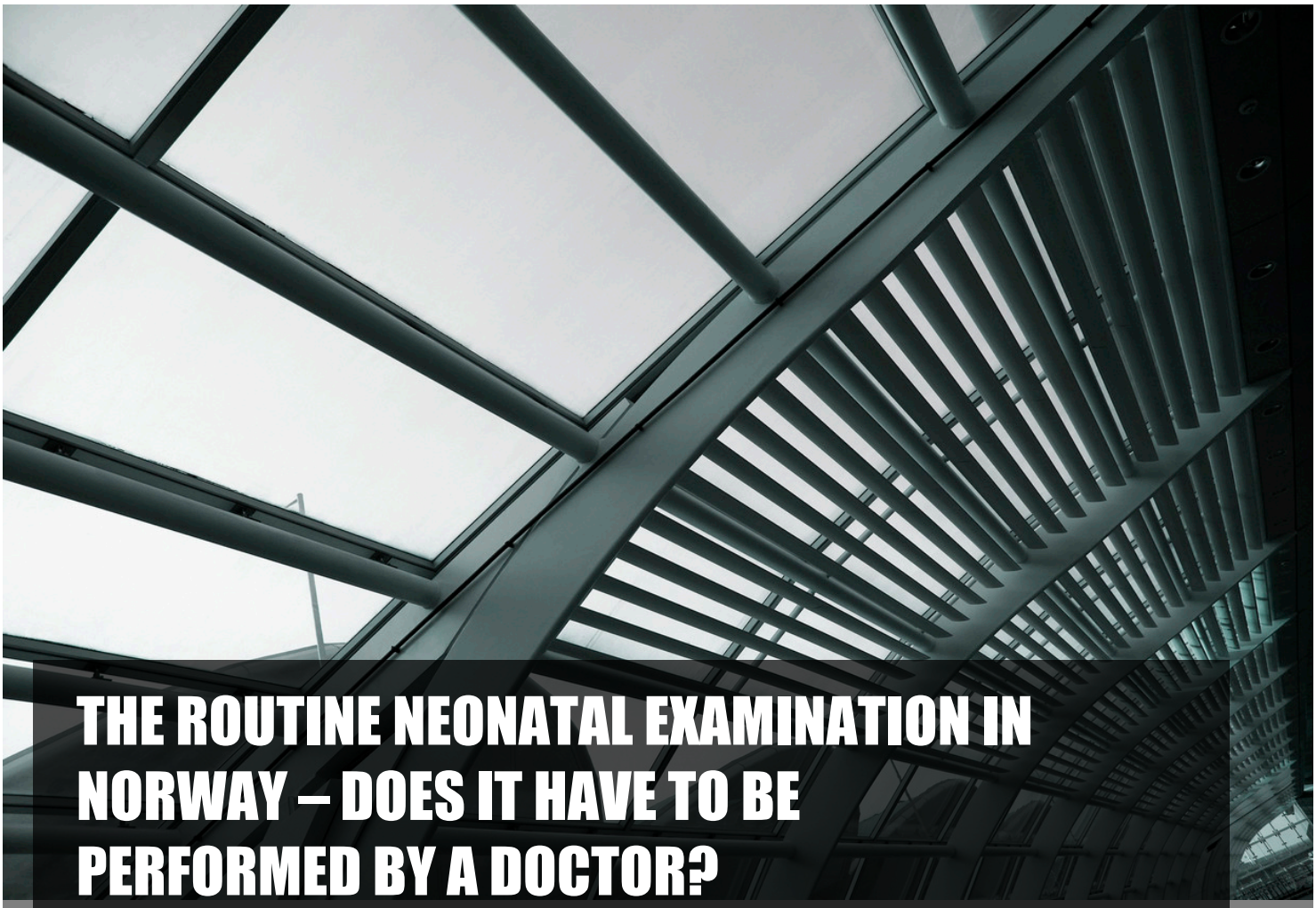

THE ROUTINE NEONATAL EXAMINATION IN NORWAY – DOES IT HAVE TO BE PERFORMED BY A DOCTOR?

A literature review and semi-structured interview.

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ABSTRACT
Objective - To assess the implications and Norway's possibilities to reduce the doctors' responsibility and towards midwives undertaking the routine neonatal examination. To approach this we have looked at other countries that already have changed their practice.
Design - This is a literature review of the comparison of routine neonatal examination done by medical practitioners and midwives/advanced neonatal nurse practitioners (ANNPs). Semi-structured interviews were held with doctors and midwives mainly concentrating on their opinions about who should do the examination and what the implication and consequences can be if changes are made.
Results – Increased quality of examination, maternal satisfaction and cost savings with midwife examination in reviewed studies. Different views were shared amongst those who were interviewed.
Conclusion – This review presents that qualified trained midwives can carry out an adequate examination based on studies that show increased quality, improved maternal satisfaction and cost savings. If midwives were to perform the examination, it can be an appropriate use of resources.

Contents

BACKGROUND

What is the neonatal examination?

All neonates are examined and screened shortly after birth for a list of conditions that are treatable, but not always clinically apparent in the newborn period. This includes:

- A full physical assessment of the newborn's every organ system by an experienced health worker within 24-48 hours after birth (see table 1),
- Some metabolic and genetic disease with blood tests,
- Hearing: Automated auditory brainstem response (AABR) or otoaucustic emissions (OAE),
- Congenital cardiac defects by pulse oxymetri.

The aim is to detect conditions that can be serious or even fatal if they are not detected at an early stage, and when no abnormalities are found, provide reassurance to the parents and discharge healthy neonates from the hospital (1-4). In our paper we mostly pay attention to the routine neonatal physical examination.

Table 1. Overview of routine newborn examination

General appearance	Colour, activity, quality of cry, malformations/abnormalities/dysmorphism, posture/tone, size/maturity
Skin	Colour, lesions, rashes
Head	Molding/shape, suture lines, fontanelles, bruising, oedema
Eyes	Symmetry, shape, discharge, erythema, red light reflex
ENT	Ear set/shape, preauricular ptis/tags, nasal patency, palate, gums, lips, tongue
Neck	Palpate sternocleidomastoid muscle, range of motion, asymmetry, masses
Thorax and breast	Shape of thorax, position of nipples, work of breathing
Lungs and heart	Breath sounds, heart murmurs, femoral pulses
Abdomen and umbilicus	Bowel sounds, liver, spleen, umbilical cord
Genitalia	Labia, hymen (or penis, testicles) and anus
Trunk and spine	Symmetry, skin lesions, masses
Extremities	Mobility, deformity, stability
Neurological	Suck, grasp (hand and feet), Moro reflex, rooting, plantar

Increasing the midwife's responsibility

Over the past few years, industrialized countries have made a switch from the traditional shared care to midwife-led care maternity services for low-risk pregnancies. This is "through recognising that midwives should take the lead role in the care of normal pregnancy and labour" (5). In UK, aside from expanding the responsibility of the midwives, there has also been a move to reduce the working hours of the junior doctors. In 1993, Middlesex University and North Middlesex and Whittington Hospital NHS Trusts joined together to make a module that could qualify midwives to perform the neonatal routine examination (6). A few years later the N96 programme was introduced for midwives. The post-registration course known as N96 or the Neurobehavioral Physiological Assessment of the Newborn, is an open course available for health visitors, midwives and doctors, and gives the midwives adequate, structured training in undertaking the routine neonatal examination and improves their expertise in general (7).

The program was quickly established in most hospitals in England, and several countries, such as Australia and Denmark, have followed to implement similar modules in their education of midwives.

Current practice
Previously, medical practitioners in Norway used to undertake the routine neonatal examination twice before discharge – at day 2 and day 5 postpartum. Today, one examination is performed at day 1-2, and the mother and infant are discharged shortly after.

Straight after birth, the midwives are trained to do a quick health assessment of the infant. They determine the Apgar score at 1 and 5 minute of age, and check for dysmorphic features, including if cleft palate is evident. The doctors undertake the routine examination as outlined above, but several studies done after new modules in UK shows that the midwife can be as clinically effective as the medical practitioner to detect findings. The increased focus on the midwives' holistic care of low-risk pregnancies gives us a good reason to raise the question:

THE ROUTINE NEONATAL EXAMINATION IN NORWAY – DOES IT HAVE TO BE PERFORMED BY A DOCTOR?

Because doctors in Norway undertake the routine neonatal examination, there are no Norwegian studies that compare the role of paediatricians and midwives regarding the neonatal examination. However, recently The Norwegian Directorate of Health outlined draft guidelines considering discharge routines of healthy newborns from maternity ward as they vary nationally, but these temporary guidelines did not refer to changes in who should perform the routine examination (8).

In this paper we explore if Norway has the possibilities to change their routines in neonatal examination based on literature review and a semi-structured interview. As we approach to the prospects of changing the practice, the centre of attention should be health-worker's competency and family-centered care. Individual responsibility amongst practitioners in Norway will be given enormous attention as new professional boundaries are set and multi-professional working encouraged. But this is still to be considered. We look at this review as important for future workforce planning and possible changes in current models of medical training.

In this paper we discuss the following questions:

- Comparison of midwives and paediatricians
    - Are midwives as good as medical practitioners in conducting the neonatal examination?
    - Who is most clinically effective?
    - Is a change of practice proper use of resources?
    - Are the mothers satisfied with midwives undertaking the examination?

METHODS
There is little published on routine neonatal examination in current Norwegian literature. We found that the best way to present this is by a literature review and semi-structured interview of different health professionals in Oslo, Norway.

Combined literature review and semi-structured interview: why?

We encountered some limitations in time and resources during the preliminary phases of our project. Initially, we decided to carry out a quantitative study by going through medical records of all newborn routine examination performed in selected hospitals in Norway during a time period of 3 months. With this we wanted to assess the quality and effectiveness of the routine neonatal examination, and compare it with practice in other countries. We concluded that it would be a task too difficult for us, as positive findings are relatively uncommon in routine neonatal examinations, and reviewing medical records of examinations done at three hospitals during 3 months would barely reveal enough positive findings to demonstrate a true, representative material. Secondly, if we were to go through numerous medical records, consent from all of the patients would be needed to access them, which would be too time-consuming.

Instead we decided to collect a body of articles and combine them with a semi-structured interview. We gathered all relevant articles on the routine neonatal examination, regardless of their country of origin. But after a broad article search, only a small number of articles reflected practice in Norway. Interviewing Norwegian health professionals showed to be the best approach in this case. We formulated questions based on a qualitative study done by Bloomfield et al (9).

Literature review

Article search

For article searches, we mostly used search engines at PubMed (http://www.ncbi.nlm.nih.gov/pubmed) and the Norwegian website Helsebiblioteket (http://www.helsebiblioteket.no/). The latter works with a "6S pyramid"-system, where articles are rated and ranked depending on their reliability. The top of the pyramid consists of summaries, which are evidence-based clinical textbooks, while single studies are at the bottom. When we searched for articles, we aimed to find resources at the top steps of the pyramids, but considering there are little published on this topic most of the articles we used are single studies. We found one systematic review regarding midwife-led care versus physician-led care, but it did not mention the newborn examination, which is the main topic in our paper (10).

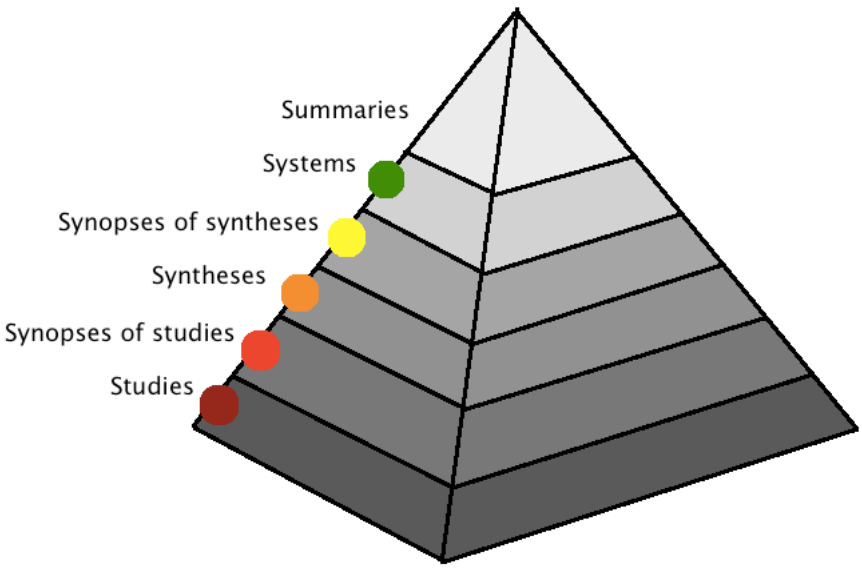

Figure 1: "6S pyramid"-system reproduced from Per Olav Vandvik's lecture *Hvordan finne svar på kliniske spørsmål om diagnostikk, prognose og behandling* held 4th June 2012 at University of Oslo.

The keywords used to search in PubMed were *routine examination, newborn, neonatal, maternal satisfaction, midwives, routine screening* and *screening examination.* A search in PubMed using *routine neonatal examination* as keywords, gives 737 results (searched on 14th of July 2013), whereas about 20 articles were relevant for our paper. This displays the limitations we had during our research. To find more relevant articles, we used the resource list at the back of each article.

Topics

Resources concerning the routine examination as a whole were limited, but we found multiple articles that concentrated on certain areas. These articles demonstrate the sensitivity of positive findings for each described area, and some even compared midwives and paediatric trainees regarding effectiveness and their ability to do a proper assessment, e.g. if they should refer the patient to a specialist. We decided to concentrate on three areas:

1. Eyes
2. Hips
3. Heart

We chose these areas as assessing the routine neonatal examination as a whole would be beyond the resources of this paper.

To find articles on eyes, hips and heart, we used keywords as *screening retinoblastoma, congenital heart disease (CHD)* and *routine examination and developmental/congenital hip dysplasia screening.* Multiple articles were found on these topics (1, 11-19).

Besides looking at the midwives' and the doctors' ability to detect a positive finding, we also reviewed the maternal satisfaction and use of resources when routine examination is done by midwives and doctors. Our supervisor helped us find articles concerning these topics (9, 10, 20-25).

Semi-structured interview

Setting

We conducted our interviews at Oslo University Hospital (Rikshospitalet and Ullevål University Hospitals) and Akershus University Hospital. These are major hospitals situated in the capital of Norway. Rikshospitalet University Hospital is a more specialized hospital, where usually the most critical and complicated cases are taken care of, while Ullevål and Akershus University Hospitals deals with more general cases. We visited the paediatric department at each hospital for the interviews, place and time to be decided by the interviewee her/himself.

Subject and consent

When we arrived at the paediatric department, we first searched for the nurse in charge to ask for consent to interview a medical practitioner and a midwife. There were separate questions for the doctors and the midwives:

- Midwives:
    - Their responsibilities at the department and experience in conducting the routine neonatal examination, if any.
    - Who do you think should perform the routine neonatal examination and why?
    - Implications and consequences if it was decided they would perform the examinations instead of the medical practitioner.

- Doctors:
    - Training and experience in conducting the routine neonatal examination
    - Who do you think should perform the routine neonatal examination and why?
    - Attitudes toward having the midwives conduct the examination.

Our interviewees consisted of one medical practitioner and one or two midwifes at each of the hospitals, in addition to two mothers in the postnatal ward at one of the hospitals. Amongst the medical practitioners there were one junior doctor and two consultants. Their years of experience in neonatal medicine ranged from 5 to 25 years. The midwives had experience ranging from 6 to 18 years. Both of the mothers had given birth to their second child and had recently gone through the routine neonatal examination with the doctor. They were both situated at the patient hotel waiting to be discharged.

Some of the questions were changed and reformulated to help with understanding, but the main points were kept. One of the interviewers typed the answers, while the other asked the questions. Straight after each interview, we discussed it and made sure both had the same understanding of the responses.

Each interviewee was given a short briefing of the paper. Verbal consent was asked to be able to quote the interviewee, and all subjects were reassured anonymity. Excluding the participants' personal information and name ensured the confidentiality of the participants. This was done by coding the interviewee, e.g. "Midwife 1", referring to midwife number 1. The interviewees' responses are formatted in *italics*.

Critical assessment of the semi-structured interview and the methods in the publications

Video recordings

Bloomfield et al (9) did a study in 2003, which at that time, was the only one to compare senior house officers (SHOs) and midwives with the use of video recordings. Consultant paediatrician and senior midwives were chosen to rate videos of routine examinations performed by SHOs and trained midwives. A proforma with 61 items was developed for the consultants and senior midwives to base their rating on. Despite organising a training day and briefing before they commenced the rating, only half of the items on the videotapes showed moderate to good agreement between the raters. The lack of well-defined "gold standards" for some items was found to be the reason for disagreement. Barlow's test of the hips, for example, was excluded from the study because it was not performed or poorly executed by the examiner, and procedures as "aortic auscultation" and "pulmonary auscultation" were hard to assess due to poor agreement.

Bloomfield et al (9) considered video recordings as a good tool to make objective assessments of the participants of the study, but it did have some limitations. For some of the examined items, it was hard for the observers to analyze correctly as they could not hear what the examiner heard nor see what the examiner saw, for example in auscultation of lungs and heart. The authors suggest the use of audio recording for further studies in the future (9).

Randomised controlled trial (RCT)

We used one RCT where the participants in the study (infants and mothers) were randomised to be examined by a midwife or SHO (23). Maternal satisfaction of the neonatal routine examination was then assessed by questionnaires answered by the mothers. Blinding in this trial was not possible as examiners were not blinded to trial participation and the identity of the examiner was known for the mother.

Another limitation in the study was the exclusion criteria. They were agreed with midwives and paediatricians, and left only 53 % of all newborns to be eligible for midwife examination. The authors suggest; "other or perhaps less stringent exclusion criteria may be considered in the future" (23). In addition, 11 % of the newborns assigned to a midwife were examined by a SHO, because the midwife was not available at that time.

Qualitative study

In general the most common limitation of a qualitative study is that the volume of samples is too small. In the study by Bloomfield et al (24), they did not regard this as a problem since their "aim was not to be a survey, but to elicit opinions from those carrying out the examinations and those whose babies were examined". Rogers et al (25) also point out their small sample as a limitation, but their aim is a presentation of experiences and opinions of midwives. As their purpose was not to make generalizations, the method used for selection of participants was considered suitable. But they see that this can affect the reliability of their findings and results of the study.

The interview conducted by the undersigned found limitations with their method as outlined above. The volume of sample was too small, with only 9 participants. Another concern was if we should have talked to health professionals in other cities than Oslo. As our aim with the interview was similar to Bloomfield et al (24) and Rogers et al (25), we did not find this necessary. Collecting participants for the interviews was harder than expected. Some of the answers were given in a hurry due to the interviewee being short on time, and recruiting other subjects to participate was not possible. This was a semi-structured interview, with the use of open-ended questions that can be difficult to analyze.

Retro- and prospective study

Lee et al (1) conducted a prospective study to look at the effectiveness of trainee paediatricians compared with advanced neonatal nurse practitioners (ANNPs) by using referrals to orthopaedics, ophthalmologists and cardiologists. Two different obstetric hospitals were used in this study, where there was shown differences between the populations included, one of the hospitals having high-risk deliveries. Despite this, the result of the study did not show any difference in abnormality rate when undertaking the neonatal examination. When looking at the specialist clinics, they found a failure to attend rate of about 10% that may have lead to a degree of bias into the study. But it is assumed that most of these infants were normal since none of them presented with abnormal hip later at the ages of 1 or 2.

Another aspect pointed out was the detection of congenital cataract. In this study infants up to 1 year of age was assessed by the ophthalmologist and examined for congenital cataract, but previous studies have shown that up to 33% of congenital cataracts do not present until after 1 year of age. This introduces the possibility of bias into the results of this study. But they did not find any reason to suspect that there was any difference in the bias between the two groups and that it probably was distributed equally between them (1).

In the study done by Williamson et al (20) the clinical effectiveness of midwives carrying out the newborn examination was assessed by testing the appropriateness with an audit tool. Retrospective data was collected and reviewed from midwives' clinical records from one district general hospital in England. They point out the size of the sample as a limitation for

this study. The clinical records of only eight midwives were studied, but these midwives were the only ones qualified to perform the examination of the newborn at the hospital at that time.

RESULTS

Quality of examination

Different studies have compared midwives or ANNPs with SHOs and observed the clinical effectiveness and quality of the routine neonatal examination performed by these two groups of health professionals (1, 7, 20). These studies have also emphasised the difficulties in detecting pathological conditions, giving congenital heart disease and developmental dysplasia of the hip as an example. To determine if the midwives are clinically effective, studies have looked at their skills to take proper family history and find relevant information, detect congenital abnormalities and make referrals (20). In addition, Rogers et al also present the value of appropriate use of resources (24).

In this part of our paper, we look at studies that have compared the quality of examination and effectiveness separately for hip abnormalities, cardiac abnormalities and congenital cataract. We also look at appropriate referrals, use of resources and the cost implications for extending the midwives role in general.

Hip

Developmental dysplasia of the hip (DDH) or congenital dislocation of the hip (CDH) is a condition that can be hard to detect on the routine neonatal examination. The incidence of dysplastic hip is found to be about 1,1% (7). Morrissy et al.'s study *Congenital Dislocation of the Hip: Early detection and Prevention of Late Complication,* demonstrates that some CDHs are imperceptible and asymptomatic during the neonatal period and therefore difficult to detect, but also presents the importance of identifying dislocated hips at an early stage to decrease the late sequelae of CDH (11).

Tredwell presented the value of the routine neonatal hip examination. Based on three different analyses; retrospective reviews reported in 1981, a prospective examination in 1989 and an economic evaluation in 1990, he concluded a routine, standardized hip examination as clinically effective (18).

Quality of examination

Bloomfield et al (9) evaluated the quality of the routine examination of the newborn undertaken by SHOs and midwives. Using video recordings when observing the SHOs' and midwives' skills when undertaking the examination, consultant paediatricians and senior midwives rated the examiners independently. The results were presented in different tables. Ortolani's test of the hips is presented in one of the tables containing items where there were rated no significant differences between SHOs and midwives and where there were good agreement between the raters. See parts of the table in Table 2.

Table 2. Selected items from table 1 (b) (9)

	Rated by consultant pediatrician		Rated by senior midwife	
Examined by	Midwives (%)	SHOs (%)	Midwives (%)	SHOs (%)
Abduction 60-90 (left) - Ortolani	77,3	88,2	72,2	70,6
Abduction 60-90 (right)	77,3	88,2	72,2	76,5

This table presents that there were no significant differences found between the examiners and that there was good agreement between the raters. Bloomfield et al presents this with an overall estimation of all items where midwifes were rated higher by consultant paediatricians in 55% of the items, while they in 60% of the items were rated higher by senior midwives. This gives no significant difference on all items between midwives and SHOs (p>0,5). In the table presented above, we can se that both the consultant paediatrician and senior midwives rated the SHOs and midwives quite evenly. SHOs were rated higher than the midwives by 10,9% (88,2%-77,3 %) in both tests by consultant paediatricians. The senior midwives rated the midwives higher by 1,6% (72,2%-70,6%) in one of the tests, but the SHOs were rated higher with 4,3% (76,5%-72,2%) in the other. (9)

Bloomfield et al (9) also present that in some parts of the examination, none of the examiners were rated highly, especially using Barlow's test the examiners skills were poor.

Even though there are some poor examiner skills, regardless if it is a midwife or doctor examining, the study by Townsend et al (7) suggests that as long as midwives get proper training and support, they can be good enough to perform the examination. In some cases they state that midwives' skills can exceed SHOs' skills, and therefore make the quality of examination even better.

Effectiveness
As mentioned in the Background, the aim of the neonatal routine examination is early detection of serious and fatal pathological conditions in newborn babies. Lee et al compared the effectiveness of routine neonatal examination undertaken by trainee paediatricians and ANNPs (1).

Lee et al concluded that there was a significant difference in sensitivity between SHOs and ANNPs ($p < 0.05$). ANNPs displayed greater sensitivity than SHOs and therefore were more effective in detecting congenital hip abnormalities (96 % vs 74 %), but there was no significant difference found in positive predictive value ($p=0.5$). Table 3 presents the sensitivity and positive predictive value (1):

Table 3: Differences in sensitivity and PPV of hip examination for paediatric trainee and ANNP

	Sensitivity	Positive predictive value (PPV)
Paediatric trainee	74 %	11 %
Advanced neonatal nurse practitioner	96 %	11 %

Cardiac
It is known that detecting congenital heart disease (CHD) with the neonatal examination can be difficult (13), and several studies, one of them Norwegian, question the use of routine neonatal examination as one of few screening tools to identify cardiac abnormalities in neonates (14-16). CHD is one of the major rare abnormalities, with only 10 per 1000 live born babies (30). Wren et al found that half of the babies with heart disease fail to be detected through the neonatal examination (17). This illustrates the problem that occurs when discussing who should be the appropriate health professional to undertake the routine examination.

Quality of examination
Table 4 includes selected items from Table 6 and 8 in the EMREN study, that compares the quality of the examination between SHOs and midwives, and if the item was appropriately

performed by the examiner. A written proforma included criteria for rating each physical component of the examination, and the raters judged the examiners on the basis of whether the item had been carried out or not, or the ranking was based on a rating scale (7). Taking the item brachial pulses palpation as an example, the midwives were rated 100% and the SHOs were rated 0.0% by both consultant paediatricians and senior midwives, meaning all midwives were observed adequately palpating brachial pulse, while it was not carried out adequately by the SHOs at all.

Table 4: Selected items from Table 6 and 8 in the EMREN study (7)

	Rated by consultant paediatrician		Rated by senior midwife	
	Midwives (%)	SHOs (%)	Midwives (%)	SHOs (%)
Sternal borders auscultation	100.0	62.5	92.9	77.8
Brachial pulses palpated	100.0	0.0	100.0	0.0
Aortic auscultation	87.5	50.0	93.8	50.0
Screening for heart disease	76.2	75.0	93.3	11.1

The study concludes that there are major differences between midwives and SHOs in quality of examination of the heart, and midwives' examinations were rated as being of higher quality than SHOs' examinations (7). But some of the items listed in the Table 4 had poor to fair inter-rater agreement, which should be taken into account (see under Methods).

Effectiveness

The EMREN study (7) showed that the midwives had a higher standard in the quality of examination, but regarding effectiveness and the ability to proper referrals Lee et al found no significant differences between the SHOs and the ANNPs for both sensitivity and positive predictive value (p=0.1) (1). Table 5 illustrates the findings from the study by Lee et al.

Table 5: Differences in sensitivity and PPV of cardiac examination for paediatric trainee and ANNP

	Sensitivity	Positive predictive value (PPV)
Paediatric trainee	39 %	58 %
Advanced neonatal nurse practitioner	50 %	83 %

The study concludes that, although there is no significant difference (p=0.1), the percentages were in the ANNPs' favour.

One of the doctors that we interviewed emphasised the difficulty and amount of experience needed to detect and assess cardiac murmurs:

> *"Even experienced doctors can have difficulties detecting cardiac murmurs. If midwives were to undertake the neonatal examination, maybe there would be more unnecessary referrals to imaging, and murmurs could be overlooked." (Doctor 3)*

On the midwives behalf, a lot of concerns were expressed about them doing the cardiac examination:

"Checking reflexes and auscultating the infant's heart is maybe outside our expertise. The midwives' responsibility is the healthy infant, and it takes a lot of knowledge about physiology and pathology to distinguish healthy from the sick. It takes broad experience to auscultate the heart of an infant." (Midwife 3)

"…To auscultate the infant's heart is much more complicated and needs basic understanding of the physiology of an adult heart. I don't have any clinical experience in auscultating the heart at all." (Midwife 4)

Eye

The examination of eye is also considered as a difficult part of the routine examination. SHOs in the qualitative study done by Bloomfield et al, expressed that there were some major problems in examining the eyes, especially to open the infant's eyes to examine red reflex (24). Lee et al refers to another study where they found that only about 35 % of the congenital cataracts are picked up on newborn examination, and that the outcome of cataract is optimised with surgical intervention before the age of 6 weeks (1).

Quality of examination

The EMREN study found that there are no significant differences when comparing midwives and SHOs regarding the quality of examination (7). The midwives performed an adequate examination of the eyes in 90 % and 95,5 % of the cases rated by consultant paediatrician and senior midwives respectively, while SHOs performed the examination adequately in 100 % and 78,6 % of the cases. The results from the study are shown in Table 6.

Table 6: Selected items from Table 7 in the EMREN study (7)

	Rated by consultant paediatrician		Rated by senior midwife	
	Midwives (%)	SHOs (%)	Midwives (%)	SHOs (%)
Eyes	90.0	100.0	95.5	78.6

Effectiveness

In the study by Lee et al (1) the midwives were significantly better in detecting abnormal ophthalmologists' findings ($p < 0.05$). Table 7 demonstrates a difference in sensitivity of examination of the eyes, 33 % versus 100 %, with midwives representing the latter. It was not a significant difference in positive predictive values ($p < 0.1$).

Table 7: Differences in sensitivity and PPV of eye examination for paediatric trainee and ANNP

	Sensitivity	Positive predictive value (PPV)
Paediatric trainee	33 %	42 %
Advanced neonatal nurse practitioner	100 %	60 %

Despite these results, the eye and hip examination were parts of the examination found difficult by some of the midwives we interviewed:

"Maybe the eye and hip examinations are the most complicated parts of the examination." (Midwife 4)

Referrals

One of the aims of the routine examination of the neonate is to screen for congenital conditions that may result in a referral to specialist clinics. Townsend et al (7) have also studied the appropriateness of referral for different pathological findings conducted on the

routine examination. They concluded that there was no significant difference between SHOs and midwives in referrals to hospital, or appropriate community referrals for problems that required further diagnosis. When it comes to inappropriate referrals to hospitals, there were not any significant differences. This is presented in Table 8:

Table 8: Number of referrals

	Appropriate referrals to hospital for major or minor problems	Appropriate community referrals	Inappropriate referrals to hospital
SHOs	4,6 %	3,1%	1,0%
Midwives	5,9 %	4,2%	1,2%
p	0,54	0,55	0,8

In the study *Neonatal examination: Are midwives clinically effective* by Williamsons et al (20) appropriate referrals were one of the aspects used to determine if midwives were clinically effective. They concluded that midwives are clinically effective in detecting abnormalities on the neonatal examination and make appropriate referrals.

Use of resources

In this section we look at the use of resources, and the cost implications for extending the midwives' role to undertake the newborn examination.

Several studies discuss the cost implications of having midwives undertake the newborn examination (1, 7, 10, 25), and there are both economic disadvantages and positive outcomes for extending the midwives' role. The main point in midwives' favour is regarding the cost of having the doctors undertake all the neonatal examinations, instead of shared workload with midwives. As mentioned earlier, UK has developed programs that support and encourage midwives to give cost-effective and efficient care to mothers, infants and their family (7).

The EMREN study authors have written a chapter about "Cost implications of midwives examining the newborn" (7). They have set up three scenarios:

- Scenario A: Midwives examining all babies without any antenatal complications or problems during birth (50 % of examinations)
- Scenario B: Midwives examine all the babies healthy enough to stay in 'normal' wards (90% of examinations)
- Scenario C: All examinations are to be performed by registrars instead of SHOs.

By the time of the study 2% of the examinations were done by midwives and 98% by SHOs and registrars. The study leads to the conclusion that with scenario A and B there are savings of cost, while scenario C leads to extra costs compared to the present situation. Costs include salary, annual costs of education, ongoing training and capital costs. Other studies are in agreement that extending the midwives role is most cost-effective (1, 25).

A qualitative study done by Steele in 2007 presents that even after introduction of N96 doctors mostly conduct the examinations. One-third of the trained midwives do not continue to practise their skills following a successful completion of the N96 (26). Is this improper use of the resource in a community? One of the midwives in our interview emphasized the economic disadvantage of the midwives' post-training in neonatal routine examination:

"It costs a lot to train a midwife, and quality assurance is a social cost." (Midwife 3)

According to Steele (26) the midwives who stopped examining newborn babies, had been motivated to use their skills after completing N96, but stopped practising for a number of reasons. These are presented in the same study and quoted below:

1. Lack of recognition of the role
2. Not being trusted by peers
3. They were likely to be the only midwife in the unit having completed the N96 course and reported feelings of isolation and lack of support.
4. Have no support network in place on completion of the course (26).

Bloomfield et al (24) stress the importance of appropriate use of resources. With the midwives conducting the neonatal examination, registrars and SHOs are cleared to use their time on other work tasks. It is well known that doctors already can be overloaded with responsibilities, as expressed by one of our interviewees:

> *"It will be less work for us, and that is a good thing." (Doctor 2)*

In the same study, another benefit of having the midwives perform the neonatal examination was identified; more mothers and babies could be discharged more quickly instead of waiting around for the paediatrician to undertake the routine examination (24, 26). This was also looked as a benefit amongst some of the midwives and doctors interviewed:

> *"The midwives are at the ward all the time, and the mothers don't have to wait for the doctor to do the examination." (Midwife 2)*

> *"The midwives know the baby and its family, and if midwives conduct the examination, they don't have to repeat the medical history. This would make it more efficient." (Doctor 1)*

As a consequence, more beds would be available for new patients, which would soothe the flow of the ward.

On the other hand, one of the doctors interviewed presented the concerns about use of resources. The interviewee stated that if midwives undertook the examination, there are limitations for what they are authorized to do when findings are detected:

> *"If there is any pathology, one must act quickly. For example, if there is any cardiac pathology or other malformations found, the midwives have to confirm this with a doctor who can refer the baby to a specialist. It seems like it will be a delay because the midwife do not have the authority to treat the baby." (Doctor 3)*

Time of examination

Delaying a full examination for a few days after birth could possibly increase the chance of detecting conditions that are not apparent immediately. For example, congenital dislocation of the hip and cardiac abnormalities may not be evident when the first examination is conducted (4, 27, 28). This concern was shared with one of the doctors we interviewed:

> *"…Some are discharged and examined less than 12 hours postpartum, and by that time some conditions are not yet detectable." (Doctor 1)*

In this paper, there is placed little emphasis on this matter, but it should be mentioned, as this is an important argument to whether or not the midwife is the preferred examiner. One of our interviewed midwives informed us that the standard in Norway is to observe the mother and infant at least 4-6 hours before being discharged. If the medical practitioner assigned to perform the neonatal examination is being held back by other commitments, it is a chance that the mother and infant have to stay another night in the hospital awaiting the examination to be performed. Steele (26) explains the delay of discharge as caused by "the demanding workload for paediatric staff whose priority is not the healthy neonate". The time of the examination was expressed as important for several of the midwives that were interviewed:

> *"Most of the mothers want to go home early, what sometimes can lead to an examination to be conducted too early after birth, because that is the only time the doctor is available. If the midwife can do the examination, they can wait a few more hours. This is appropriate, as there is increasing focus on early discharge." (Midwife 3)*

> *"When you consider the time of the examination, a midwife would be able to do it in a natural context (...) We use a lot of energy to organize the time of meeting between paediatrician, midwife and mothers." (Midwife 4)*

Maternal satisfaction

Several studies have shown that maternal satisfaction is increased when midwives perform the routine neonatal examination (7,9, 21), but this is hard to measure since no clinical rating scales are outlined. A number of factors have been identified to increase maternal satisfaction through different aspects of care, such as communication, continuity of care, health education and overall satisfaction.

Communication

Reassuring the parents that the infant is healthy is an important part of the routine neonatal examination. Mothers consider good communication to include discussing childcare issues, asking them about their concerns, giving health information, informing what the examiner is doing and explaining what is found throughout the examination (7).

Bloomfield et al (9) found that midwives were rated higher in communication skills. Another study also showed that if the mother knew the examiner, the communication was improved and the mothers were more likely to discuss their concerns and anxieties (7, 25). One of the midwives that we interviewed agreed:

> *"The midwife knows the parents already. (...) There would not be a stranger to communicate with the mother." (Midwife 4)*

One of the interviewee found the direct contact between mother and doctor to be effective and timesaving:

> *"Here, the examination is done by the medical practitioner. Mothers can have direct contact with the doctor, and further examination and referrals can be done immediately than if done by a midwife." (Doctor 2)*

We asked one mother about the communication between her and the examiner:

"I had not prepared any questions, and the examination happened so fast that I did not have time to think of any. I had some questions afterwards, and the midwife answered them adequately." (Mother 1)

Continuity of care

Increased maternal satisfaction is not correlated to the profession of the health professional undertaking the routine neonatal examination, but whether the examiner imparts health care issues and provides continuity of care (23). Wolke et al defined continuity of care as "the same midwife 'booking' the mother at the initial antenatal visit and conducting the neonatal examination" (21). In the same study, 15 % (72/474) of the newborn examinations were done by the midwife who 'booked' the first antenatal visit, and mothers were 74 % less likely to report low satisfaction if the examination was performed by the 'booking' midwife than another midwife or a junior paediatrician (21, 23).

With continuity of care there is a reduction of health professionals exposed to the mothers. By relating to only one or two midwives, the advices given to the mothers are more likely to be consistent, and the mothers get the opportunity to build a stronger relationship with the midwife (7, 24).

When the importance of continuity of care was mentioned to one of the doctors that we interviewed, the significance of a doctor's role and knowledge when conducting the examination, was seen as more important:

"It is not only about care and examining the baby, but also about taking a medical history. (...) When I do the examination, a lot of thoughts are going through my mind about that baby and its environment – what kind of baby is it? Is it born prematurely? Were there any risks during birth? Hereditary conditions? The knowledge is united with the examination. Maybe doctors are better at this than the midwives because they have the knowledge." (Doctor 2)

Health education

As mentioned above, some studies have shown that giving postpartum health education increases maternal satisfaction. A study done by Wolke et al showed that in cases where health-care issues were discussed, mothers were less than half as likely to report lower satisfaction with the examination (21).

Healthcare advises contributed were concerning feeding, stool and nappy care, sleeping and skin care. This showed to be highly appreciated by the mothers, regardless if a midwife or doctor provided it. The mothers had informed that midwives gave healthcare education twice as often as did the doctors, respectively 61% and 33% (21).

Overall satisfaction

A study done by Wolke et al showed that mothers' overall satisfaction was high; "at day one 82% of women (85% in the midwife group and 79% in the junior paediatrician group) reported a mean score of +2 or +3 (high or very high satisfaction)" (21).

Another study done by Bloomfield et al presents mothers' views in comparing doctors with midwives, and concluded that the midwives were more "approachable, easy to talk to and ask questions of" (24).

Expertise and training

In a study done by Rogers et al (25) midwives stated their examination to be more "holistic" since they gave more attention to reassurance and health education than doctors. On the other hand, expertise and training was important for most of the mothers in a study done by Bloomfield et al (24). Some of the doctors in this study showed their concerns around midwives not having the proper medical knowledge to give reassurance to the parents, and not being medically qualified enough to perform an examination. As one of our interviewees said:

> *"I think we should do it. It is a medical task." (Doctor 1)*

There were also concerns shared amongst the midwives interviewed for this paper:

> *"I like the system as it is now. The doctors are specialized in this field. It is important that serious things are found at an early stage. It is not easy for us to catch the important symptom in a child because of lack of knowledge. (…) That is why the doctors should do it." (Midwife 1)*

Also, one of the mothers interviewed expressed her increased confidence in doctors conducting the examination rather than a midwife:

> *"I do not want a midwife to undertake the examination even though they get proper training. A midwife takes care of the mother, and a doctor has more knowledge about the child and its pathology. I feel more confident and safe when it is a doctor who is undertaking the examination." (Mother 2)*

In contrast to this, one of the other mothers responded:

> *"It does not matter who undertake the examination as long as the person conducting it takes his time." (Mother 1)*

But broadly, in the study by Bloomfield et al (24), the view was that if proper training was given to the midwives, any midwife could perform the examination. This was also shared by some of our interviewees:

> *"If the midwives get proper training, I think they can do a proper assessment." (Doctor 1)*

> *"If the system was changed, and the neonatal examination was made a part of the midwife's education, the situation is different. Most children are healthy, and that is why this can work out." (Doctor 2)*

After implementing N96 in UK and giving the midwives courses in how to perform the newborn examination, most of them felt quite confident in conducting the examination (25). Generally, there was an agreement between mothers that midwives could examine normal, healthy babies, while doctors could look after babies with pathological findings (24). Some of the doctors interviewed for this paper were more reluctant to give the whole responsibility to the midwives:

"I think we are better in taking care of the sick babies, and it will therefore be easier for us to detect any pathology. With our knowledge, conditions that can be fatal later may be detected in time." (Doctor 1)

"The midwives have less knowledge about children's diseases and conditions in neonates." (Doctor 2)

Discussion

Our paper was carried out in response to the increased responsibility of midwives and the movement of increasing efficiency of medical care. We reviewed several studies originating from the UK, and the majority found that the examination done by midwives was as good as or better than the doctors' (1, 7, 20, 23).

The overall quality of the neonatal examination can be measured with different parameters. In our paper we included quality of examination, use of resources, maternal satisfaction and referral rate. Almost all of the reviewed studies favoured midwives' examination. Maternal satisfaction was primarily associated with the midwives' tendency to discuss health care issues and to provide continuity of care (7), but Wolke et al also showed that if doctors were to include general advices, the profession of the examiner did not matter for the mother (23). This correlates with the opinions expressed by one of the mothers we interviewed.

The EMREN study concludes that both doctors and midwives are in pivotal position to carry out the examination, assuming they are similarly trained (7). Training and education for SHO and midwives has been seen as a challenge for the countries that have made way for the midwives to perform the examination. In Norway today, junior doctors are mostly trained by "learning, by doing", that is, no formal training is included in their education, while midwives get teaching that is more structured. In exploring whether Norway should change their practice or not, two scenarios can be considered.

- Scenario 1: The examination is still performed by doctors only, but more structured training should be included in their education to increase the overall quality of examination.
- Scenario 2: The introduction of midwives overtaking the examination. This provides a change in Norwegian training of midwives, either by implementation of a post-registration course or by integrating a structured program in their midwife specialization.

Pros and cons can be found with both scenarios. If the doctors are to continue examining the newborn (scenario 1), the EMREN study (7) outlines cost as one of the disadvantages.

It is well known that doctors have a lot of responsibility and can be overloaded with tasks, which can make them rush through the performance of the newborn examination. It is a concern that the examination is done in a hurry with the risk of forgetting something, as stated by some of our interviewees below:

"... I have a lot of experience in conducting the examination. Previously the consultant took the responsibility for some of the newborn babies, but a SHO can now undertake more than 30 examinations during one day. This is tiring and will of course affect the quality of the examination at the end of the day." (Doctor 1)

"The examination is a good tool, because you get confirmation that everything is normal. But I think maybe it is performed in a hurry." (Mother 1)

If midwives are to overtake the routine neonatal examination (scenario 2), they assist the doctors' workload, which also give the doctors the opportunity to focus on other complex patient needs. Some studies raise the question if midwives should examine all newborns or only those who have no complications during birth or antenatal parental history (1, 4). One could consider selecting a team of midwives at each hospital to perform the examination daily, or at selected days in a week. This would relieve the costs of educating all midwives, and the selected midwives would be more likely to perform the neonatal examination following the training. Midwife 4 in our interview also stated: *"If there was a group of midwives conducting the examination on a daily basis, they would gain wide experience".* This could also relieve junior doctors for some responsibility, and the routine examination can rather be used as a learning experience for them. On the other hand, midwives express concerns about increased workload if they were to overtake the newborn examination (4, 24, 29). These views were also shared with the midwives we interviewed:

"The midwives have already a lot to do, and our staff is already limited. (...) Due to the workload, we would more likely overlook things when examining." (Midwife 1)

"We need more resources." (Midwife 2)

Even though most of the studies concluded with increased maternal satisfaction with the midwife doing the examination, some mothers in the study by EMREN also expressed that "babies with problems should be examined by doctors who they trust and see as knowledgeable, qualified and professional" (7). Tredwell (18) discussed that treating advanced stages of a condition is more expensive than treating early stages of a condition picked up by the routine examination. One could consider an increase in costs of management, if an untrained midwife was to overlook a treatable abnormality.

Another worry is the doctors' fear of junior doctors being "deskilled" (4, 7). With the midwives overtaking the examination, junior doctors will see and handle less normal babies, as babies with pathological findings usually are transferred to paediatric specialists. Even though the junior doctor is not planning to do a specialization within paediatrics, good examiner skills are important as newborns also are seen in other fields of medicine, for example in general practice (7). Our interviewees also discussed the fear of junior doctors being "deskilled":

"The routine neonatal examination is an important experience for the junior doctors. A medical practitioner needs to have knowledge about the healthy baby to be able to identify those who are ill." (Doctor 1)

"A lot of the doctors in our ward are newly graduated. (...) Medical practitioners should not lose the daily contact with the healthy infant and the unique opportunity to learn to separate normal variations from pathology. If you are experienced with normal infants, it increases your knowledge on pathology." (Midwife 4)

As mentioned earlier, the routine examinations for newborn was previously performed twice before the woman and infant was discharged. In that way, any questions regarding the health of the child or its wellbeing could be thought through in between examinations. This is a

benefit, especially for primigravida, who usually does not have a lot of experience in raising an infant. Considering today's situation, with only one examination performed with limited time, one suggestion is to tailor each consultation depending on if the mother is primi- or multigravida. A primigravida would probably need more information about general child-care, breast-feeding and the normal development of a healthy infant than the multigravida.

Time and place for the examination has not been the major focus in this paper, but it should be mentioned, as it is important for the maternal satisfaction and the quality of the examination, meaning the opportunity to detect positive findings. Wolke et al mention that the place and the timing of the examination are important for the overall quality. In their study 30 % of the examinations were done at the mothers' homes, which led to earlier and more flexibility in discharging the mothers from the hospital, which again followed by an increase in maternal satisfaction (23).

In the semi-structured interview conducted for our paper, both negative and positive aspects of the midwives overtaking the neonatal routine examination were expressed. In general, the doctors and midwives interviewed agreed that giving the responsibility to midwives seemed questionable, especially without making any changes in today's practise. The interviewees' concerns were mainly the midwives' knowledge and losing the doctors' experience, however the change seemed possible given proper midwife training and increased resources for the midwives in the post-natal ward.

With this paper, we wanted to answer: "The routine neonatal examination in Norway – does it have to be performed by a doctor?" While looking into this matter, we have faced some challenges. First of all, our biggest limitation was the lack of resources. Concerning the neonatal routine examination, only a handful of articles were relevant for our paper. Even though we found that midwives are in favour of doing the examination, our conclusion is based on a few articles where many of the same authors were involved in several studies and where the different articles were referring to each other. In addition, the studies that were relevant for our paper were published for more than 10 years ago.

To study whether or not Norway should change their practice is not easy. It requires the involvement of many authorities and different voices need to be heard; doctors, midwives, mothers, hospitals, the government and the society. We have asked ourselves if our approach has been appropriate, but we have used all resources available and relevant for our paper. We tried to look at the topic from all possible views, and revised different kinds of studies to illustrate the diversity of the problem. It required for us to look at both quantitative and qualitative studies.

Most of the studies that we have looked at compare the skills of a SHO and a midwife, but chapter four and ten in the EMREN study (7) discuss if the comparison is appropriate. During the SHOs' training they are required to rotate between different departments, while midwives meet with mothers and newborns on a daily basis. This questions the reliability of the studies where there has been found a significant difference between the midwife and SHO examination. Bloomfield et al used both senior midwives and paediatric consultants to rate the videotapes to erase the differences between midwives and SHOs (9). In addition, the medical practitioners' work in the neonatal department is not the SHOs first encounter with newborns, as they also have had opportunities to meet with them during their schooling. Lastly, as mentioned under Results, some feel more confident to have the doctor doing the examination, as their background of knowledge usually is wide and sufficient. Even though SHOs lack the

experience of handling the newborns and undertaking the examination, their knowledge should be looked at as a big advantage in the neonatal ward.

As the Department of Health in Norway is increasingly exposed to cuts in budgets, a major focus is finding the most cost-effective solutions in all possible aspects of the medicine. An appropriate study to illustrate our problem would be to compare examiners and see who is most cost-effective. After a broad search, the only article that we could find was a cost analysis done by Townsend et al (7). A proposed study could be a comparison of midwives and SHOs in the light of cost-effectiveness.

As we explore if Norway has the ability to change their practice, we have tried to think of how Norway can approach this. Even though Norway could improve a range of outcomes with a change of practice, this paper alone is not enough to make drastic changes. To make new reforms and changes in health care considering practice in newborn examination, many different political instances must be involved. The government and Parliament control the Norwegian Directorate of Health that is responsible to improve the health of the entire nation through targeted activities across services, sectors and administrative levels. If health reform legislations were made in this area, it would make sweeping changes in the way health care is organized, financed and delivered in Norway.

For this, the entire workforce planning has to be reconsidered. It is important to ensure that the new model has potential candidates with the ability to undertake the required activities and also to ensure future business success. One of the important introductions will be a change in midwife specialization and outlining definite guidelines on how the examination should be undertaken.

New updated and reliable studies have to be done in Norway to make the society believe in the changes and give the new possible reforms power. Another important thing will be informing the parents that midwives are as effective and good as the doctors to perform the examination, which is emphasized in our paper. Can Norway use UK's model to change their practice? Maybe a trial can be done where selected midwives undergoes post-registration course and perform the examination at one of the hospitals.

Conclusion and further implications

Considering the opinions of the interviewees and after looking at different studies from other countries, our conclusion is that midwives overtaking the newborn examination should be looked upon as an option, especially by selecting a team of midwives that can be given proper training and implement the neonatal routine examination as a part of their job description.

As we look at our paper with some limitations, further research has to be done. One of the recommendations can be to work out appropriate inclusion criteria for which infant midwives should examine. Another recommendation can be to consider if the quality of the examination being carried out in the community services is as good as in the hospitals. Would this assist to delay the time of the whole examination, and be a benefit in terms of increasing the chance of detecting congenital conditions? To answer this question, a systematic review can be done to compare the quality of the newborn examination carried out on day 2 and day 5. And as mentioned above, further studies can be done to evaluate the cost-effectiveness of the routine examination.

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