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Daily structured approach to awareness of fetal movements and pregnancy outcome – a prospective study

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ABSTRACT

Objectives: We investigated how women, seeking care due to decreased movements, had paid attention to fetal movements and if the method of monitoring was associated with pregnancy outcome.

Methods: A questionnaire was distributed to women from gestational week 28, who had sought care due to decreased fetal movements in Stockholm between January 1st and December 31st, 2014. Women were included in the study if the examination did not reveal any signs of a compromised fetus requiring immediate intervention. Birth outcome and sociodemographic data were collected from the obstetric record register.

Results: There were 29 166 births in Stockholm in 2014, we have information from 2683 women who sought care for decreased fetal movements. The majority (96.6%) of the women stated that they paid attention to fetal movements. Some women observed fetal movements weekly (17.2%) and 69.5% concentrated on fetal movements daily (non-structured group). One in ten (9.9%) used counting methods daily for observing fetal movements (structured group). Women in the *structured group* more often had caesarean section before onset of labor (RR 1.6, 95% CI 1.2–2.2) and a lower risk of their baby being transferred to neonatal nursery (RR 0.25, 95% CI 0.03–0.94) compared to women in the non-structured group.

Conclusions: Women, who had a daily and structured approach to awareness of fetal movements, were more likely to have a caesarean section but their babies were less likely to be transferred to a neonatal nursery as compared with women who used a non-structured method daily.

Introduction

Maternal awareness of her baby's movements is commonly used to assess fetal well-being and low awareness of fetal movements is associated with poor pregnancy outcome [1]. Further, decreased fetal movements are associated with preterm birth, fetal growth restriction and stillbirth [2,3]. When investigating stillbirths in Japan, researchers [4] concluded that a large number of stillbirths could have been prevented if the women had contacted health care earlier and if they had information about being more aware about fetal movements and what to do if their perception of fetal movements changed. Thus, a suggested mechanism for how awareness improves pregnancy outcome is that it may shorten pre-hospital delay when the mother notices reduction in her baby's activity [4,5].

Concerns about fetal movements is common among pregnant women and it is estimated that up to 50 percent have been worried sometime during pregnancy [1]. Further, maternal concern about decreased fetal movements is the most frequent reason for unscheduled antenatal visits [6,7]. While the majority of pregnant women, seeking care due to decreased fetal movements, go home after an assessment and subsequently give birth to a healthy baby, an adverse pregnancy outcome is more likely than when women do not notice any change. For example, of women presenting with decreased fetal movements there is a 26% increase in risk of fetal growth restriction and a 4% increase in risk of stillbirth [8].

Several studies have reported that pregnant women may have

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insufficient or inaccurate knowledge about fetal movements. For example, in Canada [9] researchers found that only 18% demonstrated knowledge of 'normal' fetal movement and 37.5 percent thought that it might be normal if fetal movements ceased around their due date.

Pregnant women need their health-care provider to provide them with evidence-based information about fetal movements, but women themselves report that this is not always forthcoming. For example, in studies from Australia [10] and New Zealand [11], only 62–67 percent stated that they had received information about fetal movements from their care provider. A recent international case-control study [12] reported that mothers of a stillborn baby (n = 153) were half as likely to check fetal movements than mothers giving birth to a live baby. Mothers to stillborn babies also stated that their care provider was less likely to have given them information about the importance of monitoring fetal movement than controls with a live-born baby (n = 480).

Almost all women in Sweden visit a midwife regularly during their pregnancy and antenatal care is free of charge [13]. If the pregnant woman is concerned about how her unborn baby moves, she can contact an obstetric day clinic or a delivery ward and be assessed by a midwife or an obstetrician.

There are different ways for the pregnant women to monitor the fetal movements, structured or not. The structured methods in observing fetal movements are different types of counting the fetal movements [14,15]. In standard antenatal care in Sweden women are not encouraged to use a certain method to observe fetal movements. Theres is a gap of knowledge how pregnant women usually observe their unborn babýs movements. We investigated how women, seeking care due to decreased or altered fetal movements, had paid attention to fetal movements and if the method of monitoring was associated with pregnancy outcome.

Methods

We aimed to collect information from all women seeking care due to decreased or altered fetal movements, from all seven obstetric clinics in Stockholm in Sweden between January 1st and December 31st, 2014. Data about pregnancy, birth outcome and sociodemographic factors we collected from population-based obstetric-record register.

We developed a questionnaire based on literature and clinical experiences, in Swedish, English, Spanish, Sorani, Farsi, Arabic and Somali (additional file 1 for the English version). Questionnaires consisted of both open-ended and pre-specified answering categories. As a basis for classifying monitoring fetal movements, we asked: "How have you observed your baby's movements during the past month?" The response alternatives were: "I have tried to concentrate on the baby's movements for a moment", "I have counted the number of movements during a specific time (for example 10–15 min)", "I have checked the length of time it takes for my baby to move ten times". Each response alternative could be quantified by: "Never", "About every week" or "About every day".

We included women in gestational week 28 or above with a singleton pregnancy who consulted obstetric health care due to concern about fetal movements. Only women where the examination did not indicate any signs of a compromised fetus which needed an immediate intervention were included in this study. Thus, the questionnaire was only given to women with a normal electronic fetal monitoring who were about to be discharged after the examination of the fetus. The women were given the option of answering the questionnaire before they left the hospital and could either give the completed questionnaire to hospital staff or they could post it directly to the research group.

In the analysis we divided the women according to their answers in to four groups: 1. The women who did not observe fetal movements at all; 2. The women who used one of the stated methods, weekly; 3. The women who had been concentrating on fetal movements daily and; 4. The women who used a counting method daily (Fig. 1). If the woman stated she counted daily and also answered yes to some of the other alternatives in observing fetal movements, she was included in the group of women who counted the movements daily. When analyzing data, we chose to compare women with two different methods of monitoring their unborn baby on a daily basis; the group of women who counted the movements daily (structured group) with the women who had been concentrating on fetal movements daily (non-structured group). After calculating the differences in baseline characteristics between the two groups, we adjust for potential confounders with one single variable at a time.

Data about pregnancy and birth outcome were collected from the Obstetrix register which is a medical-record system used by maternity- and obstetric clinics in Stockholm County Council. We used SPSS software (IBM SPSS statistics version 24.0) and the statistic program R (version 3.2.4) for the analyses. Prevalence ratios were used as a measure of association and we calculated 95 percent confidence intervals based on the binomial distribution. A p-value of 0.05 was regarded as indicating statistical significance

The study was approved by Regional Ethical Review Board in Stockholm, Sweden, approval number 2013/1077-31/3. The participants gave informed consent to participate in the study, both verbally and written.

Results

There were 29 166 deliveries in Stockholm in 2014, a total of 3379 questionnaires were collected of those 3033 women fulfilled the inclusion criteria for this study. As shown in Fig. 1, we analysed 2683 women's answers after excluding 350 questionnaires (176 empty or uncompleted and 174 questionnaires which could not be linked to a medical record since there were no personal identity numbers, or were unclearly written).

The women's age range was 16–47 years and median age was 31 years. Half of the women were in gestational week 37 or above when they completed the questionnaire (range gestational week 28 + 0 to 42 + 2 days). The majority of the participants were Swedish. Seventeen percent were born outside of Europe, 66 percent reported University as the highest educational level. For other demographics see Table 1. On average, they gave birth three weeks after the visit to the clinic (gestational week 30 + 2 to 42 + 3, average 39 + 4).

The majority (n = 2592, 96.6%) of the women stated that they had paid attention to the fetal movements the previous month. The most common way was to concentrate on the movements daily (n = 1866, 69.5%) (non-structured group). One in ten (n = 265, 9.9%) of the women used a counting method daily (structured group) and some women stated that they observed fetal movements weekly (n = 461, 17.2%). A minority (n = 91, 3.4%) stated that they did not observe fetal movements at all (Fig. 1)

In comparison with women using non-structured method of daily monitoring fetal movements, women with low educational level (Elementary school RR 2.7, 95% CI 1.7–4.5) and high BMI (> 35.0, RR 2.2, 95% CI 1.2–4.1) more often used a structured approach to observe fetal movements. Further, women using a structured approach were younger (≤24 RR 1.5, 95% CI 1.0–2.2) and to a lower extent born in Sweden (RR 0.6, 95% CI 0.5–0.7). (Table 2)

As shown in Table 3, none of the babies born to women in the structured group had an Apgar score below seven, five minutes after birth as compared with 0.6 percent among the babies born to women classified having a non-structured approach to monitoring fetal movements. The women classified in the structured group experienced a spontaneous onset of labor to a lower extent than those in the non-structured group (RR 0.8, 95% CI 0.7–0.9). Further, women in the structured group had a caesarean section before onset of labor more often than those in the non-structured group (RR 1.6, 95% CI 1.2–2.2) and fewer of their babies were transferred to neonatal nursery (RR 0.25, 95% CI 0.03–0.9). According to the differences in characteristics between the compared groups (structured and non-structured) as shown

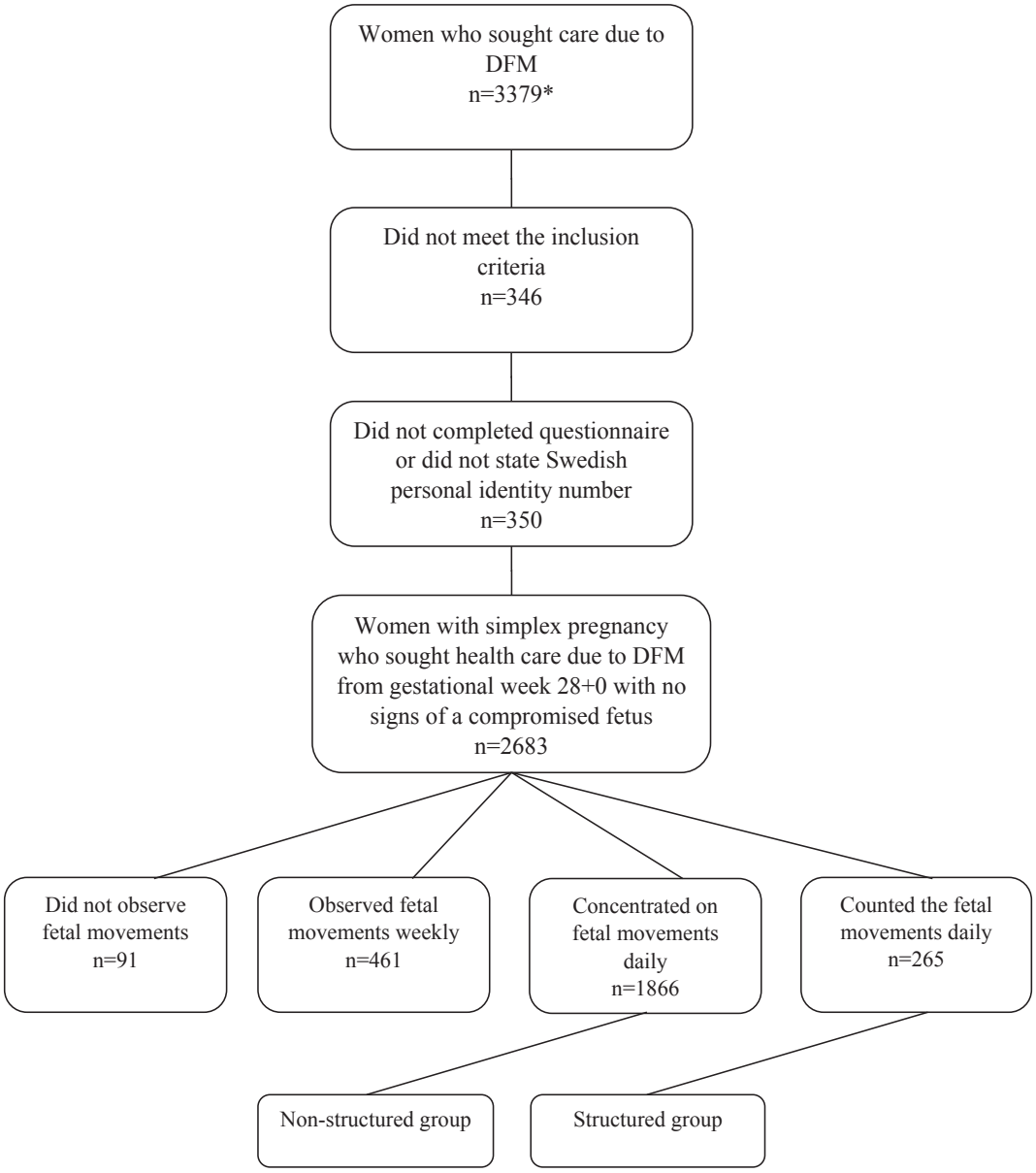

Fig. 1. Flow chart.

in Table 2, we adjusted for age, education, country of origin and BMI. Unadjusted ORs for transfer to neonatal nursery are 0.25 (CI 0.04–0.79, p-value 0.05) and the difference between the compared groups remains the same when adjusting for one variable at a time (Age: adjusted OR 0.24, CI 0.04–0.81; Education: adjusted OR 0.25, CI 0.04–0.8; Country of origin: adjusted OR 0.23, CI 0.04–0.79; BMI: adjusted OR 0.25, CI 0.04–0.75).

Women classified in the structured group contacted healthcare due to decreased fetal movements multiple times more often (36.6%) than women who were in the non-structured group (19.6%) (RR 1.9, 95% CI 1.6–2.2). The women contacted healthcare due to decreased fetal movements twice; 24.5% versus 15.6%; three times 7.2% versus 2.5%; four times 2.6% versus 1%; five times or more 2.3% versus 0.5% (not in table).

Discussion

In this population-based study we obtained information from women seeking care due to decreased or altered fetal movements, and for whom an examination showed no signs of a compromised fetus which needed immediate intervention. We classified the women concerning their method of being aware of fetal movements and investigated their pregnancy outcomes following birth. We observed an association between those who used a daily structured approach to monitoring fetal movements and fewer newborn transfers to neonatal nursery after birth. Further, we observed that daily structured monitoring was associated with increased likelihood of caesarean section before onset of labor.

We surmise that women with daily structured approach to monitoring fetal movements may react differently to a change in her unborn baby's activity compared to women using other forms of monitoring. Further, the woman who uses a structured approach may also be able to give her care provider more objective information, than if she is relying on narrating her subjective experiences from her memory alone. If women give a fetal movement history consisting of detailed objective data to their care provider, then this may also provide a high level of usability for them to make a decision as to whether to go further with more investigations or not. Further, a daily structured monitoring of fetal movements might help the woman to provide evidence to her care provider which may assist her to be less hesitant about contacting

Table 1
Characteristics for 2683 pregnant women who contacted healthcare due to decreased fetal movements where the examination did not result in any signs of a compromised fetus which needed immediate intervention and the women were about to be discharged after the examination of the fetus.

	n	%
Age		
16–24	228	8.5
25–34	1723	64.2
35–39	562	20.9
≥40	170	6.3
Education		
Elementary school	87	3.3
High school	833	31.2
University 1–3 years	505	18.9
University > 3 years	1242	46.6
Country of origin		
Sweden	1983	74.2
Nordic countries (without Sweden)	42	1.6
Europe	195	7.3
Asia	285	10.7
Africa	96	3.6
South America	52	1.9
North America	15	0.6
Other	5	0.2
Gestational length		
28 + 0–32 + 6	573	21.4
33–36 + 6	764	28.5
37 + 0–40 + 0	937	35.0
> 40	405	15.1
Parity		
Primipara	1431	53.3
Multipara	1252	46.7
In Vitro Fertilisation	155	5.8
BMI		
< 24.9	1699	64.4
25–29.9	633	24
30–34.9	240	9.1
> 35	68	2.6
Smoking at registration	97	3.7
Diabetes mellitus	31	1.1
Intrahepatic cholestasis	24	0.9
Hypertension	81	3.0
Pre- eclampsia	70	2.6

Data are missing for: Education (n = 16, 0.6%), Country of origin (n = 10, 0.4%), Gestational length (n = 4, 0.1%),
BMI (n = 43, 1.6%), Smoking at registration (n = 58, 2.2%)

healthcare if she has concerns about how her unborn baby moves. Koshida et al. [4] suggest that pregnancy outcomes can be improved if women had information about being more aware about fetal movements and what to do if their perception of fetal movements changed.

We found that women born outside Sweden were more often monitoring her fetus daily in a structured way. Women from non-western countries who live in high income countries have a higher risk of stillbirth, emergency caesarean section and of receiving suboptimal health care compared to women born in those countries [16,17]. It might be advantageous for a woman who lives in Sweden but who does not speak the Swedish language to daily use a structured approach to monitoring fetal movements. If there are difficulties with communication due to language differences, it might be easier for the woman to explain any differences in fetal movements with details including number-based information.

To use, or not to use, counting methods to improve pregnancy outcome has been highly debated. Many studies have investigated counting methods [14,15,18–21] but a large randomized controlled trial in 1989 [22] has been one of the most cited studies of the effect of fetal movement counting, concluding that there was no effects in stillbirth rate comparing counting methods with standard care [22]. After the study was published maternity care provider promotion of counting methods decreased globally [6]. However, when looking at the results from both arms of this large randomized controlled trial there was a clear decrease in stillbirth rate across the enrolled cohort during the study from an expected 4:1000 to 2.8:1000. Further, in Norway, an intervention with information to pregnant women about fetal movements and invitation to monitoring fetal movements along with guidelines for health care professionals, showed a significant reduction in stillbirth rates in the intervention group [5]. In a review [23] Heazell and others investigated studies of fetal movement counting and concluded that stillbirth decreases in most of the studies using fetal movement counting but it is hard to know whether it is the counting method itself which gives the effect or if introducing a study about fetal movements increases maternal vigilance towards fetal activity and improves her perception of changes in fetal activity, whatever method she uses. In a Cochrane review [24] the authors conclude that there is not enough evidence to show if fetal movement counting is beneficial or not. Unlike earlier studies investigating the effect of counting fetal movements and pregnancy outcomes, our study differs. In earlier studies, the women were asked by researchers to count the movements. However, the women in our study use a method they chose by themselves. Also, the women sought healthcare on their own initiative and were not following an instruction in a study protocol.

Women in the structured group experienced more intervention through increased rates of induction of labor and delivery by caesarean section prior to the start of contractions. Moore and Piacquadio [25] observed that counting methods contribute to more interventions and a lower the fetal mortality rate. In their study, women were instructed to seek care at a delivery unit if it took more than two hours for them to feel ten movements. During the study period, there were 1864 births and the fetal mortality rate decreased from 8.7 to 2.1 per 1000 births but the rates of obstetric intervention were 2.6 times higher during the study period. A recent study also showed increased rates in induction of labor and caesarean section by intervention with a care package to pregnant women and clinicians about fetal movements [26]. However, Saastad et. al. [27] did not see any differences in this kind of intervention in their randomized controlled trial i.e. the intervention group (women counting movements) and controls had induction of birth and caesarean section to the same extent. Although, growth restricted fetuses were more often identified prior to birth in intervention group compared to controls.

Methodological considerations

The study may not fully describe how pregnant women who contact healthcare due to decreased fetal movements carry out their daily observations of fetal movements. The women may claim that they observe fetal movements in a certain way and to a higher extent because they "think that they should" i.e. Hawthorne effect [28]. Also, the response, "I have been concentrating on fetal movements" can be interpreted in many ways. One woman may be referring to when she occasionally perceives movements from the fetus while another may focus on the fetal movements over a specific period of time each day. Further, we probably misclassified some women into the wrong group however, such a misclassification that would tend to dilute the measures of association we have calculated. In other words, we would have found a stronger association between the type of awareness and transference to neonatal nursery if no woman had been misclassified. When comparing groups in the cohort we chose to do a restriction by including the women who observed fetal movements on daily basis. It is hard to define the group that stated that they monitored the baby's movements weekly. The interpretation of weekly is wide and can be interpreted as once a week or six days a week.

We were unable to determine the primary reason for the caesarean section and it may or may not have had anything to do with the presentation for decreased fetal movements or the method of monitoring. The diagnostic coding is not optimal and does not fully cover the indications for caesarean section.

Table 2
Characteristics for 265 pregnant women in structured group versus 1866 pregnant women in the non-structured group. The women were discharged after the examination of the fetus as the examination did not result in any signs of a compromised fetus which needed immediate intervention.

	Structured group n = 265 (%)	Non-structured group n = 1866 (%)	RR (CI)	P-value
Age				
≤24	29 (10.9)	137 (7.3)	1.5 (1.0–2.2)	0.05
25–34	176 (66.4)	1184 (63.5)	1.0 (1.0–1.1)	0.37
35–39	46 (17.4)	415 (22.2)	0.8 (0.6–1.0)	0.08
≥40	14 (5.3)	130 (7.0)	0.8 (0.4–1.3)	0.36
Education				
Elementary school	19 (7.2)	50 (2.7)	2.7 (1.6–4.5)	< 0.001
High school	96 (36.5)	566 (30.3)	1.2 (1.0–1.4)	0.06
University 1–3 years	48 (18.3)	364 (19.5)	0.9 (0.7–1.2)	0.68
University > 3 years	100 (38.0)	880 (47.2)	0.8 (0.7–1.0)	0.01
Missing	2 (0.8)	6 (0.3)		
Country of origin				
Sweden	125 (47.3)	1464 (78.6)	0.6 (0.5–0.7)	< 0.001
Nordic countries	1 (0.4)	31 (1.7)	0.2 (0.0–1.7)	0.17
Europe	28 (10.6)	116 (6.2)	1.7 (1.2–2.5)	0.01
Asia	72 (27.3)	159 (8.5)	3.2 (2.5–4.1)	< 0.001
Africa	24 (9.0)	46 (2.5)	3.7 (2.3–5.9)	< 0.001
South America	10 (3.8)	35 (1.9)	2.0 (1–4)	0.06
North America	4 (1.5)	9 (0.5)	3.1 (1.0–10.1)	0.07
Other	0 (0)	2 (1.0)	–	–
Missing	1 (0.4)	4 (0.2)		
Gestational length				
28 + 0–32 + 6	70 (26.6)	396 (21.2)	1.3 (1.0–1.6)	0.06
33 + 0–36 + 6	70 (26.6)	520 (27.9)	0.96 (0.8–1.2)	0.71
37 + 0–40 + 0	83 (31.6)	674 (36.1)	0.87 (0.7–1.1)	0.17
> 40 + 0	40 (15.2)	276 (14.8)	1.0 (0.8–1.4)	0.9
Missing	2 (0.8)	0 (0)		
Parity				
Primipara	138 (52.1)	997 (53.4)	0.98 (0.9–1.1)	0.7
Multipara	127 (47.9)	869 (46.6)	1.0 (0.9–1.2)	0.7
Assisted reproduction	14 (5.3)	102 (5.5)	0.97 (0.6–1.7)	1.0
BMI				
≤24.9	159 (60.5)	1197 (65.2)	0.9 (0.8–1.0)	0.15
25–29.9	61 (23.2)	447 (24.3)	0.95 (0.8–1.2)	0.8
30–34.9	30 (11.4)	152 (8.3)	1.4 (0.96–2.0)	0.1
≥35	13 (4.9)	41 (2.2)	2.2 (1.2–4.1)	0.02
Missing	2 (0.8)	29 (1.6)		
Smoking at registration	13 (5)	69 (3.8)	1.3 (0.7–2.3)	0.4
Missing	3 (1.1)	43 (2.3)		
Obstetrical characteristics				
Diabetes mellitus	6 (2.3)	17 (0.9)	2.8 (1.0–6.2)	0.06
Hepatosis	4 (1.5)	19 (1.0)	1.5 (0.5–4.3)	0.5
Symphyseolysis	13 (4.9)	72 (3.9)	1.3 (0.7–2.3)	0.4
Episode of depression/panic	8 (3)	44 (2.4)	1.3 (0.6–2.7)	0.5
Hypertension	9 (3.4)	57 (3)	1.1 (0.6–2.2)	0.7
Pre- eclampsia	6 (2.3)	45 (2.4)	0.9 (0.4–2.2)	1.0

Table 3
Characteristics for 265 pregnant women in the structured group versus 1866 pregnant women in the non-structured group. The women were discharged after the examination of the fetus as the examination did not result in any signs of a compromised fetus which needed immediate intervention. On average, the women gave birth three weeks after the data-collecting visit to the clinic (week 30 + 2 to 42 + 3, average week 39 + 4).

	Structured group n = 265 n (%)	Non-structured group n = 1866 n (%)	RR (CI)	P value
Onset of labor				
Spontaneous	145 (54.7)	1219 (65.3)	0.8 (0.7–0.9)	0.001
Induction	78 (29.4)	467 (25)	1.2 (1.0–1.4)	0.13
Elective cesarean section	42 (15.8)	180 (9.6)	1.6 (1.2–2.2)	0.004
Cesarean section after spontaneous onset of labor	9 (6.2)	98 (8)	0.8 (0.4–1.5)	0.5
Apgar Score				
0–3	0 (0)	3 (0.2)	–	1.0
4–6	0 (0)	8 (0.4)	–	0.6
7–10	264 (99.6)	1851 (99.2)	1.0 (1.0–1.0)	0.4
Missing	1 (0.4)	4 (0.2)		
Preterm birth (< 37 + 0)	10 (3.8)	46 (2.5)	1.5 (0.8–3.0)	0.2
Small for Gestational Age	4 (1.5)	41 (2.2)	0.7 (0.2–1.9)	0.6
Missing	0	1 (0)		
Transfer to Neonatal nursery	2 (0.8)	56 (3.0)	0.25 (0.03–0.9)	0.04

The study was conducted in Stockholm, the capital of Sweden, and it is not clear if the associations we found are generalizable to other settings including, smaller cities, rural areas or other countries; in Stockholm, the women generally are well-educated and older when they become pregnant as compared with other parts of Sweden [29]. Other factors such as country of birth, body mass index, smoking and maternal diseases may also differ between the capital of Sweden and other parts of the country.

The high participation rate and large sample size in the study is a strength. We aimed to give the questionnaire to all the women, in gestational week 28 and above, who came to the birth clinic with concerns about decreased or altered fetal movements during 2014 in Stockholm. Thus, due to ethical reasons, we did not give a questionnaire to women where the examination indicated a compromised fetus. The study indicate that about 10% of all the pregnant women in Stockholm (29,166 deliveries in Stockholm 2014) [30] participated in the study, i.e. contacted healthcare due to decreased fetal movements (from gestational week 28). Our figures tally with the fact that about 6–15% of all pregnant women contact healthcare due to concerns about fetal movements [6,7]. Other strengths of the study include that we collected information about method of monitoring fetal movements prospectively before the outcome of the pregnancy was known.

Conclusion

We found, that women who had a daily structured approach to monitoring fetal movements, were more likely to have a caesarean section but their babies were less likely to be transferred to a neonatal nursery as compared with women who had a non-structured approach to monitoring fetal movements on daily basis. More studies are needed to evaluate the effectiveness of different methods of women's awareness of fetal movements, and their ability to report these, on pregnancy outcome.

Competing interests

The authors declare that they have no competing interests and there are not any financial competing interests.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.srhc.2019.02.002.

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