letter, clients consented either to receive the questionnaire digitally, as a hard-copy or to have an interview by phone.

RESULTS

Study population

A total of 2162 women gave permission to receive the questionnaire; 1654 (76.5%) by e-mail, 464 (21.5%) by post and 44 (2.0%) women wanted to be interviewed by phone. We received 1181 completed questionnaires (including interviews by phone), with a total response rate of 54.6%. Forty-seven questionnaires were excluded, leading to 1134 questionnaires available for the analysis: 263 with a planned birth centre birth, 350 with a planned home birth, 262 with a planned hospital birth under care of a community midwife and 115 with a planned hospital birth under supervision of an obstetrician.

Table 2 shows the characteristics of the participants and the reference group. No differences were found in parity and referral during birth between the respondents and the total group of women who gave birth in one of the participating midwifery practices. However, the respondents were significantly older, had a higher SES score, were more often of Dutch origin, were more often under supervision of the midwife at the start of

labour and the respondents received less often an intervention during birth, compared to the reference group.

Table 2: *Characteristics of the respondents and the reference group*

	Participants	**Reference group**
	(n = 1081)	*(n = 61169)*
Characteristics	*No. (%)*	*No. (%)*
Age*		
≤ 25	56 (5.6)	9204 (15.1)
26 - 35	736 (73.2)	42516 (69.6)
≥ 36	213 (21.2)	9322 (15.3)
Parity		
primiparous	490 (47.9)	28160 (46.1)
multiparous	532 (52.1)	32971 (53.9)
SES*		
low	70 (6.5)	10342 (16.9)
middle	807 (74.7)	41395 (67.7)
high	204 (18.9)	9432 (15.4)
Ethnicity*		
Dutch	921 (91.7)	46280 (78.1)
non-Dutch	83 (8.3)	12981 (21.9)
Start birth*		
midwife supervision	880 (82.1)	35288 (57.7)
obstetrician supervision	192 (17.9)	25881 (42.3)
Referral during birth		
no	815 (76.6)	46258 (75.6)
yes	249 (23.4)	14903 (24.4)
Interventions*		
no vacuum/forceps or section caesarean	928 (86.0)	47144 (77.1)
vacuum extraction/forceps	98 (9.1)	4852 (7.9)
section caesarean	53 (4.9)	9173 (15.0)

** p-value <0.05 (chi-square test)*

Table 3 shows the characteristics of the respondents according to their planned place of birth. The women who planned to give birth in a birth centre were more often primiparous and highly educated compared to the women who planned to give birth under care of a community midwife in a hospital, at home or under supervision of an obstetrician in a hospital. The women who planned to give birth in a birth centre or at home were more often of Dutch origin compared to the women who planned to give birth in a hospital (under care of a community midwife or of an obstetrician).

Table 3: *Respondent's characteristics according to planned place of birth*

	Community midwife			Obstetrician	
	Birth centre	Hospital	Home	Hospital	Total
	(n = 263)¥	*(n = 262)¥*	*(n = 350)¥*	*(n = 115)¥*	*(n = 990)¥*
	No. (%)	*No. (%)*	*No. (%)*	*No. (%)*	*No. (%)*
Age					
≤ 25	12 (4.6)	14 (5.8)	21 (6.5)	3 (2.7)	50 (5.3)
26 - 35	195 (75.0)	174 (72.5)	238 (73.2)	76 (69.1)	683 (73.1)
≥ 36	53 (20.4)	52 (21.7)	66 (20.3)	31 (28.2)	202 (21.6)
Parity*					
primiparous	154 (58.8)	113 (46.5)	126 (38.0)	47 (42.3)	440 (46.4)
multiparous	108 (41.2)	130 (53.5)	206 (62.0)	64 (57.7)	508 (53.6)
Education*					
low	16 (6.1)	14 (6.0)	26 (8.0)	10 (9.4)	66 (7.1)
middle	64 (24.4)	72 (30.9)	120 (36.9)	35 (33.0)	291 (31.4)
high	182 (69.5)	147 (63.1)	179 (55.1)	61 (57.5)	569 (61.4)
Ethnicity*					
Dutch	247 (93.9)	203 (84.6)	312 (96.3)	93 (85.3)	855 (91.3)
non-Dutch	16 (6.1)	37 (15.4)	12 (3.7)	16 (14.7)	81 (8.7)
Actual place of birth**					
birth centre	128 (48.7)	6 (2.3)	4 (1.1)	0 (0.0)	138 (13.9)
home	18 (6.8)	26 (9.9)	232 (66.3)	0 (0.0)	276 (27.9)
hospital, under care of a midwife	7 (2.7)	137 (52.3)	20 (5.7)	0 (0.0)	164 (16.6)
hospital, under supervision of an obstetrician	107 (40.7)	91 (34.7)	90 (25.7)	114 (99.1)	402 (40.7)
unknown	3 (1.1)	2 (0.8)	4 (1.1)	1 (0.9)	10 (1.0)
Experienced health mother in general					
poor/moderate	9 (3.4)	6 (2.5)	6 (1.8)	8 (7.2)	29 (3.1)
good	76 (28.9)	67 (27.5)	84 (25.5)	42 (37.8)	269 (28.4)
very good	100 (38.0)	101 (41.4)	138 (41.8)	35 (31.5)	374 (39.5)
excellent	78 (29.7)	70 (28.7)	102 (30.9)	26 (23.4)	276 (29.1)
Experienced health mother after birth					
healthy	172 (65.4)	182 (69.7)	254 (72.8)	67 (58.3)	675 (68.3)
small problems	77 (29.3)	67 (25.7)	82 (23.5)	39 (33.9)	265 (26.8)
big problems/problems, impact unclear	14 (5.3)	12 (4.5)	13 (3.8)	9 (7.8)	48 (4.9)
Experienced health baby after birth					
healthy	229 (87.4)	229 (87.4)	318 (91.4)	93 (80.9)	869 (88.0)
small problems	29 (11.1)	25 (9.5)	22 (6.3)	20 (17.4)	96 (9.7)
big problems/problems, impact unclear	4 (1.6)	8 (3.1)	8 (2.3)	2 (1.8)	22 (2.2)
Hospital admission of the child after birth*					
no	188 (72.3)	196 (74.8)	304 (87.4)	58 (50.9)	746 (75.8)
yes, at the maternity ward	63 (24.2)	58 (22.1)	38 (10.9)	41 (36.0)	200 (20.3)
yes, high care	9 (3.5)	8 (3.1)	6 (1.7)	15 (13.2)	38 (3.9)

** p-value <0.05 (chi-square test/Fisher's test)*

*** p-value <0.05 (statistical test are performed on expected place is equal to the final place of birth; hospital births under supervision of an obstetrician and unknown groups are excluded)*

¥ numbers are varying between characteristics due to missing data

Grades for experiences during birth and the postpartum period

In general, the mean and median grades of experiences during birth and the postpartum period (adjusted for parity, education and ethnicity) were quite similar within each planned places of birth. The mean grades for the planned place of birth were 8.4 (sd=1.3) in a birth centre, 8.4 (sd=1.3) in a hospital under care of a community midwife, 8.7 (sd=1.3) at home and 8.0 (sd=1.6) in a hospital under supervision of an obstetrician. The mean grade for the planned place of birth in a birth centre was significantly ($p<0.05$) higher than the mean grade for the planned place of birth in a hospital under supervision of an obstetrician. The median grades were respectively 9, 8, 9 and 8.

Table 4: *Responsiveness outcomes according to planned place of birth*

	Under care of a community midwife						
	Birth centre (REF)		**Hospital**				
	(n = 263)		*(n = 262)*				
	No. (%)		*No. (%)*				
Responsiveness during birth	**optimal**	**non-optimal**	**optimal**	**non-optimal**	**CRUDE OR**	**Adj OR**	**95% CI**
Dignity	163 (62.0)	100 (38.0)	165 (63.0)	97 (37.0)	1.04	0.94	0.65-1.37
Autonomy	92 (36.2)	162 (63.8)	104 (41.3)	148 (58.7)	1.24	1.11	0.76-1.61
Confidentiality	180 (69.8)	78 (30.2)	170 (67.7)	81 (32.3)	0.91	0.84	0.57-1.25
Communication	145 (55.3)	117 (44.7)	131 (52.0)	121 (48.0)	0.87	0.79	0.55-1.14
Prompt attention	145 (55.1)	118 (44.9)	139 (55.4)	112 (44.6)	1.01	0.99	0.69-1.42
Social considerations	212 (80.6)	51 (19.4)	187 (74.8)	63 (25.2)	0.71	0.70	0.45-1.08
Basic Amenities	215 (82.1)	47 (17.9)	189 (76.2)	59 (23.8)	0.70	0.68	0.44-1.07
Choice and Continuity	159 (60.7)	103 (39.3)	157 (64.1)	88 (35.9)	1.16	1.08	0.74-1.57
Responsiveness postpartum	**optimal**	**non-optimal**	**optimal**	**non-optimal**	**CRUDE OR**	**Adj OR**	**95% CI**
Dignity	169 (64.3)	94 (35.7)	165 (63.0)	97 (37.0)	0.95	0.93	0.64-1.35
Autonomy	196 (76.6)	60 (23.4)	176 (70.4)	74 (29.6)	0.73	0.71	0.47-1.07
Confidentiality	174 (67.4)	84 (32.6)	154 (61.1)	98 (38.9)	0.76	0.76	0.53-1.11
Communication	96 (36.6)	166 (63.4)	108 (42.9)	144 (57.1)	1.30	1.19	0.83-1.73
Prompt attention	158 (60.1)	105 (39.9)	137 (54.6)	114 (45.4)	0.80	0.81	0.56-1.16
Social considerations	179 (68.1)	84 (31.9)	162 (65.1)	87 (34.9)	0.87	0.83	0.57-1.22
Basic Amenities	208 (80.6)	50 (19.4)	197 (81.1)	46 (18.9)	1.03	1.02	0.65-1.63
Choice and Continuity	156 (59.5)	106 (40.5)	156 (63.7)	89 (36.3)	1.19	1.19	0.82-1.72

Birth centre as reference and adjusted for parity, education and ethnicity
** p < 0.05, ** p < 0.01, *** p < 0.001*

Responsiveness outcomes

Table 4 shows the crude and adjusted odds ratios (ORs) for each domain of responsiveness during birth and the postpartum period, according to the planned place of birth. We adjusted for parity, education and ethnicity, with the birth centre group as reference.

Among all the domains, the domains 'social considerations' and 'basic amenities' performed the best, followed by the domains 'dignity', 'confidentiality' and 'choice and continuity'. The last domains were the domains 'autonomy', 'communication' and 'prompt attention'.

No significant differences were found between the birth centre group and the hospital group under care of a community midwife.

The women who planned to give birth in a birth centre scored significantly lower on responsiveness than the women who planned to give birth at home.

					Under supervision of an obstetrician				
Home					**Hospital**				
(n = 350)					*(n = 115)*				
No. (%)					*No. (%)*				
optimal	**non-optimal**	**CRUDE OR**	**Adj OR**	**95% CI**	**optimal**	**non-optimal**	**CRUDE OR**	**Adj OR**	**95% CI**
265 (75.7)	85 (24.3)	1.91	1.58*	1.09-2.27	56 (48.7)	59 (51.3)	0.58	0.51**	0.32-0.81
182 (53.5)	158 (46.5)	2.03	1.77***	1.25-2.51	30 (28.6)	75 (71.4)	0.70	0.59*	0.35-1.00
244 (71.3)	98 (28.7)	1.08	1.08	0.75-1.57	65 (58.6)	46 (41.4)	0.61	0.57*	0.36-0.92
200 (58.8)	140 (41.2)	1.15	1.05	0.75-1.48	55 (49.1)	57 (50.9)	0.78	0.71	0.45-1.13
218 (65.1)	117 (34.9)	1.52	1.37	0.97-1.93	55 (49.1)	57 (50.9)	0.79	0.70	0.44-1.11
276 (82.9)	57 (17.1)	1.17	1.16	0.76-1.79	76 (67.3)	37 (32.7)	0.49	0.47**	0.28-0.79
278 (84.5)	51 (15.5)	1.19	1.21	0.77-1.90	83 (73.5)	30 (26.5)	0.61	0.60	0.35-1.04
221 (67.8)	105 (32.2)	1.36	1.16	0.81-1.64	59 (52.7)	53 (47.3)	0.72	0.65	0.41-1.04
optimal	**non-optimal**	**CRUDE OR**	**Adj OR**	**95% CI**	**optimal**	**non-optimal**	**CRUDE OR**	**Adj OR**	**95% CI**
254 (73.0)	94 (27.0)	1.50	1.37	0.95-1.97	61 (53.0)	54 (47.0)	0.63	0.61*	0.38-0.98
270 (80.6)	65 (19.4)	1.27	1.20	0.80-1.82	72 (64.3)	40 (35.7)	0.55	0.52**	0.31-0.85
239 (69.3)	106 (30.7)	1.09	1.09	0.76-1.56	71 (63.4)	41 (36.6)	0.84	0.82	0.51-1.32
155 (45.5)	186 (54.5)	1.44	1.28	0.91-1.80	49 (43.4)	64 (56.6)	1.32	1.24	0.78-1.98
223 (66.6)	112 (33.4)	1.32	1.22	0.86-1.73	57 (50.4)	56 (49.6)	0.68	0.65	0.41-1.03
253 (76.0)	80 (24.0)	1.48	1.54*	1.06-2.25	73 (64.6)	40 (35.4)	0.86	0.88	0.54-1.43
267 (81.9)	59 (18.1)	1.09	1.02	0.66-1.58	78 (69.6)	34 (30.4)	0.55	0.52*	0.30-0.88
226 (69.3)	100 (30.7)	1.54	1.43*	1.00-2.03	57 (50.9)	55 (49.1)	0.70	0.72	0.46-1.15

A significantly higher score on the domains 'dignity' ($p<0.05$) and 'autonomy' ($p<0.001$) during birth was found for the women who planned to give birth at home. They also reported a significantly higher score on the domains 'social consideration' ($p<0.05$) and 'choice and continuity' ($p<0.05$) during the postpartum period, compared to the birth centre group.

The women who planned to give birth in a birth centre reported a significantly higher score on 'dignity' ($p<0.01$), 'autonomy' ($p<0.05$), 'confidentiality' ($p<0.05$) and 'social considerations' ($p<0.01$) during birth compared to the hospital group under supervision of an obstetrician. They also reported a significantly higher score on 'dignity' ($p<0.05$), 'autonomy' ($p<0.01$) and 'basic amenities' ($p<0.05$) in the postpartum period.

Referrals

Table 5 shows the adjusted odds ratios of the referred and non-referred group for each domain of responsiveness during birth and the postpartum period. The reported scores were higher for the women who were not referred. The women who planned to give birth in a birth centre and who were not referred reported a significantly higher score during birth on all the domains except for 'confidentiality', compared to the referred women in this group. The non-referred women reported also a significantly higher score on 'dignity' ($p<0.05$), 'prompt attention' ($p<0.001$) and 'basic amenities' ($p<0.05$) in the postpartum period.

The women who planned to give birth under care of a community midwife in a hospital and were not referred reported a significantly higher score on all domains during birth except 'basic amenities', compared to the referred women in this group. Their score during the postpartum period was also significantly higher on the domains 'autonomy' ($p<0.01$) and 'basic amenities' ($p<0.05$) compared to the referred women in this group.

The women who planned to give birth at home and were not referred reported a significantly higher score on all the domains except 'basic amenities' during birth and only on 'dignity' ($p<0.05$) in the postpartum period, compared to the referred women.

For the women who planned to give birth in a hospital under supervision of an obstetrician no distinction between referred or not referred can be made, because they all have been referred during pregnancy.

Birth centre services

Table 6 shows the experiences of the respondents with the birth centre services. Most of the women who received care in a birth centre assessed the homelike environment (81.3%), hotel service (84.2%) and bath (94.8%) as good. More than 40% of the women reported that they did not use wireless internet although it was available.

Almost all the women (93.0%) reported that the birth centre experiences met their expectations. 84.9% of the women arrived and 84.7% of the women left the birth centre

Table 5: *Responsiveness outcomes according to planned place of birth for referred and non-referred women*

	Under care of a community midwife											
	Birth centre						**Hospital**					
	non-referral (REF)		**referral**				**non-referral (REF)**		**referral**			
	(n = 177)		*(n = 83)*				*(n = 196)*		*(n = 60)*			
	No. (%)		*No. (%)*				*No. (%)*		*No. (%)*			
Responsiveness during birth	**optimal**	**non-optimal**	**optimal**	**non-optimal**	**Adj OR**	**95% CI**	**optimal**	**non-optimal**	**optimal**	**non-optimal**	**Adj OR**	**95% CI**
Dignity	125 (70.6)	52 (29.4)	132 (67.3)	64 (32.7)	0.33***	0.19-0.58	132 (67.3)	64 (32.7)	29 (48.3)	31 (51.7)	0.51*	0.27-0.97
Autonomy	74 (43.8)	95 (56.2)	86 (45.7)	102 (54.3)	0.38**	0.20-0.71	86 (45.7)	102 (54.3)	15 (25.9)	43 (74.1)	0.45*	0.22-0.94
Confidentiality	126 (72.8)	47 (27.2)	138 (73.4)	50 (26.6)	0.66	0.37-1.17	138 (73.4)	50 (26.6)	28 (49.1)	29 (50.9)	0.41**	0.21-0.78
Communication	108 (61.4)	68 (38.6)	108 (56.8)	82 (43.2)	0.52*	0.30-0.91	108 (56.8)	82 (43.2)	19 (33.9)	37 (66.1)	0.48*	0.25-0.93
Prompt attention	108 (61.0)	69 (39.0)	117 (61.9)	72 (38.1)	0.51*	0.29-0.88	117 (61.9)	72 (38.1)	19 (33.9)	37 (66.1)	0.32***	0.16-0.62
Social considerations	151 (85.3)	26 (14.7)	145 (77.1)	43 (22.9)	0.39**	0.20-0.75	145 (77.1)	43 (22.9)	36 (64.3)	20 (35.7)	0.49*	0.25-0.97
Basic Amenities	152 (86.4)	24 (13.6)	142 (76.3)	44 (23.7)	0.44*	0.22-0.86	142 (76.3)	44 (23.7)	43 (76.8)	13 (23.2)	0.90	0.43-1.87
Choice and Continuity	125 (71.0)	51 (29.0)	132 (71.7)	52 (28.3)	0.26***	0.15-0.45	132 (71.7)	52 (28.3)	21 (38.2)	34 (61.8)	0.25***	0.13-0.48
Responsiveness postpartum	**optimal**	**non-optimal**	**optimal**	**non-optimal**	**Adj OR**	**95% CI**	**optimal**	**non-optimal**	**optimal**	**non-optimal**	**Adj OR**	**95% CI**
Dignity	122 (68.9)	55 (31.1)	131 (66.8)	65 (33.2)	0.48*	0.28-0.84	131 (66.8)	65 (33.2)	32 (53.3)	28 (46.7)	0.71	0.37-1.35
Autonomy	133 (78.2)	37 (21.8)	141 (75.0)	47 (25.0)	0.78	0.42-1.46	141 (75.0)	47 (25.0)	31 (55.4)	25 (44.6)	0.40**	0.20-0.80
Confidentiality	119 (68.8)	54 (31.2)	121 (64.0)	68 (36.0)	0.80	0.45-1.41	121 (64.0)	68 (36.0)	28 (49.1)	29 (50.9)	0.56	0.29-1.06
Communication	70 (39.8)	106 (60.2)	82 (43.2)	108 (56.8)	0.73	0.41-1.30	82 (43.2)	108 (56.8)	22 (39.3)	34 (60.7)	0.92	0.48-1.77
Prompt attention	118 (66.7)	59 (33.3)	111 (58.7)	78 (41.3)	0.39***	0.22-0.68	111 (58.7)	78 (41.3)	23 (41.1)	33 (58.9)	0.54	0.28-1.02
Social considerations	119 (67.2)	58 (32.8)	123 (65.8)	64 (34.2)	0.88	0.49-1.58	123 (65.8)	64 (34.2)	35 (62.5)	21 (37.5)	0.83	0.43-1.60
Basic Amenities	144 (83.7)	28 (16.3)	154 (84.2)	29 (15.8)	0.49*	0.25-0.95	154 (84.2)	29 (15.8)	39 (72.2)	15 (27.8)	0.42*	0.20-0.90
Choice and Continuity	108 (61.4)	68 (38.6)	123 (66.8)	61 (33.2)	0.80	0.46-1.39	123 (66.8)	61 (33.2)	29 (52.7)	26 (47.3)	0.56	0.30-1.07

*Non-referral as reference and adjusted for parity, education and ethnicity * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$*

Table 5 *continued: Responsiveness outcomes according to planned place of birth and (non-)referral*

	Under care of a community midwife					
	Home					
	non-referral (REF)		referral			
	(n = 196)		*(n = 60)*			
	No. (%)		*No. (%)*			
Responsiveness during birth	**optimal**	**non-optimal**	**optimal**	**non-optimal**	**Adj OR**	**95% CI**
Dignity	230 (81.6)	52 (18.4)	31 (49.2)	32 (50.8)	0.20***	0.11-0.38
Autonomy	158 (57.2)	118 (42.8)	22 (36.7)	38 (63.3)	0.48*	0.26-0.90
Confidentiality	207 (74.5)	71 (25.5)	35 (57.4)	26 (42.6)	0.43**	0.23-0.79
Communication	176 (63.8)	100 (36.2)	22 (36.1)	39 (63.9)	0.34***	0.19-0.63
Prompt attention	189 (69.7)	82 (30.3)	26 (43.3)	34 (56.7)	0.32***	0.17-0.58
Social considerations	232 (85.9)	38 (14.1)	40 (67.8)	19 (32.2)	0.30***	0.15-0.58
Basic Amenities	229 (86.4)	36 (13.6)	46 (78.0)	13 (22.0)	0.55	0.26-1.16
Choice and Continuity	195 (73.9)	69 (26.1)	23 (39.0)	36 (61.0)	0.23***	0.12-0.42
Responsiveness postpartum	**optimal**	**non-optimal**	**optimal**	**non-optimal**	**Adj OR**	**95% CI**
Dignity	212 (75.4)	69 (24.6)	38 (61.3)	24 (38.7)	0.51*	0.28-0.95
Autonomy	220 (81.2)	51 (18.8)	47 (79.7)	12 (20.3)	0.97	0.46-2.06
Confidentiality	200 (71.7)	79 (28.3)	36 (59.0)	25 (41.0)	0.59	0.32-1.08
Communication	132 (47.8)	144 (52.2)	22 (36.7)	38 (63.3)	0.79	0.43-1.45
Prompt attention	186 (68.6)	85 (31.4)	34 (57.6)	25 (42.4)	0.63	0.34-1.15
Social considerations	207 (76.7)	63 (23.3)	42 (72.4)	16 (27.6)	0.62	0.32-1.20
Basic Amenities	214 (81.4)	49 (18.6)	49 (84.5)	9 (15.5)	1.29	0.56-2.96
Choice and Continuity	186 (70.7)	77 (29.3)	35 (60.3)	23 (39.7)	0.70	0.38-1.28

Non-referral as reference and adjusted for parity, education and ethnicity
** $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$*

on their preferred time. However, 13.6% of the women preferred to arrive earlier. Most of the women who were referred from a birth centre to the obstetric unit did not evaluate the change of room (81.5%) or caregiver (81.8%) as a problem. None of the women who stayed postpartum in the same room as during birth found it a problem. As few as 8.6% of the women evaluated the postpartum stay in a different room as a small problem.

Table 6: *Experiences with birth centre services*

Facilities	**good**	**sufficient**	**insufficient**
Homelike environment	156 (81.3)	32 (16.7)	4 (2.1)
Hotel service	123 (84.2)	20 (13.7)	3 (2.1)
Bath	91 (94.8)	4 (4.2)	1 (1.0)
Expectations	**good**	**sufficient**	**insufficient**
Met	185 (93.0)	13 (6.5)	1 (0.5)
Moment	**on time**	**too late**	**too early**
Arrival	169 (84.9)	27 (13.6)	3 (1.5)
Departure	166 (84.7)	13 (8.7)	17 (6.6)
Continuity	**no problem**	**small problem**	**big problem**
Change of room in case of referral	44 (81.5)	9 (16.7)	1 (1.9)
Change of caregiver in case of referral	18 (81.8)	4 (18.2)	0 (0.0)
Postpartum stay in the same room as birth	32 (100.0)	0 (0.0)	0 (0.0)
Postpartum stay in different room as birth	32 (91.4)	3 (8.6)	0 (0.0)

DISCUSSION

The aim of this study was to assess the experiences with maternity care of the women who planned birth in a birth centre compared to alternative planned places for childbirth, by using the responsiveness concept of the World Health Organization.

The women had, in general, good experiences during birth and the postpartum period. Women who planned to give birth in a birth centre reported similar experiences as those who planned to give birth at a hospital under care of a community midwife. Women who planned to give birth at home were most positive about their experiences and scored highest on the domains autonomy and prompt attention. A referral to secondary care had a negative effect on the experiences of women in all settings. Women who received care in a birth centre highly valued the facilities, moment of arrival/departure and continuity in a birth centre. In case of referral, the physical travel from the birth centre to the obstetric unit was not a problem for most of the women.

Strengths and limitations

This is the first study comparing the experiences of women who planned to give birth in a birth centre with that of women who planned to give birth in the three other settings in the Netherlands: under care of a community midwife in a hospital, at home and under supervision of an obstetrician in a hospital. The used questionnaire avoids any implicit or explicit preference towards the providers or organizational structures, captures the client's actual experience and is unique in the coverage of the eight responsiveness domains. Therefore, we were able to evaluate the maternity care as a whole, with its different services, professionals and time windows. The experiences (positive and negative) are allocated to the entire maternity chain and not to a specific profession or person. In addition, the present study includes a nationwide approach and high coverage of Dutch birth centres.

The analyses were performed according to the women's planned place of birth. Our information was based on the place of birth which was planned one month before the birth. For women who were referred to secondary care before the 36th week of pregnancy, their planned place of birth will by necessity be in a hospital, under supervision of an obstetrician. In general, around 15% of the women are referred during pregnancy to the second echelon after the 36th week (23). In addition, some women are referred immediately at the onset of labour from home to the second echelon. Therefore, some of the women who planned to give birth under care of a community midwife in a birth centre or in a hospital have not actually been in these places or experienced these conditions. According to the 'intention to treat'-principle however, they should not be excluded from the analyses.

The women were asked to participate in the study by their own community midwife. Although we asked the midwife to invite every woman receiving postpartum care for participation, we have no information if this was done. Our response rate was 54.6%, which is a good response in itself but a selection bias might have occurred. We, therefore, compared the characteristics of the respondents with those of all the women who received postpartum care from the included midwifery practices. It appeared that the respondents have characteristics (older, higher educated, more often of Dutch origin and having less interventions during birth) that are associated with a more optimal birth experience, which may have positively influenced the results (20, 26, 27).

Interpreting the results

The women have, in general, good experiences during birth and the postpartum period. Another Dutch study showed that the quality of care experienced by low-risk women during the entire maternity care process is high (10). The few significant differences between the settings during birth are especially associated with the personal related domains (dignity, autonomy and confidentiality). In the postpartum period, the differences

are more related to the setting related domains (social consideration, basic amenities and choice and continuity). Although most differences were not significant, the women in the birth centre group have on most of the domains slightly better experiences compared to the women in the hospital group under care of a community midwife. More than 80% of the women who received care in a birth centre highly valued the facilities, the moment (on time) of arrival and departure and the continuity in the birth centre. This is in line with what several other international studies have found (12-14).

The women who planned to give birth at home have significantly better experiences than the group of women who planned to give birth in a birth centre. This is in line with what other international studies have found and can possibly be explained by the positive influence of the familiar environment at home (16, 28). Another study which compared the experiences of women giving birth in a birth centre and at home, did not find differences on overall satisfaction (15). That study included only one specific birth centre. We found that the women in the birth centre group have significantly better experiences than the group of women who planned to give birth under supervision of an obstetrician in a hospital. This is not surprising, since it is known that women who perceive no health problems for themselves or their baby have better experiences. The women giving birth in a hospital under supervision of an obstetrician are high-risk women and, therefore, probably more anxious or worried about their own or their baby's health (21).

Being referred during labour/birth has a negative influence on the experiences. This is in line with a study that found a significantly negative association between referral and the birth experience 10 days postpartum (29). Another study found referral as a significant risk factor for a negative recall of birth experience in women 3 years postpartum (30). And a cross-national study showed the negative influence of a referral as well (31). However, there is also a Dutch study which found no association between the referral and the experience of birth three weeks postpartum (32). Moreover, a physical transfer from the birth centre to the obstetric unit has shown not to be a problem for most of the women in this study.

Implications for practice

In the last decades, many birth centres have been established in different countries, including the United Kingdom, Australia, Sweden and the Netherlands. Although no significant differences were found between the experiences of women in the birth centre group and those in the hospital group under care of a community midwife, the following trend can be seen: the women in the birth centre group have on some domains slightly better experiences. Additionally, women highly valued the birth centre services. This should be considered in the further development of birth centres in the different countries. Given the result that the women who planned to give birth at home have

better experiences than the women who planned to give birth in a birth centre, more emphasis may be put on the home-like environment in the birth centres.

Being referred to secondary care has a negative effect on the experiences in all settings. Referrals cannot always be prevented, but one possible solution might be that the community midwife or her colleague, who are familiar with the woman, continues accompanying the client. In general, priority must be given to 1) autonomy (more specific: including the client in decision-making on pain-relief/setting of birth, acceptance of treatment refusal) and 2) prompt attention (more specific: access for contact in all situations, waiting time for service, physical accessibility of the setting, prompt phone response).

CONCLUSIONS

The women had, in general, good experiences during birth and the postpartum period. The domains 'social considerations' and 'basic amenities' performed the best. The domains 'autonomy', 'communication' and 'prompt attention' scored relatively lower. So, one should focus more on the latter domains.

Although no significant differences were found between the birth centre group and the hospital group under care of a community midwife, the following trend can be seen: the birth centre group report on some domains slightly better experiences. The women who planned to give birth in a birth centre reported less positive experiences than the women who planned to give birth at home. Most of the women who received care in a birth centre highly valued the services. For women who do not want to give birth at home a birth centre is a good choice, it leads to slightly better, but not significantly, experiences as a planned hospital birth.

REFERENCES

1. Sitzia J, Wood N. Patient satisfaction: a review of issues and concepts. Social science & medicine. 1997;45(12):1829-43.
2. Wensing M, Jung HP, Mainz J, Olesen F, Grol R. A systematic review of the literature on patient priorities for general practice care. Part 1: Description of the research domain. Social science & medicine. 1998;47(10):1573-88.
3. Campbell SM, Roland MO, Buetow SA. Defining quality of care. Social science & medicine. 2000;51(11):1611-25.
4. Valentine N, Darby C, Bonsel GJ. Which aspects of non-clinical quality of care are most important? Results from WHO's general population surveys of "health systems responsiveness" in 41 countries. Social science & medicine. 2008;66(9):1939-50.
5. Oppenheimer C. Organising midwifery led care in The Netherlands. BMJ. 1993;307(6916):1400-2.
6. Mander R. The relevance of the Dutch system of maternity care to the United Kingdom. Journal of advanced nursing. 1995;22(6):1023-6.
7. Bradley PJ, Bray KH. The Netherlands' Maternal- Child Health Program: Implications for the United States. Journal of Obstetric, Gynecologic, & Neonatal Nursing. 1996;25(6):471-5.
8. Johnson TR, Callister LC, Freeborn DS, Beckstrand RL, Huender K. Dutch women's perceptions of childbirth in the Netherlands. MCN: The American Journal of Maternal/Child Nursing. 2007;32(3):170-7.
9. De Vries R, Wiegers TA, Smulders B, van Teijlingen E. The Dutch obstetrical system. Birth models that work. 2009:31.
10. Wiegers TA. The quality of maternity care services as experienced by women in the Netherlands. BMC pregnancy and childbirth. 2009;9:18.
11. Wiegers T, de Graaf H, van der Pal K. The rise of birth centres and their role in health care [in Dutch:De opkomst van geboortecentra en hun rol in de zorg]. Tijdschrift voor gezondheidswetenschappen. 2012;90(8):475-8.
12. Waldenström U, Nilsson CA. Women's satisfaction with birth center care: a randomized, controlled study. Birth. 1993;20:3-13.
13. Coyle KL, Hauck Y, Percival P, Kristjanson LJ. Ongoing relationships with a personal focus: mothers' perceptions of birth centre versus hospital care. Midwifery. 2001;17(3):171-81.
14. Coyle KL, Hauck Y, Percival P, Kristjanson LJ. Normality and collaboration: mothers' perceptions of birth centre versus hospital care. Midwifery. 2001;17(3):182-93.
15. Borquez HA, Wiegers TA. A comparison of labour and birth experiences of women delivering in a birthing centre and at home in the Netherlands. Midwifery. 2006;22(4):339-47.
16. Cunningham JD. Experiences of Australian mothers who gave birth either at home, at a birth centre, or in hospital labour wards. Social Science & Medicine. 1993;36(4):475-83.
17. Valentine NB, de Silva A, Kawabata K, Darby C, Murray CJL, Evans DB, et al. Health system responsiveness: concepts, domains and operationalization. Health systems performance assessment: debates, methods and empiricism. 2003:573-96.
18. Murray CJL, Frenk J. A framework for assessing the performance of health systems. Bulletin of the world Health Organization. 2000;78(6):717-31.
19. Valentine NB, de Silva A, Kawabata K, Darby C, Murray CJL, Evans DB, et al. Health system responsiveness: concepts, domains and operationalization. Health systems performance assessment: debates, methods and empiricism. 2003:573-96.

20. van der Kooy J, Valentine NB, Birnie E, Vujkovic M, de Graaf JP, Denktaş S, et al. Validity of a questionnaire measuring the world health organization concept of health system responsiveness with respect to perinatal services in the dutch obstetric care system. BMC health services research. 2014;14:622.
21. Scheerhagen M, van Stel, H.F., Birnie, E., Franx, A., Bonsel, G.J. Measuring client experiences in maternity care under change: development of a questionnaire based on the WHO responsiveness model. Plos one. 2015.
22. Hermus MAA, Wiegers TA, Hitzert MF, Boesveld IC, van den Akker-van ME, Akkermans HA, et al. The Dutch Birth Centre Study: study design of a programmatic evaluation of the effect of birth centre care in the Netherlands. BMC pregnancy and childbirth. 2015;15:148.
23. The Netherlands Perinatal Registry. Perinatal care in the Netherlands 2013 [in Dutch: Perinatale zorg in Nederland 2013]. Utrecht: 2014.
24. Spss I. IBM SPSS statistics version 21. Boston, Mass: International Business Machines Corp. 2012.
25. Central Committee on Research Involving Human Subjects. [cited 2015 June 13th 2015]. Available from: http://www.ccmo.nl/en/ccmo-directives.
26. Raleigh VS, Hussey D, Seccombe I, Hallt K. Ethnic and social inequalities in women's experience of maternity care in England: results of a national survey. Journal of the Royal Society of Medicine. 2010;103(5):188-98.
27. Liabsuetrakul T, Petmanee P, Sanguanchua S, Oumudee N. Health system responsiveness for delivery care in Southern Thailand. International Journal for quality in health care. 2012;24(2):169-75.
28. Lock LR, Gibb HJ. The power of place. Midwifery. 2003;19(2):132-9.
29. Kleiverda G, Steen AM, Andersen I, Treffers PE, Everaerd W. Confinement in nulliparous women in The Netherlands: subjective experiences related to actual events and to post-partum well-being. Journal of Reproductive and Infant Psychology. 1991;9(4):195-213.
30. Rijnders M, Baston H, Schönbeck Y, Van Der Pal K, Prins M, Green J, et al. Perinatal factors related to negative or positive recall of birth experience in women 3 years postpartum in the Netherlands. Birth. 2008;35(2):107-16.
31. Christiaens W, Gouwy A, Bracke P. Does a referral from home to hospital affect satisfaction with childbirth? A cross-national comparison. BMC health services research. 2007;7:109.
32. Wiegers TA, Zee Jvd, Keirse MJNC. Transfer from home to hospital: what is its effect on the experience of childbirth? Birth. 1998;25:19-24.

Chapter 8

General discussion

AIMS OF THIS THESIS

In the Netherlands, pregnant women at low-risk of complications can choose where they would like the birth to take place: at home, in a hospital or in a birth centre, all being supervised by a community midwife. In recent years, more women are planning birth out of home because they do not feel safe at home or are asking for a referral to get pain relief (1). This trend may partly be caused by the results from the EURO-PERISTAT, which got a lot of media-attention. The EURO-PERISTAT study put the Netherlands in terms of perinatal health outcomes near the bottom of a ranked list of European countries (2). The study was directly linked to the operational set-up of the Dutch maternity care system, which has a clear segmentation of primary care (community midwife-led) from secondary care (obstetrician-led) (3, 4).

The large number of low-risk women who planned to give birth in a hospital led to pressure on the obstetric units in the hospitals. In the last 15 years, there was a rapid increase in the number of birth centres. Birth centres are regarded as settings where women with low-risk pregnancies can give birth in a homelike environment, supervised by a community midwife and a maternity care assistant (5). Some birth centres are freestanding from a hospital, others are separated from an obstetric unit but in a hospital and some birth centres are located within an obstetric unit (5). Birth centres have been established because of various reasons; to reduce the pressure on the capacity of hospital maternity wards, to offer a more homelike environment than in a hospital, to compete with neighbouring hospitals and to offer additional facilities during childbirth (like a bath and nitrous oxide).

The increase in the number of birth centres is in line with the general view on the Dutch maternity care system where low-risk women could best give birth under the supervision of a community midwife in a non-clinical setting. It has been assumed that birth centres provide better quality of care due to better collaboration, when compared to the existing system of primary and secondary maternity care. Scientific evidence on this assumption and a clear definition of birth centres were missing.

The main aim of this thesis was to evaluate the performance of birth centres. The following sub-aims were addressed:

Part I

1 To study the organizational processes in a limited number of birth centres.

Part II

2 To study maternal and perinatal outcomes by planned birth in a birth centre compared with planned birth in a hospital and at home by using, among others the optimality index and a composite adverse outcome score.
3 To study the cost-effectiveness of planned birth in a birth centre compared with planned birth in a hospital and at home.
4 To assess the client experiences of planned birth in a birth centre compared with planned birth in a hospital and at home.

In order to assess these aims, a mixed method approach was used. In that approach, elements of qualitative and quantitative research are combined for the broad purposes of breadth and depth of understanding birth centres (6). This thesis consists of two parts; each draws evidence from different sources.

Part I focuses on how processes in and around birth centres link the organizational structure to outcomes. Data in this part were mainly collected through direct observations in seven birth centres and took in total around 1000 hours, spread over one year. Additionally a questionnaire and spatial data were used. Part II includes the study of the effects of organizational structure on perinatal and maternal outcomes, costs and client experiences. Outcomes were compared according to the intention to treat method, by planned place of birth: in a birth centre, in a hospital or at home. Separate analyses were performed for different types of birth centres, based on location and integration profile. A case record form was used to measure the health outcomes and costs. This form was intended to complement the data from the Netherlands Perinatal Registry Perined (7). Furthermore, a questionnaire was used to assess clients' experiences.

PRINCIPAL FINDINGS

Four sub-aims were addressed, described in separate chapters. Below, the most prominent results are summarized per research aim.

Part I: Organizational processes in and around seven birth centres

Part I (Chapter 2-4) focuses on how processes in and around birth centres link the structure to outcomes, as the way in which a certain type of organizational structure leads to outcomes remains mostly an intransparant black box. Interprofessional collaboration is seen as an important element in good quality and safe health care. Co-location may strengthen this process of collaboration. We focussed on a proposition that has emerged from our field work: co-location of birth centres and hospitals is important for the qual-

ity of collaboration within maternity care. This research teaches us that the importance of co-location appears to vary across different levels of analysis and that co-location is not enough for better collaboration (Chapter 2).

Next, we evaluated handover practices from a process perspective, to identify obstacles and opportunities for quality improvements. Handovers within and between health care settings are known to affect quality of care. Dutch birth centres struggle how to guarantee best care during handovers. Ensuring quality during handovers requires a care-specific process approach. We revealed distinctive aspects during handovers, concrete obstacles and potential solutions for quality improvements in inter-organizational networks (Chapter 3).

Despite many publications in recent years about the poor collaboration within the Dutch maternity care, our research teaches us that professionals certainly get help from outside their own group. We provided quantitative and qualitative insights in helping behaviour in birth centres by describing seven complex maternity care networks. Helping behaviour is of high importance in birth centres. When problems arise or other expertise is necessary, professionals need to ask help from each other and provide help when asked. The presence of this helping behaviour diminishes the traditional boundaries and increases collaboration (Chapter 4).

Part II: Outcomes of birth centre care

Part II includes the studies of the effects of organizational structure on perinatal and maternal outcomes, costs and client experiences.

Perinatal and maternal outcomes

The perinatal and maternal outcomes of planned birth in a birth centre, in a hospital and at home for low-risk pregnant women under supervision of a community midwife were compared in Chapter 5. In addition, the effects of the different types of location and integration profiles of birth centres were compared. Our primary outcome measure was the optimality index (OI). A tool to measure 'maximum outcome with minimal intervention'. There was no relevant difference in score on the OI for women who planned to give birth in a birth centre compared to women who planned to give birth in a hospital. A higher score (more favourable) on the OI was seen for women with planned home birth compared to women with planned birth in a birth centre. There were no relevant differences in health outcomes among the types (location and integration profile) of birth centres. Our secondary outcome measure was a description of a maternal and perinatal composite adverse outcome score (CAO).

Costs and effects

The costs and health outcomes of the different birth settings in the Netherlands (i.e. hospital and home) for low-risk women have been widely discussed in recent years. However, evidence on costs and health outcomes in birth centres was still lacking. The assessment of the costs and effects of planned birth in a birth centre, in a hospital and at home for low-risk women under care of a community midwife at the start of labour was described in Chapter 6. Additionally, the costs and effects of the different types of location and integration profiles of birth centres were assessed. Health care costs were measured from start of labour until seven days after birth. The effects were assessed by the OI and the CAO. We found no differences in costs and health outcomes for low-risk women under the care of a community midwife with planned birth in a birth centre and in a hospital. For nulliparous and multiparous low-risk women, planned birth at home was the most cost-effective option compared to planned birth in a birth centre.

Client experiences

Traditionally, the quality of maternity care is described in terms of perinatal morbidity and mortality outcomes. Currently, other aspects of health care, such as client experiences, are important as well, also in terms of their potential to affect clinical outcomes. The client experiences were described in chapter 7. The aim of this study was to assess the experiences with maternity care of the women who planned birth in a birth centre compared to alternatively planned places for childbirth, by using the responsiveness concept of the World Health Organization. Women who planned to give birth in a birth centre reported similar experiences as those who planned to give birth at a hospital under care of a community midwife. Women who planned to give birth at home were most positive about their experiences and scored highest on the domains autonomy and prompt attention. A referral to secondary care had a negative effect on the experiences of women in all settings, but the physical travel from the birth centre to the obstetric unit was not a problem for most of the women.

METHODOLOGICAL CONSIDERATIONS

There were some methodological considerations in this study.

Study design

In this study, a multi-centre, multi-method study design was used, comparing birth centre care with usual care (hospital and home), which allowed us to demonstrate differences between the settings. No one else studied this issue in depth, from multiple perspectives and with a nation-wide approach like we did in this study. Focusing on

different perspectives offered a broad view on the performance of the birth centres. The enthusiastic participation of the birth centres and community midwives showed the interest of this research. Their high participation rate reduced the chance of selection bias. With regard to participation of the birth centres, all eligible Dutch birth centres participated as planned place of birth in this study. To fully understand the nature and complexity of the birth centres, seven birth centres were studied in-depth. The observations in these birth centres took in total around 1000 hours, spread over one year.

We faced an important limitation of our study design as well. In order to investigate the outcomes of birth centre care, a randomized controlled trial would be methodologically the most appreciate study design. Since women are not willing to participate in a study that randomizes them to an intervention (birth centre) or to a control (home or hospital) status, a design like that was not feasible. The problem is that women with different places of birth differ in their characteristics (8). Although this was taken into account to some extent in the statistical analyses by adjusting for some characteristics, we did not adjust for factors like view on childbirth, lifestyle factors and obstetric history. Women's choice for planned place of birth often reflects their underlying perception of childbirth (9, 10). Women who planned to give birth in a birth centre or in a hospital may have a different perception of childbirth and are perhaps more anxious than women who planned to give birth at home, which may have negatively influenced the outcomes. In addition, there may be differences between the groups in lifestyle (including smoking, alcohol consumption, unhealthy eating habits) and obstetric history (such as the number of miscarriages), characteristics that are associated with less optimal outcomes (11). Therefore, the small differences found in this study may be the result of differences between women instead of settings.

Data collection

Data of the Netherlands Perinatal Registry (Perined) were used in the sub-studies on the effects and costs of planned birth in a birth centre, at home and in a hospital (Chapter 5 and 6). Since we suspected some missing accurate information in the Netherlands Perinatal Registry on the planned place of birth (especially if the planned place of birth is a birth centre) and other process factors and outcomes a case report form was developed. This way, more detailed data about process factors and outcomes, including planned place of birth at the start of labour, final place of birth, reasons for referral to secondary care, methods of pain relief and reasons for admission to the hospital were collected. In total, 4063 case report forms were completed. For each participating woman, the data of the case record form were linked to the data of the Netherlands Perinatal Registry by unique anonymous identifiers (date of birth child, date of birth mother and code of midwifery practice). If linkage was not possible because of lacking data in the Netherlands Perinatal Registry (n=346, 8.5%), the missing information was manually obtained from

the client record in the midwifery practices and linked. When this was not possible, we had to exclude the cases.

Instruments

The data collection in the first part of this study (Chapter 2-4) was mainly done by observations. Although the validity of the data was increased by our observations in the natural setting (12), all these observations were done by a single researcher. This may have led to observer bias and treated the study's internal validity.

Given that the prevalence of serious adverse outcomes in the study population of women with a low-risk of complications is very low, the optimality index was used as one of the primary outcome measures (Chapter 5 and 6). This tool made the comparison of different low-risk groups possible. It measures a maximum outcome with minimal interventions and has a self-weighing aspect: any non-optimal obstetrical variable of serious clinical significance is accompanied by a number of other non-optimal variables (13). Focussing on optimality instead of adverse outcomes is relatively unknown in the Dutch health care in general.

Birth centres were classified by location and integration profile. The costs and effects of these different types of birth centres were assessed (Chapter 5 and 6). Since there was no suitable instrument available to examine integrated care in birth centres, a new questionnaire was constructed. The questionnaire is based on the Rainbow Model of Integrated Care and includes 25 multiple-choice questions (14). A limitation is the fact that this questionnaire was not yet validated before it was used in this study.

To assess the client experiences (Chapter 7) the ReproQ questionnaire was used (15). This questionnaire avoids any implicit or explicit preference towards providers or organizations by allocating the positive and negative experiences to the entire maternity chain and not to a specific profession or setting like a birth centre. It is unique in the coverage of the eight responsiveness domains of the World Health Organization. This way we evaluated the maternity care as a whole, with its different services, professionals and time windows.

Study population

All participating women had a low-risk of complications and gave birth after a pregnancy of 37 weeks or more under supervision of a community midwife. The women were asked to participate in the client experience study by their own community midwife (Chapter 7). Although we asked the community midwives to invite every woman receiving care during our study period for participation, we have no information if this was done. We explicitly tried to include women from different origins and different levels of education, by giving the possibility of an interview by phone. Despite of this effort, it appeared that the respondents are higher educated and more often of Dutch origin compared

to all the women who received care from the participating midwifery practices. These factors are associated with a more optimal birth experience, which may have positively influenced the results (16-18).

Analyses

The analyses in the second part of this study (Chapter 5-7) were performed according to the so-called intention to treat approach: women were classified according to their planned place of birth (being a birth centre, hospital or home). This approach is preferably used in epidemiological and clinical comparative research in order to prevent bias as a result of selective loss in the investigated groups. This may occur between the moment of classification of the groups and measurement of the results. Through this selective loss, the groups will not be comparable anymore. In research on maternity care,the final place of birth is a variable where selective loss occurs because of referral during childbirth. These referrals ensure that women who have a complication or an increased risk of a complication during birth do not give birth in primary care, even if they planned to do so. Comparing the outcomes by final place of birth will always lead to a more favourable score of home births than hospital births. All risks for an adverse outcome in the home birth group are filtered through the referral of the women to the hospital. This way, we better understand the occurrence of possible complications in groups. This approach may mean that women are assigned to a group while they, in the end, have never been in the setting they were assigned to. For instance, a woman planning to give birth in a birth centre can already be referred from home to secondary care, because of a complication or wish for pain relief. This woman is allocated to the birth centre group but has not been there. Therefore, additionally, the same analyses were carried out for the women that have been present at the place where they planned to give birth. These analyses showed the same results.

In this study, birth centres were classified by location and integration profile. The costs and effects of the different birth centre types were assessed. 23 birth centre were classified in freestanding birth centres (n=3), alongside birth centres (n=14) and on-site birth centres (n=6). The number of freestanding birth centres were limited and the data is mainly collected in one region. This region is known for its preserved attitude towards health care in general and might therefore not be representative. We are prudent to generalize our results of planned births in a freestanding birth centre.

In the sub-study on the cost-effectiveness of planned birth centre birth compared to planned hospital and home birth, big differences in costs were found in Dutch literature. We, therefore, conducted sensitivity analyses. These analyses, using different prices, led to similar results and conclusions as the original generalized linear model on costs, in other words: the impact of systematic errors (bias) was low. In this sub-study, a first attempt have been made to expand the regression framework from two to three settings

(the comparison of a planned birth in a birth centre compared to a planned birth in a hospital and home). Further research on this topic is warranted to find the most appropriate way to do this.

Context

This study was conducted in a period of time in which maternity care was subject of discussion. The discussion mainly concerned the need for integrated care and the financing of maternity care. This has in part led to a very enthusiastic participation of birth centres and community midwives. They were eager to show how birth centres uphold the current maternity care system, where community midwives take responsibility for births of women with low-risk of complications, in a non-clinical setting. In addition, many regions are still searching for the best organization structure of maternity care in their region. In this study, we focused mainly on the birth period, the period in which birth centres provide care. A large part of obstetric care is provided, however, during pregnancy and the postpartum phase, outside of the birth centre. We studied the collaboration between different care providers in and around birth centres, but the care providers often contact each other outside of the birth centre as well, for example in a regional midwifery partnership. Thus, in this study we evaluated birth centre care, being a small part of the entire, lively, maternity chain.

IMPLICATIONS AND RECOMMENDATIONS

Based on the findings of this study we can formulate the following implications and recommendations for future research and policy.

Scientific implications

- Most research within maternity care focus on structure and performance outcomes instead of the process. These studies ignore the 'black box' of how processes link structure to outcome. To better understand the whole phenomenon, we recommend researchers who evaluate the performance of an organizational structure to look not only into outcomes, but also into the processes that lead to, and thereby influence, these outcomes.
- We recommend researchers who compare places of birth to take the view of the pregnant women on childbirth into account. Women who plan to give birth in a birth centre may have a different opinion on childbirth and are perhaps more anxious than women who plan to give birth at home. Characteristics such as lifestyle (e.g. smoking) and obstetric history (e.g. the number of miscarriages) should be taken into account as well. This way it can be ruled out that the differences in outcomes between the

groups are due to differences in characteristics of the women. Instrumental-variable analysis might be an alternative method for the above mentioned problem (19). This method deals with confounding factors and estimates therapeutic effects. A well-chosen instrumental variable has the theoretical advantage of measured and unmeasured confounding factors having no influence on the effect estimator. Regional differences in treatment is an well-known example of an instrumental variable. However, instrumental-variable analysis seems mainly to provide opportunities for research in large groups of respondents.

- Our study demonstrated that there are no big differences in health outcomes for women who planned to give birth in a birth centre compared to women who planned to give birth in a hospital. The difference for women who planned birth in a birth centre compared to the women who planned birth at home was mostly due to the number of referrals. Further analyses showed that the most important reason for this was found in referrals for failure to progress in first stage and a wish for pain relief. One component of the definition of a birth centre is 'homelike', but birth centres differ significantly on this component. Future research on birth centres should focus on the influence of the place of birth on the professionals' attitude. Are professionals in a more clinical environment more likely to refer a woman?
- Most research and discussions on the collaboration in maternity care focus on the collaboration between obstetricians and community midwives. We recommend to include maternity care assistants in future research as well, as they are important (but often not recognised) key players within the maternity care, especially in birth centres.
- The Dutch Perinatal Registry (PRN) database includes a large amount of data from pregnancies in the Netherlands (7). However, accurate information on the planned place of birth (especially if the planned place of birth is a birth centre) and lifestyle factors are often missing. This information is important when comparing places of birth, we therefore recommend to pay more attention to the accurate registration of this information, both to the suitability of the tool and the attention of the professional.
- We recommend researchers to use the same costs in all studies on costs of the Dutch maternity care. Standardisation of the very varied costs is necessary to make studies comparable with each other.
- Further research on the regression framework in cost-effective analyses is recommended. Until now, only two treatments were compared in literature on cost-effectiveness analyses. In our study, the first attempt has been made to expand the regression framework to three treatments. Research to find the most appropriate way to do this is recommended.

Health policy implications

- We recommend further development of birth centres. Birth centres are a good alternative to midwife-led hospital births for women at low-risk of complications. They lead to similar medical outcomes, costs and client experiences. Birth centres fit into the Dutch maternity care system where community midwives take responsibility for births of women with a low-risk of complications, in a non-clinical setting. Based on the results of this study, no specific type of birth centre can be recommended. The birth centre should fit the local needs with regards to the organization and structure of the birth centre.
- We recommend to pay more attention to the role that meso- and micro-level co-location can play in the development of birth centres and to pay more attention to the role of informal collaboration. The role of a birth centre goes beyond just a place to give birth. A birth centre is a place where various healthcare professionals meet each other. The establishment and maintenance of a birth centre is a reason for the professionals to discuss the completion of the centre. For example, they have to develop protocols with each other. In our study, we see that the professionals involved in the establishment of a birth centre continue to play a central role in the helping network of a birth centre, even after a number of years.
- Being referred to secondary care has a negative effect on the client experiences in all settings (birth centre, home, hospital) and increases the opportunity for errors. Since referrals are a basic feature of the performance of the Dutch maternity care system, they should be organized as optimal as possible. Mainly at birth centres where a smooth referral is expected, given its location near the hospital, there appeared to be room for improvement. Solutions for that include: 1) making agreements between the birth centre and the obstetric care unit on the support of the client in case a caregiver is absent, 2) face-to-face communication during handover, 3) the use of one electronic health record, 4) a joint compulsory training of acute situations by the different caregivers, 5) continuity of a caregiver (e.g. a community midwife who is familiar with the client and accompanies her after referral) and 6) the possibility of postpartum care in a birth centre.
- In this study, we have seen a high percentage of referrals of women with a planned place of birth in a birth centre. Since this percentage is mainly associated with the wish for pain relief, we recommend to extend the use of nitrous oxide in birth centres. A single centre study concluded that nitrous oxide is under strict requirements a safe and effective analgesic option within birth centres (20) and avoids the need of referral of the low-risk woman to secondary care.
- We advise to improve the information to the client on the place of birth, particularly on birth centres. Now the differences between a birth centre and a hospital often

remains unclear for a client. In addition, the client should get a better explanation about a possible referral from the birth centre to the obstetric unit.

- This study did not show any specific characteristic of birth centres that results in better outcomes. Therefore, we advise to adapt the organization and structure of a birth centre to the wishes and needs of the local situation.
- Given the results that the women who planned to give birth at home have better experiences than the women who planned to give birth in a birth centre, more emphasis may be put on the homelike environment in these centres and the facilities that support physiological birth.
- Special attention must be given to the autonomy of the client, such as including the client in decision-making on pain relief and birth setting. In addition, more emphasis must be given to prompt attention, such as access for contact in all situations, waiting time for service, physical accessibility of the setting and prompt phone response.
- The enthusiastic participation of birth centres and community midwives showed the interest in this research and this innovation in birthing care. This interest is partly due to the difficult financial position of most birth centres. Since planned birth centre births and planned hospital births lead to similar outcomes, the financial barriers of birth centres should be taken away.

CONCLUSIONS

Planned birth centre births differ hardly from planned hospital births in the process- and outcome measures, while planned home births score better in terms of health outcomes, costs and client experiences. We therefore conclude that a birth centre is a good choice to give birth for low-risk women who do not want to give birth at home. When different types of birth centres are compared based on their location and integration profile, there are no relevant differences. There are major differences in the organization of care between the Dutch birth centres; they are adapted to the local situation. Birth centres in their present forms are promising (good outcomes). We recommend further development of birth centres with a homelike environment and facilities that support physiological birth including the use of nitrous oxide, all adapted to the wishes and needs of the local situation. Special attention should be given to the smooth referral of a client from a birth centre to the obstetric care unit and the positive role of informal collaboration between the different professions.

REFERENCES

1. Offerhaus PM, Hukkelhoven CW, Jonge A, Pal- de Bruin KM, Scheepers PL, Lagro- Janssen AL. Persisting Rise in Referrals During Labor in Primary Midwife- led Care in The Netherlands. Birth. 2013;40(3):192-201.
2. Mohangoo AD, Buitendijk SE, Hukkelhoven CW, Ravelli AC, Rijninks-van Driel GC, Tamminga P, et al. Higher perinatal mortality in The Netherlands than in other European countries: the Peristat-II study. Nederlands tijdschrift voor geneeskunde. 2008;152(50):2718-27.
3. Amelink-Verburg MP, Buitendijk SE. Pregnancy and Labour in the Dutch Maternity Care System: What Is Normal? The Role Division Between Midwives and Obstetricians. Journal of Midwifery & Women's Health. 2010;55(3):216-25.
4. Pieters A, Van Oirschot C, Akkermans H. No cure for all evils. International Journal of Operations & Production Management. 2010;30(11).
5. Hermus M, Boesveld I, Hitzert M, Franx A, de Graaf J, Steegers E, et al. Defining and describing birth centres in the Netherlands-a component study of the Dutch Birth Centre Study. BMC Pregnancy and Childbirth. 2017;17:210.
6. Johnson RB, Onwuegbuzie AJ, Turner LA. Toward a definition of mixed methods research. Journal of mixed methods research. 2007;1(2):112-33.
7. The Netherlands Perinatal Registry Perined. 2014. www.perined.nl.
8. van Haaren-ten Haken T, Hendrix M, Nieuwenhuijze M, Budé L, de Vries R, Nijhuis J. Preferred place of birth: characteristics and motives of low-risk nulliparous women in the Netherlands. Midwifery. 2012;28(5):609-18.
9. Kleiverda G, Steen AM, Andersen I, Treffers PE, Everaerd W. Place of delivery in The Netherlands: maternal motives and background variables related to preferences for home or hospital confinement. European Journal of Obstetrics & Gynecology and Reproductive Biology. 1990;36(1-2):1-9.
10. Wiegers TA, van der Zee J, Kerssens JJ, Keirse MJNC. Home birth or short-stay hospital birth in a low risk population in the Netherlands. Social Science & Medicine. 1998;46(11):1505-11.
11. Timmermans S, Bonsel GJ, Steegers-Theunissen RPM, Mackenbach JP, Steyerberg EW, Raat H, et al. Individual accumulation of heterogeneous risks explains perinatal inequalities within deprived neighbourhoods. European journal of epidemiology. 2011;26(2):165-80.
12. Greenhalgh T, Taylor R. How to read a paper: Papers that go beyond numbers (qualitative research). BMJ. 1997;315(7110):740-3.
13. Wiegers TA, Keirse M, Berghs GAH, Van der Zee J. An approach to measuring quality of midwifery care. Journal of clinical epidemiology. 1996;49(3):319-25.
14. Boesveld IC, Bruijnzeels MA, Hitzert M, Hermus MA, Pal-de Bruin KM, Van Den Akker-Van ME, et al. Typology of birth centres in the Netherlands using the Rainbow model of integrated care: results of the Dutch Birth Centre Study. BMC Health Services Research. 2017;17:426.
15. Scheerhagen M, van Stel HF, Tholhuijsen DJC, Birnie E, Franx A, Bonsel GJ. Applicability of the ReproQ client experiences questionnaire for quality improvement in maternity care. PeerJ. 2016;4:e2092.
16. van der Kooy J, Valentine NB, Birnie E, Vujkovic M, de Graaf JP, Denktas S, et al. Validity of the ReproQ; a questionnaire measuring the world health organization concept of responsiveness in perinatal care. van der Kooy J, editor. 2013:151-74.
17. Raleigh VS, Hussey D, Seccombe I, Hallt K. Ethnic and social inequalities in women's experience of maternity care in England: results of a national survey. Journal of the Royal Society of Medicine. 2010;103(5):188-98.

18. Liabsuetrakul T, Petmanee P, Sanguanchua S, Oumudee N. Health system responsiveness for delivery care in Southern Thailand. International Journal for quality in health care. 2012;24(2):169-75.
19. Martens EP, Pestman WR, de Boer A, Belitser SV, Klungel OH. Instrumental variables: application and limitations. Epidemiology. 2006;17(3):260-7.
20. Kooy J, Graaf JP, Kolder ZM, Witters KD, Fitzpatrick E, Duvekot JJ, et al. A newly developed scavenging system for administration of nitrous oxide during labour: safe occupational use. Acta Anaesthesiologica Scandinavica. 2012;56(7):920-5.

Chapter 9

Summary

Samenvatting

SUMMARY

Chapter 1 describes the background and aims of the studies presented in this thesis. In the Netherlands, pregnant women with a low-risk of complications can choose where they would like to give birth; at home, in a hospital or in a birth centre, all accompanied by a community midwife. During the last years, more women are planning birth out of home because they do not feel safe at home or are asking for a referral to get pain relief. In the last 15 years, there was a rapid increase in the number of birth centres. Birth centres have been established because of various reasons, including a more homelike environment than in a hospital, competition with neighbouring hospitals, additional facilities during childbirth (like a bath and nitrous oxide) and to reduce the pressure on the capacity of hospital maternity wards. It has been assumed that birth centres provide better quality of care due to better collaboration, when compared to the existing system of primary and secondary maternity care. Scientific evidence on this assumption was missing.

This thesis consist of four objectives:

1) To study the organizational processes in a limited number of birth centres.
2) To study maternal and perinatal outcomes by planned birth in a birth centre compared with planned birth in a hospital and at home by using, among others the optimality index and a composite adverse outcome score.
3) To study the cost-effectiveness of planned birth in a birth centre compared with planned birth in a hospital and at home.
4) To evaluate the client experiences with care of planned birth in a birth centre compared with planned birth in a hospital and at home.

Part I: Organizational processes in and around birth centres

Part I (Chapter 2-4) describes the studies that deal with how the processes in and around birth centres link structure to outcomes. The process of how a particular type of organization leads to outcomes usually stays an in-transparant black box. Therefore, the focus of part I of this thesis is to understand how daily care is organized. The analysis of these processes required an in-depth study with an exploratory approach. The data were mainly collected through direct observation in seven birth centres and took a total of about 1000 hours, spread over a year. In addition, a questionnaire was used and spatial data were collected.

Chapter 2 describes the importance of co-location for inter-organizational collaboration. Collaboration within maternity care was not listed by the managers of the seven birth centres as the dominant reason for the establishment of the centres. In most regions, the capacity shortfall of the obstetric unit was the reason for the establishment of

a birth centre. The distance between a birth centre and the obstetric unit seems to effect the collaboration. The shorter the distance was, the better the mutual communication, common goals, shared knowledge and mutual respect were appreciated by the maternity care assistants, community midwives, obstetricians and paediatricians. At the level of a direct personal contact, a short distance can both have a negative and a positive influence. Caregivers did not automatically have more contact in a joint office. But when caregivers from the hospital and birth centre encountered each other in the hallway of the birth centre, spontaneous conversations emerged.

In **Chapter 3,** handovers in the seven birth centres are investigated from a process perspective, potential obstacles are identified and opportunities for improvement in practice are given. This was done through process mapping. Potential improvement opportunities that emerged from the obstacles are: 1) making agreements for client support when the community midwife and / or maternity care assistants is/are not present yet in the birth centre, 2) face-to-face communication during handover, 3) the use of an electronic medical record, 4) a joint mandatory training for emergency situations by all caregivers, 5) continuity of caregiver like a familiar community midwife who accompanies the client after handover and 6) the possibility for postpartum care in a birth centre.

In **Chapter 4,** a multiple case study approach was used to provide quantitative and qualitative insights in helping behaviour in seven Dutch birth centres. Overall, the results show some strained relations, but primary care professionals working in a birth centre do name secondary care professionals as helpful and vice versa. The maternity care professionals often mentioned to receive help from a professional belonging to another group. The birth centre is seen as a benefit, as a place where maternity care professionals from different backgrounds can meet each other and improve maternity care which is an important goal of the birth centres. A request for help to another profession was experienced as difficult. The central individuals in the seven networks are often the managers and the maternity care professionals with management tasks.

Part II: Outcome of birth centre care

In Part II, the impact of organizational structure on maternal and perinatal outcomes (Chapter 5), costs (Chapter 6), and client experiences (Chapter 7) are investigated. Planned births in a birth centre were compared to planned hospital and home births. Furthermore, additional analyses were done for different types (location and integration profile) of birth centres.

In **Chapter 5,** the maternal and perinatal outcomes were studied using the optimality index (OI) and a composite outcome score (CAO). The optimality index is a tool to measure 'a maximum outcome with minimal interventions' and includes both process and outcome items. Whether women planned to give birth in a birth centre or in a hospital did not make a difference on the outcome of the optimality index. For women who

planned to give birth at home, the average score on the optimality index was higher; in other words, more favourable, compared to women who planned to give birth in a birth centre. No relevant differences were found on the optimality index for the different types (location and integration profile) of birth centres. For the composite adverse outcome score, no differences were found between the planned places of birth, except for nulliparous women with a planned birth in a birth centre with a mixed integration profile. They have less favourable outcomes, compared to the more multidisciplinary oriented birth centres.

In **Chapter 6**, the cost-effectiveness of planned births in a birth centre with respect to planned birth in a hospital or at home is described. The calculation includes all costs of care from the start of labour till one week after birth. On average, a planned birth in a birth centre costs €3.327,-. This amount is equal to the cost of a planned hospital birth (€3.330,-). The costs for a planned home birth (€2.998,-) are significantly lower than a planned birth in a birth centre. The costs for all types of birth centres are equally high regardless of location and integration profile. For nulliparous and multiparous women with low-risk of complication, a planned home birth was the most cost-effective option compared with a planned birth in a birth centre and in a hospital.

In **Chapter 7,** the experiences of women with planned births in a birth centre are compared with planned births in a hospital and at home. The experiences of the women with care during birth are measured on the basis of the World Health Organization (WHO) responsiveness concept, consisting of eight domains. Women who planned to give birth in a birth centre were found to have similar experiences as women who planned to give birth in a hospital. Their experiences are less positive than the experiences of women who planned to give birth at home. The difference was statistically significant for the domains of autonomy and continuity of care. Women who were referred during labour had less positive experiences regardless of their planned places of birth. The services in birth centres were highly rated: more than 80% of women who have been in a birth centre assess the facilities, time of arrival and departure and continuity in a birth centre as good. In case of a referral, most women found the transfer from the birth centre to the obstetric unit no problem.

In **Chapter 8,** all the results of the above studies are critically discussed and recommendations and implications are given. Birth centres were expected to provide a better quality of care as a result of better collaboration compared with usual care (hospital and home birth). However, do birth centres actually perform better compared to usual care? Planned birth in a birth centre hardly differs from planned birth in a hospital in the process- and outcome measures. Moreover, planned home births score better in terms of health outcomes, client experiences and costs. When comparing different types of birth centres on the basis of their location and integration profile, no relevant differences were found. The major differences in the organization of care among the Dutch birth centres

are notable. Birth centres, in their current form, are promising. We recommend further profiling of birth centres, including a homelike environment and facilities that stimulate the physiological birth (e.g. nitrous oxide). All tailored to the needs of the local situation. Particular attention should be paid to the referral of a client from a birth centre to the obstetric unit and the role of informal collaboration among the various professions.

SAMENVATTING

Hoofdstuk 1 beschrijft de achtergrond en doelen voor de studies die gepresenteerd worden in dit proefschrift. Zwangere vrouwen met een laag risico op complicaties kunnen in Nederland kiezen of ze onder begeleiding van een verloskundige thuis of poliklinisch in het ziekenhuis zouden willen bevallen. In de afgelopen jaren plannen meer vrouwen om niet thuis te bevallen, omdat zij zich thuis niet veilig voelen of vragen om een verwijzing voor pijnbestrijding. In de laatste 15 jaar was er een snelle toename van het aantal geboortecentra. Geboortecentra zijn opgericht omwille van allerlei redenen, waaronder een meer huiselijke omgeving dan in een ziekenhuis, concurrentie met naburige ziekenhuizen, extra faciliteiten tijdens de bevalling (zoals een bad en lachgas) en om de druk op de klinische verloskamers te verminderen. Aangenomen werd dat geboortecentra een betere kwaliteit van zorg bieden, als gevolg van een betere samenwerking, in vergelijking met de poliklinische en thuisbevalling. Hier was echter nog geen wetenschappelijk bewijs voor.

Dit proefschrift bestaat uit vier doelen:

1) Het bestuderen van organisatorische processen in een beperkt aantal geboortecentra.
2) Onderzoek naar de maternale en perinatale uitkomsten van een geplande bevalling in een geboortecentrum in vergelijking met een geplande poliklinische en thuisbevalling, met behulp van de optimality index en een samengestelde adverse outcome score.
3) Onderzoek naar de kosteneffectiviteit van een geplande bevalling in een geboortecentrum ten opzichte van een geplande poliklinische en thuisbevalling.
4) Het evalueren van cliëntervaringen met de zorg van een geplande bevalling in een geboortecentrum in vergelijking met een geplande poliklinische en thuisbevalling.

Deel I: Organisatorische processen in en rondom geboortecentra

Deel I (hoofdstuk 2-4) beschrijft de studies die gaan over hoe processen in en rondom de geboortecentra structuur aan uitkomsten verbinden. Het proces van hoe een bepaald type organisatiestructuur leidt tot uitkomsten blijft meestal een intransparante 'black box'. Daarom is de focus van deel I van dit proefschrift het begrijpen van hoe de dagelijkse zorg wordt georganiseerd. De analyse van deze processen vereiste een dieptestudie met een verkennende benadering. De gegevens werden hoofdzakelijk verzameld door middel van directe observatie in zeven geboortecentra en nam in totaal ongeveer 1000 uur in beslag, verspreid over een jaar. Daarnaast is een vragenlijst gebruikt en zijn ruimtelijke gegevens verzameld.

Hoofdstuk 2 beschrijft het belang van co-locatie voor de interorganisationele samenwerking. Samenwerking binnen de geboortezorg werd door de managers van de zeven geboortecentra niet als dominante ontstaansreden van de centra genoemd. In de meeste regio's gaf het capaciteitstekort op de klinische verloskamers de doorslag voor de opzet van een geboortecentrum. De afstand tussen het geboortecentrum en de klinische verloskamers lijkt van invloed op de samenwerking. Hoe korter de afstand hoe beter de onderlinge communicatie, de gemeenschappelijke doelstellingen, de gedeelde kennis en het wederzijds respect werd gewaardeerd door de kraamverzorgenden, verloskundigen, gynaecologen en kinderartsen. Op het niveau van direct persoonlijk contact kan een korte afstand zowel een negatieve als een positieve invloed hebben. In een gemeenschappelijke werkkamer voor alles professies kregen de zorgverleners niet vanzelfsprekend altijd meer contact. Maar waar zorgverleners uit het ziekenhuis en van het geboortecentrum elkaar op de gang van het geboortecentrum tegenkwamen, ontstonden juist wel spontane gesprekken.

In **hoofdstuk 3** zijn de overdrachten in de zeven geboortecentra bestudeerd vanuit een proces perspectief, mogelijke obstakels geïdentificeerd en verbetermogelijkheden voor in de praktijk aangedragen. Dit is gedaan doormiddel van process mapping. Verbetermogelijkheden die uit de obstakels voortkwamen waren: 1) het maken van afspraken over de opvang van de cliënt in het geboortecentrum wanneer de verloskundige en/of kraamverzorgende nog niet aanwezig is, 2) face-to-face communicatie tijdens de overdracht, 3) het gebruik van een elektronisch medisch dossier, 4) een gezamenlijke verplichte opleiding voor acute situaties door alle zorgverleners, 5) continuïteit van een zorgverlener zoals een bekende verloskundige die ook na de overdracht met de cliënt meegaat en 6) de mogelijkheid voor postpartum zorg in een geboortecentrum.

In **hoofdstuk 4** is een multiple case study benadering gebruikt om kwantitatief en kwalitatief inzicht te geven in het hulpgedrag in zeven Nederlandse geboortecentra. Over het geheel genomen laten de resultaten gespannen relaties zien, maar de eerstelijns zorgverleners die in een geboortecentrum werken, noemen de tweedelijns zorgverleners als behulpzaam en vice versa. De geboortezorg professionals noemden vaak het krijgen van hulp van een professional die bij een andere groep behoorde. Het geboortecentrum wordt gezien als een voordeel, als een plaats waar geboortezorg professionals met verschillende achtergronden elkaar kunnen ontmoeten en de geboortezorg verbeteren, wat een belangrijk doel van geboortecentra is. Een verzoek om hulp aan een professional met een andere professie werd als moeilijk ervaren. De centrale personen in de zeven netwerken zijn vaak de managers en geboortezorg professionals met managementtaken.

Deel II: Uitkomsten van geboortecentrum zorg

In deel II worden de effecten van de organisationele structuur op de maternale en perinatale uitkomsten (hoofdstuk 5), kosten (hoofdstuk 6) en cliëntervaringen (hoofdstuk 7) onderzocht. Hierbij zijn geplande bevallingen in een geboortecentrum vergeleken met geplande poliklinische en thuisbevallingen. Daarnaast zijn extra analyses gedaan voor verschillende typen (locatie en integratieprofiel) geboortecentra.

In **hoofdstuk 5** zijn de maternale en perinatale uitkomsten bestudeerd met behulp van de optimality index (OI) en een samengestelde adverse outcome score (CAO). De optimality index is een instrument om een 'maximale uitkomst met minimale interventies' te meten en bevat zowel proces als uitkomst items. Of vrouwen in een geboortecentrum of poliklinisch planden te bevallen, maakte geen verschil voor de uitkomsten op de optimality index. Bij vrouwen die thuis planden te bevallen was de gemiddelde score op de optimality index hoger, oftewel gunstiger, in vergelijking met vrouwen die in een geboortecentrum planden te bevallen. Er werden geen relevante verschillen gevonden op de optimality index voor de verschillende typen (locatie en integratieprofiel) geboortecentra. Voor de samengestelde adverse outcome score zijn geen verschillen gevonden tussen de geplande plaatsen van bevalling, behalve voor nullipara met een geplande bevalling in een geboortecentrum met een gemengd integratieprofiel, zij hebben een ongunstigere score ten opzichte van de meer multidisciplinair georiënteerde geboortecentra.

In **hoofdstuk 6** is de kosteneffectiviteit van geplande bevallingen in een geboortecentrum ten opzichte van geplande poliklinische en thuisbevallingen beschreven. Bij de berekening zijn alle kosten voor zorg vanaf de start van de bevalling tot één week na de bevalling betrokken. Gemiddeld kost een geplande bevalling in een geboortecentrum €3.327,-. Dit bedrag is gelijk aan de kosten van een geplande poliklinische bevalling (€3.330,-). De kosten voor een geplande bevalling thuis (€2.998,-) zijn significant lager dan een geplande bevalling in een geboortecentrum. De kosten zijn voor alle typen geboortecentra even hoog, ongeacht locatie of integratieprofiel. Voor nullipara en multipara vrouwen met een laag risico op complicaties, was een geplande bevalling thuis de meest kosteneffectieve optie in vergelijking met een geplande bevalling in een geboortecentrum en poliklinisch in het ziekenhuis.

In **hoofdstuk 7** zijn de ervaringen van vrouwen met een geplande bevalling in een geboortecentrum vergeleken met een geplande poliklinische en thuisbevalling. De ervaringen van de vrouwen met de zorg tijdens de bevalling zijn gemeten aan de hand van het World Health Organization (WHO) responsiveness concept, bestaande uit acht domeinen. Vrouwen die planden om in een geboortecentrum te bevallen, bleken vergelijkbare ervaringen te hebben met vrouwen die poliklinisch planden te bevallen. Hun ervaringen zijn minder positief dan de ervaringen van vrouwen die planden om thuis te bevallen. Het verschil was statistisch significant voor de domeinen autonomie

en continuïteit van zorg. Vrouwen die tijdens de bevalling werden verwezen hadden minder positieve ervaringen ongeacht hun geplande plaats van bevalling. De diensten in geboortecentra werden hoog gewaardeerd: meer dan 80% van de vrouwen die in een geboortecentrum zijn geweest beoordeelt de faciliteiten, het moment van aankomst en vertrek en de continuïteit in een geboortecentrum als goed. In geval van een verwijzing vonden de meeste vrouwen de verplaatsing van het geboortecentrum naar de klinische verloskamers geen probleem.

In **hoofdstuk 8** worden alle uitkomsten van bovenstaande studies kritisch besproken en worden er aanbevelingen en implicaties gegeven. Van geboortecentra werd verwacht dat zij een betere kwaliteit van zorg leveren, als gevolg van betere samenwerking in vergelijking met de gebruikelijke zorg (een poliklinische en thuisbevalling). Maar, presteren geboortecentra daadwerkelijk beter in vergelijking met de gebruikelijke zorg? Geplande bevallingen in een geboortecentrum verschillen nauwelijks van de geplande poliklinische bevallingen op de proces- en uitkomstmaten, terwijl de geplande thuisbevallingen beter scoren in termen van gezondheidsuitkomsten, cliëntervaringen en kosten. Wanneer verschillende typen geboortecentra worden vergeleken op basis van hun locatie en integratieprofiel zijn er geen relevante verschillen gevonden. Opvallend zijn de grote verschillen in de organisatie van zorg tussen de Nederlands geboortecentra. Geboortecentra in hun huidige vorm zijn veel belovend. We raden verdere profilering van de geboortecentra aan, inclusief een huiselijke omgeving en faciliteiten die de fysiologische geboorte stimuleren (bv. lachgas). Dit allemaal aangepast aan de wensen en behoeften van de lokale situatie. Bijzondere aandacht moet worden besteed aan de verwijzing van een cliënt vanuit een geboortecentrum naar de klinische verloskamers en de rol van de informele samenwerking tussen de verschillende professies.

Chapter 10

AUTHORS AND AFFILIATIONS

M.E. van den Akker-van Marle	Department of Medical Decision Making, Leiden University Medical Centre, Leiden, the Netherlands
H.A. Akkermans	Department of Management, Tilburg University, Tilburg, the Netherlands
I.C. Boesveld	Jan van Es Institute, Netherlands Expert Centre Integrated Primary Care, Almere, the Netherlands
P. van Dommelen	Department of Life Style, TNO, Leiden, the Netherlands
A. Franx	Division Woman and Baby, University Medical Centre Utrecht, Utrecht, the Netherlands
J.P. de Graaf	Department of Obstetrics and Gynaecology, Erasmus University Medical Centre, Rotterdam, the Netherlands
M.A.A. Hermus	Department of Child Health, TNO, Leiden, the Netherlands-Department of Obstetrics, Leiden University Medical Centre, Leiden, the Netherlands Midwifery Practice Trivia, Oosterhout, the Netherlands
A. Kramer	Department of Management, Tilburg University, Tilburg, the Netherlands
J.M.M. van Lith	Department of Obstetrics, Leiden University Medical Centre, Leiden, the Netherlands
N. Luurssen-Masurel	Department of Child Health, TNO, Leiden, the Netherlands
B.R. Meijboom	Department of Management, Tilburg University, Tilburg, the Netherlands
K.M. van der Pal-de Bruin	Department of Child Health, TNO, Leiden, the Netherlands
M. Scheerhagen	Department of Obstetrics and Gynaecology, Erasmus University Medical Centre, Rotterdam, the Netherlands
E.A.P. Steegers	Department of Obstetrics and Gynaecology, Erasmus University Medical Centre, Rotterdam, the Netherlands
T.A. Wiegers	NIVEL (Netherlands Institute for Health Services Research), Utrecht, the Netherlands

MANUSCRIPTS

Manuscripts related to this thesis

Chapter 2

Hitzert M., Meijboom B.R., de Graaf J.P., van der Pal-de Bruin K.M., Steegers E.A.P., Akkermans H.A.

Co-location and inter-organizational collaboration in Dutch maternity care. Results of the Dutch Birth Centre Study.

Submitted

Chapter 3

Hitzert M., Boesveld I.C., Hermus M.A.A., de Graaf J.P., Wiegers T.A., Steegers E.A.P., Meijboom B.R., Akkermans H.A.

Quality improvement opportunities for handover practices in maternity care: a case study from a process perspective.

Submitted

Chapter 4

Hitzert M., Kramer A.

Help - I need somebody! A multiple case study on helping behaviour in birth centres.

Submitted

Chapter 5

Hermus M.A.A., **Hitzert M.**, Boesveld I.C., van den Akker-van Marle M.E., van Dommelen P., Franx A., de Graaf J.P., van Lith J.M.M., Luurssen-Masurel N., Steegers E.A.P., Wiegers T.A., van der Pal-de Bruin K.M.

Differences in optimality index between planned place of birth in a birth centre and alternative planned places of birth, a nationwide prospective cohort study in the Netherlands.

BMJ open, 2017, 7.11: e016958

Chapter 6

Hitzert M., Hermus M.A.A., Boesveld I.C., Franx A., van der Pal-de Bruin K.M., Steegers E.A.P., van den Akker-van Marle M.E.

Cost-effectiveness of a planned birth in a birth centre compared with planned birth in a hospital and at home in women with low-risk of complication. Results of the Dutch Birth Centre Study.

BMJ Open 2017;7:e016960

Chapter 7
Hitzert M., Hermus, M. A., Scheerhagen M., Boesveld, I. C., Wiegers T. A., van den Akker-van M. E., van Dommelen P., van der Pal - de Bruin K.M., de Graaf J. P. (2016). Experiences of women who planned birth in a birth centre compared to alternative planned places of birth. Results of the Dutch Birth Centre Study.
Midwifery, 2016, 40: 70-78

OTHER MANUSCRIPTS

Scientific journals

Hermus M.M.A., Wiegers T.A., **Hitzert M.**, Boesveld I.C., van den Akker-van M.E., Akkermans H. A., Bruijnzeels M.A., Franx, A, de Graaf J.P., Rijnders M.E.B., Steegers, E.A.P., van der Pal - de Bruin K.M. A. (2015). The Dutch Birth Centre Study: study design of a programmatic evaluation of the effect of birth centre care in the Netherlands.
BMC Pregnancy & Childbirth, *15*, 1

Hermus M.A.A., Boesveld I.C., **Hitzert M**., Franx A., de Graaf J.P., Steegers E.A.P. Wiegers T.A., van der Pal - de Bruin K.M. Defining and describing birth centres in the Netherlands-a component study of the Dutch Birth Centre Study.
BMC pregnancy and childbirth, 2017 Jul 3; 17:210

Boesveld I.C., Hermus M.A.A., de Graaf J.P., **Hitzert M.**, de Graaf J.P., Franx A., Wiegers T.A., van der Pal - de Bruin K.M., de Vries, R.G., Franx A., Wiegers, TA. Developing quality indicators for assessing quality of birth centre care: a mixed-methods study.
BMC Pregnancy and Childbirth, 2017; 17:259

Boesveld I.C, Hermus M.A.A., van der Velden-Bollemaat E.C., **Hitzert M.**, de Graaf J.P., Franx A., Wiegers T.A. An approach to assessing the quality of birth centres.
Submitted

Boesveld I.C., Bruijnzeels M.A., **Hitzert M**., Hermus M.A.A., van der Pal - de Bruin K.M., van den Akker - van Marle M.E., Steegers E.A.P., Franx A., de Vries R.R, Wiegers T.A.
Typology of birth centres in the Netherlands using the Rainbow model of integrated care: results of the Dutch Birth Centre Study.
BMC Health Services Research. 2017 Jun 21;17:426

Boesveld I.C., Valentijn P.P., **Hitzert M.**, Hermus M.A.A., Franx A., de Vries R.G., Wiegers T.A., Bruijnzeels M.A. An approach to measuring Integrated Care within a Maternity Care System: Experiences from the Maternity Care Network Study and the Dutch Birth Centre Study.
International Journal of Integrated Care, 2017;17(2):6,pp1-13.

Boesveld I.C., **Hitzert M.**, Hermus M.A.A., Wiegers T.A., van den Akker-van Marle M.E., de Vries R.D, Franx A., Bruijnzeels M.A.
Exploring the triple aim in integrated perinatal care: experienced quality of care. Perinatal outcomes and costs of birth centres in the Netherlands.
Submitted

Health reports

van den Akker-van M.E., Akkermans H. A., Boesveld I.C., Bruijnzeels M.A., Franx, A., de Graaf J.P., Hermus M.M.A., **Hitzert M.**, van der Pal - de Bruin K.M., Steegers, E.A.P., Wiegers T.A.
Evaluatie van zorg in geboortecentra in Nederland. Resultaten van het Geboortecentrum Onderzoek. 2016. (Report for 'ZonMw', The Netherlands Organisation for Health Research and Development, report in Dutch).

SUMMARY OF PHD TRAINING AND TEACHING

Name PhD student:	Marit Hitzert
Erasmus MC Department:	Obstetrics and Gynaecology
PhD period:	February 2013 - May 2016
Promotores:	Prof. dr. Eric A.P. Steegers
	Prof. dr. Henk A. Akkermans
Co-promotores:	Dr. M. Elske van den Akker-van Marle
	Dr. Johanna P. de Graaf

1. PhD training

	Year	Workload (Hours/ECTS)
General courses		
- Biomedical English Writing and Communication	2014	4.0 ECTS
- Research Integrity	2014	0.3 ECTS
Specific courses (e.g. Research school, Medical Training)		
- Kwalitatief onderzoek in de praktijk van de gezondheidszorg	2013	3.0 ECTS
- Case study research	2014	5.0 ECTS
- Doelmatigheidsonderzoek: methoden en principes	2014	3.0 ECTS
Seminars, workshops and research meetings		
- Erasmus MC PhD day	2013	0.2 ECTS
- Workshop Endnote	2014	0.1 ECTS
- Workshop peer-review	2014	0.1 ECTS
- Workshop social media	2014	0.1 ECTS
- Workshop Photoshop and Illustrator	2014	0.3 ECTS
- Seminar dynamics of social structures	2014	0.2 ECTS
- Erasmus MC PhD day	2014	0.2 ECTS
- Workshop popularising sciences	2014	0.2 ECTS
- Workshop blogging & twitter for academics	2014	0.2 ECTS
- Workshop media contacts for researchers	2015	0.1 ECTS
- Erasmus MC PhD day	2015	0.2 ECTS
- Onderwijsactiviteit over thema posters	2015	0.1 ECTS
- Seminar Career Orientation	2015	0.1 ECTS
- Sophia research day	2015	0.1 ECTS
- Workshop omgaan met groepen	2015	0.1 ECTS
- Weekly research meetings department of obstetrics and gynaecology (3 oral presentations)	2013-2016	4.0 ECTS
- Research meetings department of medical decision making Leiden University Medical Centre (2 oral presentations)	2015-2016	2.0 ECTS

(Inter)national conferences		
- Conference Euroma 2014, Palermo, Italy (oral presentation)	2013	1.0 ECTS
- Attending symposium 'Beweging in de geboortezorg', Rotterdam, the Netherlands	2013	0.2 ECTS
- Attending Symposium 'Gezamelijke besluitvorming', Nijmegen, the Netherlands	2014	0.2 ECTS
- Attending symposium on behalf of the 5 year anniversary of the 'Sophia Birth Centre', Rotterdam, the Netherlands	2014	0.2 ECTS
- Attending symposium 'Beweging in de geboortezorg', Rotterdam, the Netherlands	2015	0.2 ECTS
- Wladimirof Symposium, Erasmus MC (oral presentation)	2016	1.0 ECTS
- Symposium 'Geboortecentrum Onderzoek', Utrecht, the Netherlands (two oral presentations)	2016	2.0 ECTS
- Symposium 'Organisatie van Ketenzorg', Tilburg, the Netherlands (oral presentation)	2016	1.0 ECTS
Other		
- Advisory committee of the Dutch Birth Centre Study, Leiden, the Netherlands (5 oral presentations)	2013-2015	5.0 ECTS
- Support committee of the Dutch Birth Centre Study, Utrecht, the Netherlands (3 oral presentations)	2013-2015	3.0 ECTS
- Side visit 'ZonMw, the Netherlands Organisation for Health Research and Development, the Hague, the Netherlands (oral presentation)	2014, 2016	1.5 ECTS
- Member check with professionals working in participating birth centres, Rotterdam, the Netherlands (oral presentation)	2014	1.5 ECTS
- Attending expertmeetings on non-respons in client experience questionnaires, Utrecht, the Netherlands	2015, 2016	1.0 ECTS
- Acted as a committee member at a pre-defence of a PhD-student, Tilburg, the Netherlands	2016	0.5 ECTS
2. Teaching		
Lecturing		
Supervising practicals and excursions, Tutoring		
- Tutoring first-year medical students in the first months of their studies, also preparing them for an academic environment	2015-2016	1.0 ECTS
Supervising Master's theses		
- Public Health student Sharon van den Burg, title: 'Partner experiences with birth centre care'	2014	1.0 ECTS
Other		
- Guided several persons working on data entry	2014, 2015	1.0 ECTS
- Guided a junior researcher during her activities within the Dutch Birth Centre Study	2015	1.5 ECTS

ABOUT THE AUTHOR

Marit Hitzert was born on September 11th, 1989 in Rotterdam. She grew up in Nieuw-Beijerland, a town located on an island at the south of Rotterdam. In 2008, she finished her pre-university education (VWO) at the RSG Hoeksche Waard. Marit's first career choices involved being a community midwife or an obstetrician. Later she became interested in broader, societally relevant, complex health issues. She moved to Wageningen to study Health and Society, obtaining her Bachelor of Science degree in August 2011. At the same period she took extra classes focussing on the multicultural society at the Leiden University. In September 2011 she moved back to Rotterdam to study Health Care Management at the Erasmus University, obtaining her Master of Science degree in May 2013. Besides her study she finished a traineeship at the Birth Centre Sophia Rotterdam. Her interests: obstetrics, multiculturalism and social medicine, came together. In January 2013 she started as a Phd student at the department of Obstetrics and Gynaecology, subdivision Obstetrics and Prenatal medicine of the Erasmus Medical Centre. Her research focussed on the organizational processes and (health) outcomes of birth centre care (Supervisors Prof. dr E.A.P. Steegers (Erasmus Medical Centre), Prof. dr. H.A. Akkermans (Tilburg University), Dr. M.E. Van den Akker-van Marle (Leiden University Medical Centre) and Dr. J.P. de Graaf (Erasmus Medical Centre)). Since December 2016 she is working at the Dutch National Institute for Public Health and Environment (RIVM) on the coordination of prenatal screening.

DANKWOORD

Wanneer ik de afgelopen jaren een proefschrift ontving bladerde ik altijd eerst naar het dankwoord, nieuwsgierig naar de ervaringen van diegene die mij voorgingen. Nu is de tijd gekomen dat ik mijn dankwoord kan schrijven.

Deel uitmaken van een landelijk onderzoeksproject binnen de verloskunde; een ervaring die mij nog lang zal bijblijven. Wat was ik onder de indruk van de inzet en openheid van de verloskundig zorgverleners en cliënten in de geboortecentra. Ik kreeg de mogelijkheid om in diverse geboortecentra zelf te ervaren hoe het eraan toegaat. Dit was heel leerzaam en het maakte mij nog enthousiaster! Wat een persoonlijke en wetenschappelijke groei heb ik de afgelopen jaren doorgemaakt, hiervoor wil ik een aantal personen bedanken.

Allereerst mijn promotoren en co-promotoren.

Prof. Steegers, beste Eric, hartelijk dank voor het vertrouwen en de vrijheid die ik ervaren heb. Ik wist dat als het nodig was ik altijd bij u terecht kon.

Prof. Akkermans, beste Henk, in het zuiden scheen altijd de zon! Dank voor het relativeren: er zijn veel dingen belangrijker dan het werk. Ik zal het onthouden.

Elske, dank voor je altijd positieve support. Ik heb onze samenwerking heel prettig gevonden en ben blij met je inzet en ondersteuning. Je bent een voorbeeld voor mij!

Hanneke, het begon allemaal bij jou. Zonder jou was ik nooit aan dit promotietraject begonnen, dank voor deze bijzondere kans. Het was fijn dat ik op ieder moment van de dag op jou kon terugvallen.

De leden van de kleine commissie, bestaande uit Prof. dr. I.K.M. Reiss, Prof. dr. C.A. Uyl-de Groot en Prof. dr. J.M.M. van Lith. Dank voor de tijd en moeite die u heeft genomen om mijn proefschrift te lezen en te beoordelen. Ook dank aan dr. M.J. Nieuwenhuijze , Prof. dr. M. de Hoog en Prof. dr. D. Tibboel voor het willen plaatsnemen in de grote commissie.

Natuurlijk bedank ik ook allen met wie ik de afgelopen jaren heb samengewerkt, om te beginnen met Inge en Marieke. Bloed, zweet en tranen. Van onderzoek tot lief en leed, alles hebben we gedeeld de afgelopen jaren. En wat een gemêleerd stel zijn we, misschien juist daarom heb ik zo genoten van jullie. Daarnaast wil ik de projectgroep bedanken, in het bijzonder Karin (dank voor je support en persoonlijke interesse), Trees (dank voor je altijd snelle en kritische reacties) en Prof. Franx. Tevens wil ik Prof. Meijboom bedanken voor de prettige samenwerking.

Een van de belangrijkste ingrediënten voor een fijne baan vind ik leuke directe collega's. Joops Angels, jullie waren dat voor mij. We hebben 'tranen gelachen, onnozel gedaan'. Jiskoot bedankt voor de apenliefde, jij zorgde regelmatig voor ontspanning. CinCin, Puh voelde zich alleen naast jou zo op z'n gemak, dat is zeer veel waard. Mijn-Riv en Anne-Lotte, ieder uniek, jullie maakten de tuin oprecht compleet! Dank voor de lunches en liters warme chocolademelk. Overige collega onderzoekers, in het bijzonder Yvonne en Wendy, bedankt!

Tenslotte is dit dankwoord niet compleet zonder het noemen van mijn lieve vrienden en familie. Om goed te kunnen presteren is ontspanning noodzakelijk. Dank aan de vrienden en familie die dit geboden hebben. Dank voor de interesse in mijn onderzoek, of juist even niet.

Speciale dank voor mijn ouders. Jullie hebben mij een veilig nest gegeven, jaren lang in mij geïnvesteerd, zelfstandig gemaakt en interesse getoond. Bedankt voor alles!

De laatste woorden van dank zijn voor jou, lieve Ömer. Ik ben heel blij dat je er altijd bent! Je zorgt er op de juiste momenten voor dat ik in een versnelling lager ga ("effe rustig Blond"). Ook wanneer de zon niet schijnt kan ik op je vertrouwen. Er is niemand bij wie ik mij meer thuis voel dan bij jou!

APPENDIX 1: QUESTIONNAIRE ON RELATIONAL COORDINATION

Relational Coordination Questionnaire

Appendix 1

1. How *frequently* do you communicate with care providers in these groups about clients?

Maternity care assistants	never	monthly	weekly	daily	a few times a day
Community midwives	never	monthly	weekly	daily	a few times a day
Nurses	never	monthly	weekly	daily	a few times a day
Midwives	never	monthly	weekly	daily	a few times a day
Obstetricians (trainees)	never	monthly	weekly	daily	a few times a day
Paediatricians (trainees)	never	monthly	weekly	daily	a few times a day

2. Do care providers in these groups community with you in a *timely* way about clients?

Maternity care assistants	n/a	never	rarely	sometimes	often	always
Community midwives	n/a	never	rarely	sometimes	often	always
Nurses	n/a	never	rarely	sometimes	often	always
Midwives	n/a	never	rarely	sometimes	often	always
Obstetricians (trainees)	n/a	never	rarely	sometimes	often	always
Paediatricians (trainees)	n/a	never	rarely	sometimes	often	always

3. Do care providers in these groups communicate with you *accurately* about clients?

Maternity care assistants	n/a	never	rarely	sometimes	often	always
Community midwives	n/a	never	rarely	sometimes	often	always
Nurses	n/a	never	rarely	sometimes	often	always
Midwives	n/a	never	rarely	sometimes	often	always
Obstetricians (trainees)	n/a	never	rarely	sometimes	often	always
Paediatricians (trainees)	n/a	never	rarely	sometimes	often	always

4. When problems arise regarding the care of client, do care providers in these groups work with you to *solve the problem*?

Maternity care assistants	n/a	never	rarely	sometimes	often	always
Community midwives	n/a	never	rarely	sometimes	often	always
Nurses	n/a	never	rarely	sometimes	often	always
Midwives	n/a	never	rarely	sometimes	often	always
Obstetricians (trainees)	n/a	never	rarely	sometimes	often	always
Paediatricians (trainees)	n/a	never	rarely	sometimes	often	always

5. How much do care providers in these groups *know* about the work you do in caring for clients?

Maternity care assistants	n/a	nothing	little	some	a lot	everything
Community midwives	n/a	nothing	little	some	a lot	everything
Nurses	n/a	nothing	little	some	a lot	everything
Midwives	n/a	nothing	little	some	a lot	everything
Obstetricians (trainees)	n/a	nothing	little	some	a lot	everything
Paediatricians (trainees)	n/a	nothing	little	some	a lot	everything

6. How much do care providers in these groups *respect* the work you do in caring for clients?

Maternity care assistants	n/a	not at all	a little	somewhat	a lot	completely
Community midwives	n/a	not at all	a little	somewhat	a lot	completely
Nurses	n/a	not at all	a little	somewhat	a lot	completely
Midwives	n/a	not at all	a little	somewhat	a lot	completely
Obstetricians (trainees)	n/a	not at all	a little	somewhat	a lot	completely
Paediatricians (trainees)	n/a	not at all	a little	somewhat	a lot	completely

7. How much do care providers in these groups *share your goals* for the care of clients?

Maternity care assistants	n/a	not at all	a little	somewhat	a lot	completely
Community midwives	n/a	not at all	a little	somewhat	a lot	completely
Nurses	n/a	not at all	a little	somewhat	a lot	completely
Midwives	n/a	not at all	a little	somewhat	a lot	completely
Obstetricians (trainees)	n/a	not at all	a little	somewhat	a lot	completely
Paediatricians (trainees)	n/a	not at all	a little	somewhat	a lot	completely

8. Which work group do you belong to?


HOME
BIRTH CENTRE
HOSPITAL