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Alterations in maternally-perceived fetal movement and their association with late stillbirth – findings from the Midland and North of England Stillbirth Case-Control Study

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**Keywords:**

- Maternal Perception, Fetal movement, Reduced Fetal Movement, Exaggerated Fetal Movement, Stillbirth, Risk Factor
Alterations in maternally-perceived fetal movement and their association with late stillbirth – findings from the Midland and North of England Stillbirth Case-Control Study

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Running Title – Fetal movements and late stillbirth
Abstract

Objective - To report perception of fetal movements in women who experienced a stillbirth compared to controls at a similar gestation with a live birth.

Design - Case-control study.

Setting – 41 maternity units in the United Kingdom.

Participants – Cases were women who had a late stillbirth ≥28 weeks’ gestation (n=291) and controls were women with an ongoing pregnancy at the time of interview (n=733). Controls were frequency matched to cases by obstetric unit and gestational age.

Methods - Data were collected using an interviewer-administered questionnaire which included questions on maternal perception of fetal movement (frequency, strength, increased and decreased movements and hiccups) in the two weeks before the interview/stillbirth. Five fetal movement patterns were identified incorporating the changes in strength and frequency in the last two weeks by combining groups of similar pattern and risk. Multivariable analysis adjusted for known confounders.

Primary outcome measure – Association of maternally-perceived fetal movements in relation to late stillbirth.

Results – In multivariable analyses women who reported increased strength of movements in the last two weeks had decreased risk of late stillbirth compared to those whose movements were unchanged (adjusted OR 0.18, 95%CI 0.13-0.26). Women with decreased frequency (without increase in strength) of fetal movements were at increased risk (aOR 4.51, 95%CI 2.38-8.55). Daily perception of fetal hiccups was protective (aOR 0.31, 95%CI 0.17-0.56).

Conclusions – Increased strength of fetal movements and fetal hiccups are associated with decreased risk of stillbirth. Alterations in frequency of fetal movements are important in identifying
pregnancies at increased risk of stillbirth, with the greatest risk in women noting a reduction in fetal activity. Clinical guidance should be updated to reflect that increase in strength and frequency of fetal movements is associated with the lowest risk of stillbirth, and that decreased fetal movements are associated with stillbirth.

**Trial Registration** – ClinicalTrials.gov registration NCT02025530

**Strengths and Limitations**

- This is the largest case-control study reporting detailed information about maternal perception of fetal movements in relation to stillbirth
- This study addressed different aspects of fetal activity including frequency and strength and hiccups
- Case control studies can be affected by measurement error, though this is not likely to differ between groups.
- Attempts were made to reduce recall bias including: using a structured questionnaire, and no explicit hypotheses communicated to participants.
- The recruitment rate was lower than initially expected, 44.1% for cases and 25.9% for controls., which may introduce selection bias.

**Disclosure of Interests** - All authors declare that they have no competing interests.

**Funding** – The Midland and North of England Stillbirth Study was funded by grant GN2156 from Action Medical Research, Cure Kids and Sands.

**Keywords**

Maternal Perception; Fetal movement; Reduced Fetal Movement; Exaggerated Fetal Movement; Stillbirth; Risk Factor.
Introduction

Maternal perception of fetal activity is an accepted marker of fetal wellbeing. Conversely, maternal perception of changes in activity can indicate fetal compromise; the most commonly reported change is a reduction in fetal movement. Maternal perception of reduced fetal movements (RFM) is associated with adverse pregnancy outcomes including fetal growth restriction, oligohydramnios, and stillbirth. These conditions are associated with placental dysfunction, which is observed in women with reduced fetal movements. Despite the known association between RFM and stillbirth, two Confidential Enquiries into antepartum stillbirth in the United Kingdom (UK) conducted 15 years apart highlighted suboptimal care in terms of the information given to mothers about fetal movements and clinical management when mothers attend with RFM as factors contributing to stillbirth.

In comparison to a reduction in frequency of fetal movements little is known about other aspects of perceived fetal activity, such as: strength of movements, an episode of vigorous movement and fetal hiccups and how these relate to risk of stillbirth. Data from one case-control study and a large international cohort study have both suggested that any significant deviation from a mother’s usual pattern of fetal movement is a risk factor for stillbirth. Importantly, existing data suggest that an increase in both strength and frequency of fetal movements in late pregnancy was reported significantly less frequently by women who had a stillbirth. Due to this paucity of data it is important to better understand maternal perception of altered fetal activity and whether these perceptions can be used to identify fetuses at high risk of antepartum stillbirth. Furthermore, women report receiving mixed messages about the importance of fetal movements and the significance of RFM, indicating the need for clear information regarding these symptoms. To address these needs, we conducted a case-control study to explore modifiable risk factors associated with late stillbirth. The objective of this manuscript is to report maternally-perceived fetal
movements in women who experienced a recent stillbirth compared to a control group of women at
similar gestation who had a live baby.

Methods

The Midlands and North of England Stillbirth Study (MiNESS) was conducted in 41 maternity units in
the UK. The study was registered on www.clinicaltrials.gov (NCT02025530) and the study protocol
was published. Ethical and research approvals were obtained (Ref 13/NW/0874). Participants were
recruited between April 2014 and March 2016. The study methodology has been described in detail
elsewhere. Cases were included if the stillbirth occurred at or after 28 weeks’ gestation and the
fetus did not have a congenital anomaly. The cause of stillbirth was assigned using the ReCoDe
classification system.
Controls were women with an ongoing pregnancy randomly selected from
booking lists with a frequency matching that of the expected distribution of stillbirths based on the
prior four years of data from that unit. This matching ensured that controls would be at a similar
gestation to cases. Women with multiple pregnancies, maternal age less than 16 years and inability
to give consent were excluded from the study.

The primary outcome reported here was the association of maternal perception of fetal movements
with late stillbirth. Maternal perception of fetal movements were classified as increased, reduced or
stayed the same. Data specific to this analysis relates to questions asked about fetal movements and
more specifically about changes in strength and frequency in the last 2 weeks (before the baby died
for cases and last 2 weeks before interview for controls). Additional information was collected on
fetal hiccups. Data on uterine contractions were also collected as it has been argued elsewhere that
women may interpret uterine contractions as fetal movements. All questions as asked are reported
in Table 1.

Statistical methods
Univariable analyses were carried out using logistic regression to estimate the effect of each variable. Due to likely relationships between the variables, bivariate models were fitted between each pair of movement variables to assess (by changes in effect size) which variables were able to be placed in multivariable analyses together. There was a strong association between reduced movements after 26 weeks’ gestation and the variables for strength and frequency of movements in the last 2 weeks, meaning these variables could not be included in the same multivariable model. Additionally the question relating to reduced fetal movements since 26 weeks is complicated by the fact that the timeframe relating to this question varies by subjects, i.e. 2 weeks for a woman at 28 weeks gestation and 15 weeks at 41 weeks gestation. Although the strength and frequency variables were also associated with each other they measure different aspects of movement. Therefore, a combined strength/frequency variable was developed to describe the relationship between the changes in strength and frequency of movements in the last two weeks. This was done by assessing the risk associated with all 16 possible combinations and combining groups of similar pattern and risk (see Supplementary Table 1), the prioritised strength/frequency variable used the following rule:

1. Increase in strength of movements
2. Increase in frequency but not strength of movements
3. Decrease in frequency of movements
4. Unsure of change in strength or frequency
5. No change in strength or frequency

Multivariable analyses were carried out by adding the variables identified as not showing significant co-linearity (prioritised strength/frequency variable, frequency of increased fetal movements, and frequency of feeling hiccups) to the model previously developed in relation to the risk of stillbirth in this study (maternal: age, ethnicity, parity, education, smoking in pregnancy, marital status; customised birthweight centile; sleep factors on the last night before stillbirth/interview (position went to sleep in, sleep duration, number of times got up to toilet); naps in the daytime; gestation
and study centre). All analyses were carried out using the logistic procedure in SAS v9.4 (SAS Institute, Cary, N.C.).

**Results**

In total 3490 women were identified as potentially eligible participants (660 cases and 2830 controls, Figure 1). 760 women could not be contacted (77 cases, and 683 controls) and 1700 women did not consent to participate in the study (287 cases and 1413 controls). Six cases were excluded after data collection (five stillbirths had previously unidentified congenital abnormalities and one control participant had a stillbirth). Cases were more likely to participate than controls (p<0.0001), 291 cases (44.1%) and 733 controls (25.9%) were included in the analysis (Figure 1).

The demographic characteristics of the study population have been presented in detail previously. Briefly, the majority of participants were from white ethnic background (80.4% of cases and 81.0% of controls), with a significant proportion of participants from South Asian (13.4% of cases and 13.0% controls) and Black ethnic groups (4.1% of cases and 4.0% of controls). Participants’ ages were distributed across the reproductive lifespan, with the largest group between 30-34 years of age in both groups (29.6% cases, 36.6% controls). The mean body mass index of cases was 26.9 kg/m$^2$ compared to 26.0 kg/m$^2$ for controls. The median gestation at interview was 36 weeks 3 days for controls (Interquartile Range (IQR) 32 weeks 6 days to 38 weeks 5 days). In cases, the median gestation at diagnosis of stillbirth was 37 weeks 4 days (IQR 33 weeks 4 days to 39 weeks 5 days, p=0.003 compared to controls). The median interval between the presumed date of death in utero and diagnosis was 0 days (IQR 0-1). The median time between the date of diagnosis of stillbirth and the interview was 25 days (IQR 17-35). The most frequent factors associated with stillbirth were fetal growth restriction (45.2%), placental insufficiency (16.4%), placental abruption (6.5%) and acute infection (4.5%).

The prevalence of each variable relating to fetal movements and their univariable odds ratios associated with stillbirth are presented in Table 1. Women who reported RFM any time after 26
weeks’ gestation were at increased risk of having a stillbirth with the risk increasing with the number of times that they reported that decreased movements had occurred ranging from an odds ratio (OR) of 2.36 (95% Confidence Interval (CI) 1.69-3.30) for one episode to an OR of 5.11 (95% CI 3.22-8.10) for 3 or more episodes.

Women who reported a decrease in either strength (OR 1.61, 95%CI 1.05-2.46) and even more so frequency (OR 3.54, 95%CI 2.44-5.15) of fetal movements in the last 2 weeks were at increased risk of having a stillbirth compared to those who reported no change. Conversely, increasing strength (OR 0.15, 95%CI 0.11-0.22) or frequency (OR 0.38 95%CI 0.26-0.56) of fetal movement were associated with reduced stillbirth risk compared to those who reported no change. The data relating to the number of times vigorous fetal movements were felt in the last 2 weeks showed a significantly decreased stillbirth risk in those reporting more than one episode of vigorous movement (OR 0.34, 95%CI 0.25-0.47) and a trend towards increased stillbirth risk in women who felt a single episode of vigorous movement (OR 1.47, 95%CI 0.94-2.31) compared to those who never perceived movements to be more vigorous than usual. The combined variable derived from the strength and frequency variables showed that compared to no change in frequency or strength of movement, those who reported increased strength in the last two weeks, which was the most commonly reported scenario in controls (62%), had a decreased risk of stillbirth (OR 0.18, 95%CI 0.13-0.26). Those with increased frequency but not strength had a non-significant decrease in risk (numbers were relatively small), whilst those reporting decreased frequency of movements were at increased risk (OR 3.45, 95% CI 2.20-5.43).

Maternal perception of fetal hiccups in the last two weeks was associated with a decreased risk of stillbirth (OR 0.41, 95%CI 0.30-0.54). The magnitude of this reduced risk increased as the frequency of feeling hiccups increased, OR 0.32, 95% CI 0.21-0.48 for daily perception of hiccups. Feeling contractions in the last two weeks was not associated with stillbirth (OR 0.97, 95% CI 0.72-1.29).

The multivariable model (Table 2) showed that a decrease in frequency of fetal movements remained associated with increased risk of stillbirth (aOR 4.51, 95%CI 2.38-8.55) and increasing
strength of fetal movements was still associated with decreased risk of stillbirth (aOR 0.14, 95%CI 0.08-0.24) compared to no change in perception of frequency or strength of movement in the last two weeks. The decreased risk associated with feeling vigorous movements on more than one occasion in the last two weeks remained statistically significant (aOR 0.59, 95%CI 0.37-0.96). The increased risk associated with feeling vigorous movements only once in the last two weeks increased and became statistically significant (aOR 2.10, 95%CI 1.06-4.17). Compared to not feeling hiccups in the last two weeks, feeling hiccups daily was associated with a significant reduction in risk (aOR 0.31, 95%CI 0.17-0.56). If increased strength of movements is used as the reference category all other groups have an increased risk of stillbirth with the highest risk of stillbirth associated with decreased frequency of movements, aOR 31.98 (95%CI 15.63-65.42), with a population attributable risk of 60%.

We found that when baby’s movements were reported as less than usual in the preceding two weeks, mothers of cases were significantly more likely to have spoken to a health professional (79% vs 70%, p=0.02) and more likely to have attended hospital due to reduced fetal movements (68% vs 60%, p=0.07) than controls.

**Discussion**

**Main Findings**

This study shows that the majority of women with ongoing pregnancies after 28 weeks’ gestation perceive an increase in strength of fetal movements. Similarly, most women whose pregnancy ended in a live birth feel fetal hiccups. Perception of these patterns of fetal movements is associated with a substantial reduction in the risk of late stillbirth (aORs 0.14 and 0.31 respectively). Conversely, a decrease in the strength or frequency of fetal movements is associated with an increased risk of late stillbirth particularly if this is a recurrent phenomenon (OR 2.36 rising to 5.11). A single episode of vigorous fetal activity is also associated with an increased risk of stillbirth.

**Strengths and Limitations**
This study is the largest case control study that has reported detailed information about maternal perception of fetal movements in relation to the risk of late stillbirth. A comparatively novel feature of this study is that analysis of fetal activity was not restricted to a reduction in the frequency of fetal movements, but addressed changes in frequency and strength of fetal activity as well as fetal hiccups. Apart from the Auckland Stillbirth Study (TASS) most recent publications evaluating the significance of fetal movements have comprised small cohort studies of women with reduced frequency of fetal movements in centres where intervention may be employed to prevent stillbirth. \textsuperscript{16, 17} By including a broad description of fetal activity this study has been able to report the frequency and strength of fetal movements in ongoing pregnancy and patterns that are related to late stillbirth.

A case-control design was considered the most practical means to identify late stillbirth, as a prospective cohort study is not feasible, requiring almost 108,000 women to identify 291 late stillbirths (at the current frequency of 2.9 per 1,000 late stillbirths in the UK). However, it is important to consider the potential influence of recall bias, a limitation of case-control studies. This study attempted to minimise recall bias in several ways. Firstly, all participants were asked the same series of questions about fetal movements embedded in a questionnaire about many different factors (e.g. smoking, diet, stress, social situation, sleep position and fetal movements). Secondly, women who experienced a stillbirth were interviewed within a median of 25 days, a time when events surrounding the death of a baby are likely to be clearly recalled. \textsuperscript{18} As women in the control group were still pregnant at the time they completed the survey it is unlikely that experiences or concerns would be biased by knowledge of the outcome of their pregnancy. Finally, this study described novel findings of vigorous fetal movements and fetal hiccups, which are rarely addressed in prior studies, reducing the possibility that respondents may have read about these symptoms in advance of the questionnaire. While recall bias cannot be completely discounted, responses from participants’ who had a stillbirth do not universally show a deviation from controls e.g. there was no different in maternal perception of uterine contractions between the two groups.
The recruitment rate of MiNESS was lower than that of the TASS case control study (Cases 45.3% vs. 72%; Controls 26.2% vs. 72% respectively). The possibility of selection bias was minimised by recruiting controls who were frequency matched to cases over the duration of the study period which resulted in similar ages and ethnicities in both groups.

**Interpretation**

Maternal perception of fetal movement is regarded as an indicator of fetal wellbeing. Data regarding the pattern of fetal movements in late pregnancy are limited. Previous literature has suggested that the frequency of fetal movements increases until the 32nd week of pregnancy and then plateaus. Studies also note that the type and quality of fetal movements change with advancing gestation.

In this study the majority of controls reported that the frequency of fetal movements stayed the same (54.3%) but that there was increased strength of fetal movements (62.8%) in the preceding two weeks, the next most common response regarding the strength of movements was that there had been no change (27.3%). Interestingly, an increase in strength of fetal movements had a greater protective effect for stillbirth than increase in frequency (OR 0.15 vs. 0.38). These findings are similar to those reported in TASS. Ultrasound studies suggest that mothers are more likely to feel larger movements of trunk and limbs; it is probable that an increase in strength may also be perceived as an increase in frequency. Critically, for interpretation as a risk factor for stillbirth a reduction in frequency of fetal movements can only be judged in retrospect, whereas, increased strength may be easier to judge in real time.

Although regular vigorous movements are important and protective, a one-off episode of excessive fetal activity may be a warning sign of fetal compromise. These data are in agreement with TASS which described an aOR for late stillbirth of 6.81 (95% CI 3.01-15.41) for a single episode of excessive fetal movements and a large cohort study of 1,714 women who experienced a stillbirth, in which 8.5% of respondents noted a single episode of excessive fetal activity. However, practical application of this association is challenging as a woman cannot know at the time whether an
episode of vigorous movement is isolated or will become a part of regular fetal activity. Furthermore, the origin of the excessive movement is unclear. Therefore, this association requires further investigation in our planned individual participant data (IPD) meta-analysis to establish whether it is a consistently observed association, and whether there are any clues to the aetiology of this symptom prior to considering any public health intervention.

In agreement with many studies since the mid-1970s we have confirmed that decreased frequency of fetal movements is a major risk factor for late stillbirth. Furthermore, this study agrees with data from other UK units that recurrent presentation with RFM is associated with an even greater risk of adverse outcome. This link is biologically plausible as RFM is associated with abnormal placental structure and function which may deteriorate as pregnancy progresses. Notably, mothers with recurrent episodes of RFM have been shown to have an increased likelihood of abnormal uterine artery Doppler waveforms in the second trimester and delivery of a small for gestational age infant, both of which are associated with abnormal placental morphology. This study did not have sufficient power to determine whether maternal perception of RFM was related to stillbirths associated with a specific cause (e.g. placental dysfunction), but this will be addressed in the IPD meta-analysis.

Our data regarding fetal hiccups are an important observation and the protective effect of maternal perception of regular hiccups are consistent with findings from TASS. This finding is in contrast to a single case report which proposed that hiccups are linked to umbilical cord complications. Fetal hiccups were observed using ultrasound in 1977 and appear to be interspersed with normal breaths and are considered a normal physiological function. Mothers are aware of fetal hiccups throughout pregnancy, one study of 45 women suggested that they were perceived more frequently prior to 26 weeks’ gestation and remained constant after that with an average of 0.4 episodes per hour. Another study suggests that 36.6% of women perceived hiccups in pregnancy, and this perception increased with gestational age. Fetal hiccups do not appear to relate to other aspects of
fetal movement, although they do appear to be associated with active fetal behavioural state. Irrespective of the uncertainty surrounding the origin of fetal hiccups, maternal perception of hiccups appears to be protective of late stillbirth, particularly if they occur daily.

Women in this study with RFM who went on to have a stillbirth were more likely to have spoken to a healthcare professional about the symptom and 68% attended hospital because of RFM, indicating that contacting a health professional and attending hospital does not appear to prevent stillbirth. This may be because management of RFM is varied or that the baby was already dead at the time of presentation. Critically, management is presently not informed by high-quality evidence as there are insufficient data from randomised trials to guide practice. Nevertheless, two Confidential Enquiries into Antepartum Stillbirth conducted 15 years apart have highlighted suboptimal information regarding fetal movements and management of RFM as an important factor in cases. It is anticipated that the AFFIRM study, a multi-centre stepped-wedge cluster randomised trial will address whether standardised information for women and a standardised management strategy (employing antepartum cardiotocography and ultrasound for fetal biometry and liquor volume) following attendance with RFM will reduce stillbirth.

Conclusion

This study demonstrates that maternal perception of increased strength of fetal movements in late pregnancy is protective of late stillbirth. Decreased frequency of fetal movements is associated with risk of stillbirth as is decreased strength. Clinical guidelines and health promotion information currently suggest that fetal movements tend to increase until the 32nd week of pregnancy and then plateau. However, data from this study and TASS show that an increase in strength and frequency of fetal movements is associated with the lowest risk of stillbirth suggesting that guidance should be altered to indicate that maternal perception of fetal movement normally increases throughout pregnancy. This study adds to the evidence base that when fetal movements are reduced there is an increased risk of late stillbirth. Thus, women should contact their maternity care provider and be
managed according to current clinical guidance. Importantly, development of an effective strategy for the investigation and management of RFM in late pregnancy has the potential to reduce the incidence of late stillbirth.

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Contribution to Authorship

AH, TS, BM, DR, EM & LM contributed to all aspects of the study design and obtained funding. AH had overall responsibility for the study. JB coordinated the running of the study. ML & JT analysed the data with input from AH, JB, RC, BB, EM and LM. All authors were responsible for the drafting of the manuscript. All authors gave approval for the final version of the manuscript.

Details of Ethical Approval

This study was reviewed by NRES Committee North West - Greater Manchester Central Reference (13/NW/0874) on 24th January 2014.

Data Sharing Statement

The original research data presented in this manuscript do not have ethical approval for their use in additional research studies. The anonymised data may be made available following further application for research ethics approval. Please contact the corresponding author.
References


469

470 Figure Legend

471 Figure 1 - Flow diagram reporting the numbers of women eligible for the study, women who did not participate and those included in the final analysis.

473 Table Legends

474 Table 1 - Univariable risks associated with perception of fetal movements and late stillbirth risk.

476 Table 2 - Univariable and multivariable odds of late stillbirth associated with perceptions of fetal movements.

478 Supplementary Table 1 - Prevalence and risk of stillbirth associated with the 16 possible combinations of change in strength and frequency of movement in the last 2 weeks.

480 Supplementary File 1 – Questionnaire used to obtain data from participants in the Midlands and North of England Stillbirth Study

482
Table 1 - Univariable risks associated with perception of fetal movements and late stillbirth risk.

<table>
<thead>
<tr>
<th>Event</th>
<th>Cases n (%)</th>
<th>Controls n (%)</th>
<th>Odds ratio (95% Confidence Interval)</th>
<th>χ², p-value</th>
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<tr>
<td>Was there any time from 26 weeks of pregnancy that your baby’s movements were less than usual?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>112 (38.7%)</td>
<td>469 (64.2%)</td>
<td>Reference: χ²=66.69, p&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>Once</td>
<td>88 (30.5%)</td>
<td>156 (21.3%)</td>
<td>2.36 (1.69-3.30)</td>
<td></td>
</tr>
<tr>
<td>Twice</td>
<td>39 (13.5%)</td>
<td>65 (9.9%)</td>
<td>2.51 (1.61-3.93)</td>
<td></td>
</tr>
<tr>
<td>Three or more times</td>
<td>50 (17.3%)</td>
<td>41 (5.6%)</td>
<td>5.11 (3.22-8.10)</td>
<td></td>
</tr>
<tr>
<td>In the last two weeks did the strength of your baby’s movements increase</td>
<td>53 (18.3%)</td>
<td>455 (62.8%)</td>
<td>0.15 (0.11-0.22)</td>
<td></td>
</tr>
<tr>
<td>Decrease</td>
<td>62 (21.4%)</td>
<td>50 (6.9%)</td>
<td>1.61 (1.05-2.46)</td>
<td></td>
</tr>
<tr>
<td>Stay the same</td>
<td>153 (52.8%)</td>
<td>198 (27.3%)</td>
<td>Reference: χ²=169.96, p&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>Unsure</td>
<td>22 (7.6%)</td>
<td>22 (3.0%)</td>
<td>1.29 (0.69-2.42)</td>
<td></td>
</tr>
<tr>
<td>In the last two weeks did the frequency of your baby’s movements increase</td>
<td>37 (12.7%)</td>
<td>254 (34.8%)</td>
<td>0.38 (0.26-0.56)</td>
<td></td>
</tr>
<tr>
<td>Decrease</td>
<td>86 (29.6%)</td>
<td>63 (8.6%)</td>
<td>3.54 (2.44-5.15)</td>
<td></td>
</tr>
<tr>
<td>Stay the same</td>
<td>153 (52.6%)</td>
<td>397 (54.3%)</td>
<td>Reference: χ²=103.49, p&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>Unsure</td>
<td>15 (5.2%)</td>
<td>17 (2.3%)</td>
<td>2.29 (1.12-4.70)</td>
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</tr>
<tr>
<td>During the last 2 weeks did you notice anytime that your baby was more vigourous than usual?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>182 (62.5%)</td>
<td>326 (44.7%)</td>
<td>Reference: χ²=57.39, p&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>Once</td>
<td>41 (14.1%)</td>
<td>50 (6.9%)</td>
<td>1.47 (0.94-2.31)</td>
<td></td>
</tr>
<tr>
<td>More than once</td>
<td>68 (23.4%)</td>
<td>354 (48.5%)</td>
<td>0.34 (0.25-0.47)</td>
<td></td>
</tr>
<tr>
<td>During the last two weeks did you feel you baby having hiccups?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>126 (43.5%)</td>
<td>460 (62.9%)</td>
<td>0.41 (0.30-0.54)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>141 (48.6%)</td>
<td>209 (28.6%)</td>
<td>Reference: χ²=38.10, p&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>Unsure</td>
<td>23 (7.9%)</td>
<td>62 (8.5%)</td>
<td>0.55 (0.33-0.93)</td>
<td></td>
</tr>
<tr>
<td>How often did you feel hiccups in the last two weeks?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not felt hiccups</td>
<td>141 (48.5%)</td>
<td>209 (28.6%)</td>
<td>Reference: χ²=42.01, p&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>Yes</td>
<td>No</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>----------</td>
<td>----------</td>
<td>------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Unsure</td>
<td>23 (7.9%)</td>
<td>62 (8.5%)</td>
<td>0.73 (0.39-1.35)</td>
<td></td>
</tr>
<tr>
<td>Once</td>
<td>17 (5.8%)</td>
<td>36 (4.9%)</td>
<td>0.69 (0.37-1.27)</td>
<td></td>
</tr>
<tr>
<td>Occasionally</td>
<td>69 (23.7%)</td>
<td>235 (32.2%)</td>
<td>0.44 (0.32-0.62)</td>
<td></td>
</tr>
<tr>
<td>Daily</td>
<td>38 (13.1%)</td>
<td>177 (24.3%)</td>
<td>0.32 (0.21-0.48)</td>
<td></td>
</tr>
<tr>
<td>Unsure of frequency</td>
<td>3 (1.0%)</td>
<td>11 (1.5%)</td>
<td>0.37 (0.17-0.80)</td>
<td></td>
</tr>
</tbody>
</table>

During the last two weeks did you feel uterine contractions (tightenings/pre-labour contractions/Braxton Hicks contractions/false labour) for longer than an hour

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Yes</th>
<th>No</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>94 (32.3%)</td>
<td>241 (33.0%)</td>
<td>0.97 (0.72-1.29)</td>
</tr>
<tr>
<td>No</td>
<td>191 (65.6%)</td>
<td>473 (64.7%)</td>
<td>Reference: χ²=0.12, p=0.94</td>
</tr>
<tr>
<td>Unsure</td>
<td>6 (2.1%)</td>
<td>17 (2.3%)</td>
<td>0.87 (0.34-2.25)</td>
</tr>
</tbody>
</table>

Combination of strength and frequency changes in the last 2 weeks (prioritised variable)*

<table>
<thead>
<tr>
<th>Change in strength and frequency</th>
<th>Yes</th>
<th>No</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased strength</td>
<td>53 (18.2%)</td>
<td>455 (62.1%)</td>
<td>0.18 (0.13-0.26)</td>
</tr>
<tr>
<td>Increased frequency but not strength</td>
<td>8 (2.8%)</td>
<td>22 (3.0%)</td>
<td>0.57 (0.25-1.32)</td>
</tr>
<tr>
<td>Decreased frequency</td>
<td>79 (27.2%)</td>
<td>36 (4.9%)</td>
<td>3.45 (2.20-5.43)</td>
</tr>
<tr>
<td>Unsure strength or frequency</td>
<td>22 (7.6%)</td>
<td>17 (2.3%)</td>
<td>2.04 (1.04-3.98)</td>
</tr>
<tr>
<td>Same</td>
<td>129 (44.3%)</td>
<td>203 (27.7%)</td>
<td>Reference: χ²=205.34, p&lt;0.0001</td>
</tr>
</tbody>
</table>

† χ² and associated p-values are given for the overall effect of each variable

*See Supplementary table 1 for detailed description of category’s included in prioritised variable categories.
Table 2 - Univariable and multivariable odds of late stillbirth associated with perceptions of fetal movements

<table>
<thead>
<tr>
<th>Perception of Fetal Movements</th>
<th>Univariable Odds Ratio (95% Confidence Interval)</th>
<th>Multivariable* Odds Ratio (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased strength</td>
<td>0.18 (0.13-0.26)</td>
<td>0.14 (0.08-0.24)</td>
</tr>
<tr>
<td>Increased frequency but not strength</td>
<td>0.57 (0.25-1.32)</td>
<td>0.86 (0.30-2.52)</td>
</tr>
<tr>
<td>Decreased frequency</td>
<td>3.45 (2.20-5.43)</td>
<td>4.51 (2.38-8.55)</td>
</tr>
<tr>
<td>Unsure strength or frequency</td>
<td>2.04 (1.04-3.98)</td>
<td>2.02 (0.77-5.25)</td>
</tr>
<tr>
<td>Same</td>
<td>Reference</td>
<td>Reference: $\chi^2=104.90$, p&lt;0.0001</td>
</tr>
</tbody>
</table>

During the last 2 weeks did you notice anytime that your baby was more vigorous than usual

<table>
<thead>
<tr>
<th>How often did you feel your baby having hiccups in the last two weeks</th>
<th>Univariable Odds Ratio (95% Confidence Interval)</th>
<th>Multivariable* Odds Ratio (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>Reference</td>
<td>Reference: $\chi^2=12.43$, p=0.002</td>
</tr>
<tr>
<td>Once</td>
<td>1.47 (0.94-2.31)</td>
<td>2.10 (1.06-4.17)</td>
</tr>
<tr>
<td>More than once</td>
<td>0.34 (0.25-0.47)</td>
<td>0.59 (0.37-0.96)</td>
</tr>
</tbody>
</table>

*Controls for age, ethnicity, parity, education, marital status, smoking in pregnancy, customised birthweight centile, going-to-sleep position, sleep duration, got up to toilet in the night, naps in the daytime, gestation and study centre
Figure 1 - Flow diagram reporting the numbers of women eligible for the study, women who did not participate and those included in the final analysis.

Potential Cases
N=660

Cases receiving study information
N=583

Non-participants
N=287

Excluded:
5 cases had lethal abnormality diagnosed by post-mortem

Analysed Cases
N=291

Potential Controls
N=2830

Controls receiving study information
N=2147

Non-participants
N=1413

Excluded:
1 control had a stillbirth after interview

Analysed Controls
N=733

Could not be contacted
N=77

Could not be contacted
N=683
### Supplementary Table 1 - Prevalence and risk of stillbirth associated with the 16 possible combinations of change in strength and frequency of movement in the last 2 weeks

<table>
<thead>
<tr>
<th>Strength</th>
<th>Frequency</th>
<th>Stillbirths</th>
<th>Controls</th>
<th>Univariable OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N=290 (missing=1)</td>
<td>N=724 (missing=9)</td>
<td></td>
</tr>
<tr>
<td>Increase</td>
<td>Increase</td>
<td>29 (10.0%)</td>
<td>232 (32.0%)</td>
<td>0.18 (0.11, 0.28)</td>
</tr>
<tr>
<td>Increase</td>
<td>Decrease</td>
<td>7 (2.4%)</td>
<td>27 (3.7%)</td>
<td>0.37 (0.16, 0.88)</td>
</tr>
<tr>
<td>Increase</td>
<td>Same</td>
<td>16 (5.5%)</td>
<td>190 (26.2%)</td>
<td>0.12 (0.07, 0.21)</td>
</tr>
<tr>
<td>Increase</td>
<td>Unknown</td>
<td>1 (0.3%)</td>
<td>6 (0.8%)</td>
<td>0.24 (0.03, 2.01)</td>
</tr>
<tr>
<td>Decrease</td>
<td>Increase</td>
<td>1 (0.3%)</td>
<td>2 (0.3%)</td>
<td>0.72 (0.06, 7.97)</td>
</tr>
<tr>
<td>Same</td>
<td>Increase</td>
<td>5 (1.7%)</td>
<td>13 (1.8%)</td>
<td>0.55 (0.19, 1.58)</td>
</tr>
<tr>
<td>Unknown</td>
<td>Increase</td>
<td>2 (0.7%)</td>
<td>6 (0.8%)</td>
<td>0.48 (0.10, 2.40)</td>
</tr>
<tr>
<td>Decrease</td>
<td>Decrease</td>
<td>51 (17.5%)</td>
<td>23 (3.2%)</td>
<td>3.17 (1.84, 5.46)</td>
</tr>
<tr>
<td>Same</td>
<td>Decrease</td>
<td>22 (7.6%)</td>
<td>10 (1.4%)</td>
<td>3.15 (1.44, 6.88)</td>
</tr>
<tr>
<td>Unknown</td>
<td>Decrease</td>
<td>5 (1.7%)</td>
<td>3 (0.4%)</td>
<td>2.38 (0.56, 10.16)</td>
</tr>
<tr>
<td>Decrease</td>
<td>Unknown</td>
<td>2 (0.7%)</td>
<td>2 (0.3%)</td>
<td>1.43 (0.20, 10.29)</td>
</tr>
<tr>
<td>Same</td>
<td>Unknown</td>
<td>5 (1.7%)</td>
<td>2 (0.3%)</td>
<td>3.57 (0.68, 18.73)</td>
</tr>
<tr>
<td>Unknown</td>
<td>Same</td>
<td>8 (2.7%)</td>
<td>6 (0.8%)</td>
<td>1.91 (0.65, 5.63)</td>
</tr>
<tr>
<td>Unknown</td>
<td>Unknown</td>
<td>7 (2.4%)</td>
<td>7 (1.0%)</td>
<td>1.43 (0.49, 4.18)</td>
</tr>
<tr>
<td>Decrease</td>
<td>Same</td>
<td>8 (2.7%)</td>
<td>23 (3.2%)</td>
<td>0.50 (0.22,1.15)</td>
</tr>
<tr>
<td>Same</td>
<td>Same</td>
<td>121 (41.6%)</td>
<td>172 (23.5%)</td>
<td>Reference</td>
</tr>
</tbody>
</table>
Maternal Interview

1. Study arm?
   - Case
   - Control

2. Hospital

3. Study Number:

4. Date of Interview:
   DD-MM-YYYY

5. Interviewer

6. Who else is present during the interview?
Inclusion Criteria

7. Cases: Is gestation greater than or equal to 28 weeks at the time of the stillbirth? (Not at time of birth)
   ○ Yes ☐ No

8. Cases: Did the stillbirth occur 1-6 weeks prior to the interview? (Not eligible if more than 6 weeks previously)
   ○ Yes ☐ No

9. Controls: Is the gestation within 2 weeks of the gestation specified at the time of interview (or at birth if already given birth)?
   ○ Yes ☐ No

10. Gestational age?
    
    Weeks
    Days

11. Singleton pregnancy?
    ○ Yes ☐ No

12. Major fetal abnormality?
    ○ Yes ☐ No

13. Consent form signed?
    ○ Yes ☐ No

14. Fluent in English?
    ○ Yes ☐ No

If not fluent in English, was an interpreter used?
## Maternal Demographics

15. What is your date of birth?

- DD
- MM
- YYYY

DD/MM/YYYY

16. Which country were you born in?

[ ]

17. If not the United Kingdom: how many years have you lived in the UK?

- Years

- Months

18. If not the United Kingdom: what is your immigration status?

- UK National
- EEA National
- Discretionary leave to remain
- Indefinite leave to remain
- Study Visa
- Work Visa
- Husband/Wife Sponsorship
- Asylum seeker awaiting decision
- Refugee
- Humanitarian Protection
- Declined to answer

19. How do you describe your ethnicity?

- White-British
- Irish
- Gypsy or Irish Traveller
- Any other white background
- Black/Black British
- African
- Caribbean
- Any other black background
- Asian/Asian British
- Indian
- Pakistani
- Bangladeshi
- Chinese
- Any other Asian background
- Multiple ethnic group
- White & Black Caribbean
- White & Black African
- White & Asian
- Any other multiple ethnic background
- Declined to answer
20. What is the postcode of your usual residential address? (At the time of the interview).


21. Which of the following best describes the place you live in? (Lived in most of the time during your pregnancy).

- Own house
- Private rental
- Council/ Housing Association rental
- Stay with family or friends
- No fixed address
- Other (please specify)


22. How many people usually live in your house? (The house you lived in during your pregnancy).

- Couples (including yourself)
- Children under 10 years
- Other adults and children over 10 years


23. How many bedrooms does your house have? (The house you lived in during your pregnancy).

Number of bedrooms


24. Do you feel your house is large enough for your family’s needs? (The house you lived in during your pregnancy).

- Yes
- No


25. What is your highest educational qualification? (Please tick one answer only).

- None
- GCSE level (GCSE, O Level, Standards)
- A level (A, AS, S-level, Highers)
- Undergraduate (Diploma)
- Graduate (Degree, BSc, BA)
- Post-graduate (MSc, MA, PhD)
- Vocational education (NVQ, HNC, HND)
26. What was your work situation prior to this pregnancy? (Please tick one answer only).
- Full time work (over 30 hours per week)
- Part time work (includes casual work)
- Student
- Housewife
- Unemployed
- Long-term sickness benefit
- Other (please specify)

27. What was your work situation in the last month? (before your baby died). (Please tick one answer only).
- Full time work (over 30 hours per week)
- Part time work (includes casual work)
- Student
- Housewife
- Unemployed
- Long-term sickness benefit
- Off-work due to pregnancy complications
- Maternity leave
- Other (please specify)

28. If you are currently on maternity leave, how many weeks were you when you began your maternity leave?

29. Do you or have you ever worked regular night shifts?
- Yes
- No

30. Do you consider your work to be of a physical nature?
- Yes
- No

Please add details
31. What was your partner’s (not necessarily father of your baby) work situation in the last month? (before your baby died) (Please tick one answer only).

- Full time work (over 30 hours per week)
- Part time work (includes casual work)
- Student
- Home maker
- Unemployed
- Long term sickness benefit
- Other/ unknown/ no partner

32. What is your combined household income?

- <£10,000
- £10,000-£14,999
- £15,000-£19,999
- £20,000-£24,999
- £25,000-£29,999
- £30,000-£39,999
- £40,000-£49,999
- £50,000-£59,999
- £60,000-£74,999
- £75,000 +
33. What is your marital status? (Please tick one answer only).

- Single
- Married
- Cohabiting

34. How old is the father of your baby?

[ ] Age in years: [ ]

[ ] Don't know

35. How would he describe his ethnicity?

- Unknown
- White/British
- Irish
- Gypsy or Irish traveller
- Any other white background
- Black/Black British
- African
- Caribbean
- Any other black background
- Asian/Asian British
- Indian
- Pakistani
- Banladeshi
- Chinese
- Any other Asian background
- Multiple ethnic group
- White & Black Caribbean
- White & Black African
- White & Asian
- Any other multiple ethnic background
- Declined to answer

36. Is this your first pregnancy with this father?

[ ] Yes
[ ] No
37. How long had you had a relationship with the father of your baby when you conceived?

- Conceived on first episode of intercourse
- Less than 6 months
- 6-12 months
- More than 1 year
- Declined to answer

38. Are you related to the father of your baby? (Other than by marriage).

- Yes
- No

If yes what relation are you to each other?

[space for answer]
### General Health and Past History

**39. Did you have any medical conditions before the start of your pregnancy? (Please tick all relevant answers).**

- [ ] None
- [ ] Anaemia (prior to booking Hb<10g/L)
- [ ] Asthma
- [ ] Cervical surgery
- [ ] Depression
- [ ] Diabetes type 1 - Insulin dependent
- [ ] Diabetes type 2
- [ ] Epilepsy
- [ ] Heart condition - congenital
- [ ] Heart condition - rheumatic
- [ ] Hypertension - Essential
- [ ] Hyperthyroid
- [ ] Hypothyroid
- [ ] Inflammatory bowel disease (Crohn’s disease or ulcerative colitis)
- [ ] Polycystic ovarian syndrome
- [ ] Psychiatric disorder (other than depression)
- [ ] Renal disease
- [ ] Sickle cell disease
- [ ] Systemic lupus erythematosus
- [ ] Thalassaemia
- [ ] Thrombophilia
- [ ] Urinary tract infections (recurrent)
- [ ] Uterine abnormality
- [ ] Uterine surgery
- [ ] Venous thromboembolism

Other medical condition

**40. Did you have fertility treatment to get pregnant with your baby?**

- [ ] Yes
- [ ] No
41. If yes, what was the treatment? (Please tick one answer only).

- Artificial insemination
- Ovulation induction
- IVF
- GIFT
- ICSI

Other (please specify) 

42. Have you ever been pregnant before?

- Yes
- No
## Pregnancy History

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>43. If yes how many pregnancies were:</td>
<td></td>
</tr>
<tr>
<td>Miscarriages or ectopic pregnancies in the first 12 weeks of pregnancy</td>
<td></td>
</tr>
<tr>
<td>Miscarriages or ectopic pregnancies between 13 and 24 weeks of pregnancy</td>
<td></td>
</tr>
<tr>
<td>Surgical termination of pregnancy below 14 weeks</td>
<td></td>
</tr>
<tr>
<td>Medical termination of pregnancy below 14 weeks</td>
<td></td>
</tr>
<tr>
<td>Surgical termination of pregnancy between 15 and 24 weeks of pregnancy</td>
<td></td>
</tr>
<tr>
<td>Medical termination of pregnancy between 15 and 24 weeks of pregnancy</td>
<td></td>
</tr>
<tr>
<td>Termination of pregnancy after 24 weeks</td>
<td></td>
</tr>
<tr>
<td>44. How many other pregnancies have you had?</td>
<td></td>
</tr>
<tr>
<td>45. If yes, can you tell me about your other pregnancies and births?</td>
<td></td>
</tr>
<tr>
<td>Year of birth</td>
<td></td>
</tr>
<tr>
<td>Gestation</td>
<td></td>
</tr>
<tr>
<td>Birth weight (in grams)</td>
<td></td>
</tr>
<tr>
<td>Mode of delivery</td>
<td></td>
</tr>
<tr>
<td>Outcome (LB/SB/NND)</td>
<td></td>
</tr>
<tr>
<td>Were there any complications?</td>
<td></td>
</tr>
<tr>
<td>46. If yes, can you tell me about your other pregnancies and births?</td>
<td></td>
</tr>
<tr>
<td>Year of birth</td>
<td></td>
</tr>
<tr>
<td>Gestation</td>
<td></td>
</tr>
<tr>
<td>Birth weight (in grams)</td>
<td></td>
</tr>
<tr>
<td>Mode of delivery</td>
<td></td>
</tr>
<tr>
<td>Outcome (LB/SB/NND)</td>
<td></td>
</tr>
<tr>
<td>Were there any complications?</td>
<td></td>
</tr>
<tr>
<td>Year of birth</td>
<td>Gestation</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**48. If yes, can you tell me about your other pregnancies and births?**

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>Gestation</th>
<th>Birth weight (in grams)</th>
<th>Mode of delivery</th>
<th>Outcome (LB/SB/NND)</th>
<th>Were there any complications?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**49. If yes, can you tell me about your other pregnancies and births?**

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>Gestation</th>
<th>Birth weight (in grams)</th>
<th>Mode of delivery</th>
<th>Outcome (LB/SB/NND)</th>
<th>Were there any complications?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**50. If yes, can you tell me about your other pregnancies and births?**

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>Gestation</th>
<th>Birth weight (in grams)</th>
<th>Mode of delivery</th>
<th>Outcome (LB/SB/NND)</th>
<th>Were there any complications?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Antenatal care in this pregnancy

51. How many weeks pregnant were you when you first saw a health professional about this pregnancy?

Weeks

52. Who did you first see? (Please tick one answer only).

- GP
- Midwife
- Infertility specialist
- Hospital obstetrician
- Family planning clinic
- Pharmacist
- Nurse
- Private obstetrician

Other (please specify)

53. Did you have morning sickness during this pregnancy?

- Yes
- No

54. If yes, were you admitted to hospital due to your vomiting?

- Yes
- No

If yes, how many times?

55. Did you have any of these common illnesses/problems during your pregnancy? (Please tick all relevant answers).

<table>
<thead>
<tr>
<th>Illness/Problem</th>
<th>Anytime during your pregnancy</th>
<th>In the last two weeks of your pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>High fever</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Runny nose/sore throat/swollen glands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cough with phlegm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diarrhoea and/or vomiting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequent urge to urinate and/or pain on urinating</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

56. Were you unwell in any other way in the last 2 weeks of your pregnancy?

- Yes
- No

If yes, please describe
57. Did you have any vaginal bleeding in your pregnancy? (Please tick one answer only).

- No bleeding
- Single episode <20 weeks gestation
- Recurrent bleeds <20 weeks gestation
- Single episode >20 weeks gestation
- Recurrent bleeds >20 weeks gestation
- Recurrent bleeds throughout
- Unsure

58. During your pregnancy, did you take any antibiotics?

- Yes
- No
- Unsure

If yes, what antibiotics and what did you have them for?

59. How many weeks pregnant were you when you took the antibiotics? (If more than one course of antibiotics, record gestation of the most recent course).

Weeks
Personal Habits

60. Do you currently smoke? (Please tick one answer only)

☐ Yes
☐ No, stopped in pregnancy
☐ No, stopped prior to pregnancy
☐ No, never smoked

61. If yes, what do you smoke and what is the average amount per day?

<table>
<thead>
<tr>
<th>Smoke cigarettes</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoke roll ups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoke cannabis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chew tobacco</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use shisha</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Average amount per day

62. If you smoked at any time during pregnancy, how much a day on average did you smoke?

Amount per day

63. If you stopped smoking during pregnancy, how many weeks pregnant were you when you stopped?

Weeks

64. Did you use any nicotine-replacement products during pregnancy?

☐ Electronic cigarettes
☐ Nicotine gum
☐ Nicotine inhalators
☐ Nicotine lozenges
☐ Nicotine microtabs
☐ Nicotine nasal spray
☐ Nicotine patches
☐ Other (please specify)

65. Have you changed you smoking habits during your pregnancy?

☐ Yes
☐ No

If so, what have you changed?
66. If you have stopped or reduced smoking during pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

- Midwife
- GP
- Hospital doctor
- Friend/relative
- Internet
- Magazine
- Pregnancy book
- TV

Please add details

67. Does your partner smoke?

- Yes
- No
- No partner

68. Does anyone else living in your house smoke?

- Yes
- No
- No partner

69. On average, how many standard alcoholic drinks (if any) do you have each week during your pregnancy?

<table>
<thead>
<tr>
<th>In the first 3 months of your pregnancy</th>
<th>1-2 std drinks/wk</th>
<th>3-4 std drinks/wk</th>
<th>≥5 std drinks/wk</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 std drink/wk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the last month of your pregnancy</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

70. What was the highest number of standard alcoholic drinks that you had on any one occasion during your pregnancy? (Please tick one answer only).

- None
- 1 to 2
- 3 to 4
- 5 to 10
- greater than 10

71. How many weeks pregnant were you when you had the most drinks?

- Weeks
- Not Known

72. Have you changed your drinking habits during your pregnancy?

- Yes
- No

If so, what have you changed?
73. If you have changed your alcohol intake during pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

- Midwife
- GP
- Hospital doctor
- Friend/relative
- Internet
- Magazine
- Pregnancy book
- TV

Please add details

74. Have you taken any street drugs during pregnancy?

- Yes
- No

75. If yes, have you used any of the following, if so when?

<table>
<thead>
<tr>
<th>Drug</th>
<th>In the first 3 months of pregnancy</th>
<th>In the last month of pregnancy</th>
<th>In the last week of pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphetamine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amyl Nitrites</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cannabis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cocaine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecstasy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heroin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ketamine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magic Mushrooms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methadone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tranquilisers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (please specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

76. If yes, how often did you use these drugs?

- Daily use
- Weekly use
- Occasional use
- Once only

Other (please specify)
77. Have you changed your drug habits during your pregnancy?

- [ ] Yes
- [ ] No

If so, what have you changed?

78. If you have changed your drug use during pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

- [ ] Midwife
- [ ] GP
- [ ] Hospital doctor
- [ ] Friend/relative
- [ ] Internet
- [ ] Magazine
- [ ] Pregnancy book
- [ ] TV

Please add details

79. Have you taken any prescribed medication during your pregnancy?

- [ ] Yes
- [ ] No

80. If yes, please list all the prescribed medication you have taken during your pregnancy?

- [ ] Please add details

81. Have you taken any vitamins? If so, which ones.

<table>
<thead>
<tr>
<th></th>
<th>Prior to pregnancy</th>
<th>During the first 3 months of pregnancy</th>
<th>During the last month of pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Folic Acid 400mcg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Folic Acid 5mg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron supplement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-vitamin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-vitamin for pregnant women</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Omega-3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin D 10mcg</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comment

Please add details
### Perceived Stress Scale

**82. The questions in this scale ask you about your feelings and thoughts during the LAST MONTH (before your baby died).**

<table>
<thead>
<tr>
<th>Question</th>
<th>Never 0</th>
<th>Almost Never 1</th>
<th>Sometimes 2</th>
<th>Fairly Often 3</th>
<th>Very Often 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How often have you been upset because of something that happened unexpectedly?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. How often have you felt that you were unable to control the important things in your life?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. How often have you felt nervous and &quot;stressed&quot;?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. How often have you felt confident about your ability to handle your personal problems?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. How often have you felt that things were going your way?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. How often have you found that you could not cope with all the things that you had to do?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. How often have you been able to control irritations in your life?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. How often have you felt that you were on top of things?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. How often have you been angered because of things that were outside your control?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. How often have you felt difficulties were piling up so high that you could not overcome them?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other (please specify)
### Diet

**83. On average, how often did you eat the following foods in the month before you were pregnant and during the last 4 weeks (before your baby died)?**

<table>
<thead>
<tr>
<th>Food Type</th>
<th>Pre Pregnancy</th>
<th>Within the last 4 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice and pasta (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White bread (1 slice)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wholemeal bread (1 slice)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crisps (1 bag)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processed meat (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salad vegetables (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green vegetables (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other vegetables (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetable dishes/ foods (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soft drinks (1 glass)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diet soft drinks (1 glass)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chips (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full fat spread (for 1 slice of bread)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**84. Please write how many per day.**

- Total teaspoons of sugar added each day to cereals, tea, coffee etc (tsp)
- Full-fat milk on average consumed per day in drinks, cereals etc (pints)
- Semi-skimmed milk on average consumed per day in drinks, cereals etc (pints)
- Skimmed milk on average consumed per day in drinks, cereals etc (pints)
85. How many cups (190mls) of coffee/tea do you drink per day?

<table>
<thead>
<tr>
<th>Number of servings/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instant coffee</td>
</tr>
<tr>
<td>Brewed coffee (filter/percolated)</td>
</tr>
<tr>
<td>Decaffeinated coffee (brewed/instant)</td>
</tr>
<tr>
<td>Tea</td>
</tr>
<tr>
<td>Chai tea</td>
</tr>
<tr>
<td>Green tea</td>
</tr>
<tr>
<td>Drinking chocolate</td>
</tr>
<tr>
<td>Energy drinks/250ml serving</td>
</tr>
<tr>
<td>Cola (regular/diet)/330ml serving</td>
</tr>
<tr>
<td>Chocolate/50g bar</td>
</tr>
</tbody>
</table>

86. Have you changed any aspects of your diet or caffeine intake during your pregnancy?

- [ ] Yes
- [x] No

If so, what have you changed?

87. If you have changed your diet or caffeine intake during pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

- [ ] Midwife
- [ ] GP
- [ ] Hospital doctor
- [ ] Friend/relative
- [ ] Internet
- [ ] Magazine
- [ ] Pregnancy book
- [ ] TV

Please add details
Sleep Practices

If the main period of sleep is in the day (such as for shift workers) then use the daytime for the following questions.

88. On average how many hours actual sleep did you usually get at night? (Hours).

- Before pregnancy
- In the last four weeks* before your baby died
- In the last week*
- Last night*

89. What size bed did you sleep in last night? (the last night before your baby died).
(Please tick one answer only).

- Small single
- Single
- Small double
- Double
- King size
- Superking
- Other - didn't sleep in bed (specify)

90. Did anyone else sleep in the same bed as you last night? (The last night before your baby died).

- Yes, partner
- No
- Yes, other
- Other (please specify)

91. What side of the bed do you usually sleep on?

- Left
- Middle
- Right
- Unsure
92. Which side of the bed did you sleep in last night? (The last night before your baby died).
- Left
- Middle
- Right
- Unsure

93. How many pillows did you usually use at night in the last few weeks? (Before your baby died).

No. of pillows

94. What position did you usually fall asleep in? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Left side</th>
<th>Back</th>
<th>Right side</th>
<th>Tummy</th>
<th>Variable</th>
<th>Propped up</th>
<th>Don't remember</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last night (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

95. What position did you usually wake up in? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Left side</th>
<th>Back</th>
<th>Right side</th>
<th>Tummy</th>
<th>Variable</th>
<th>Propped up</th>
<th>Don't remember</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last night (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

96. Did you change sleep position during the night? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>Possibly once</th>
<th>Possibly twice</th>
<th>More than twice but not lots</th>
<th>Lots of times</th>
<th>Don't remember</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last night (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

97. Would you describe yourself as a restless sleeper (i.e move a lot during the night)? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>A little</th>
<th>Average</th>
<th>More than average</th>
<th>Very restless</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last night (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

98. Have you EVER been told that you snore, or are you aware that you snore?
- Yes
- No
99. If you have been told you snore, or you have woken yourself up snoring, how often has this happened? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During the last 4 weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(the 4 weeks before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

100. Did you snore last night? (The last night before your baby died).

- Yes
- No
- Don't know

101. Has your snoring ever bothered other people?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

102. Did your snoring bother anyone last night? (The last night before your baby died).

- Yes
- No
- Don't know

103. How loud is your snoring reported to be? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Slightly louder than breathing</th>
<th>As loud as talking</th>
<th>Very loud, can be heard in adjacent rooms</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last night (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

104. Have you been told you briefly stop breathing when you are asleep? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Every night</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 weeks ago (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

105. Were you told you briefly stopped breathing when asleep last night? (The night before your baby died).

- Yes
- No

106. Have you been told that you cough or choke during sleep? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Every night</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 weeks ago (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
107. Were you told you coughed or choked last night? (The last night before your baby died).

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

108. Do your legs twitch or jerk often while you sleep? (Do not count the sudden jerk that sometimes occurs as you fall asleep). (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Before pregnancy</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
</table>

109. Did your legs twitch or jerk often while you slept last night? (The last night before your baby died).

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Don't know</th>
</tr>
</thead>
</table>

110. Did you take medication for sleep? (Prescribed medication NOT herbal remedies). (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Before pregnancy</th>
<th>Never</th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
</table>

4 weeks ago (before your baby died)

111. Did you take medication for sleep last night? (The night before your baby died).

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

112. How would you rate your sleep quality overall? (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Before pregnancy</th>
<th>Very good</th>
<th>Fairly good</th>
<th>Average</th>
<th>Fairly bad</th>
<th>Very bad</th>
</tr>
</thead>
</table>

Last 4 weeks (before your baby died)

113. How often do you feel tired or fatigued AFTER your night’s sleep? (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Before pregnancy</th>
<th>Never</th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
</table>

Last 4 weeks (before your baby died)

114. During your WAKE TIME do you feel tired, fatigued or not up to par? (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Before pregnancy</th>
<th>Never</th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
</table>

Last 4 weeks (before your baby died)
115. BEFORE YOUR PREGNANCY how likely were you to doze off or fall asleep in the following situations, in contrast to just feeling tired? (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Activity</th>
<th>Would never doze</th>
<th>Slight chance of dozing</th>
<th>Moderate chance of dozing</th>
<th>High chance of dozing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting and reading</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watching TV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting inactive in a public place (eg cinema, meeting)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As a passenger in a car for an hour without a break</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lying or sitting down to rest in the afternoon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting and talking to someone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting quietly after lunch without alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In a car, while stopped for a few minutes in the traffic</td>
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</tr>
</tbody>
</table>

116. IN THE LAST 4 WEEKS (of pregnancy) how likely were you to doze off or fall asleep in the following situations, in contrast to just feeling tired?
Even if you have not done some of these things recently try and work out how they would have affected you.
(Please tick one answer per line).

<table>
<thead>
<tr>
<th>Activity</th>
<th>Would never doze</th>
<th>Slight chance of dozing</th>
<th>Moderate chance of dozing</th>
<th>High chance of dozing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting and reading</td>
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<td></td>
<td></td>
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<tr>
<td>In a car, while stopped for a few minutes in the traffic</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

117. On average how many times would you take a nap during the day? (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Never</th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every day</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
118. Have you changed your sleeping habits during your pregnancy?

☐ Yes  ☐ No

If so, what have you changed?

119. If you have changed your sleeping habits during your pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

☐ Midwife
☐ GP
☐ Hospital doctor
☐ Friend/relative
☐ Internet
☐ Magazine
☐ Pregnancy book
☐ TV

Please add details
**Fetal Movements**

120. Did anyone give you information about fetal movements during your pregnancy?
- [ ] No information was given
- [ ] Verbal information
- [ ] Written information
- [ ] Other (please specify)

121. Was there anytime from 26 weeks of pregnancy that your baby's movements were less than usual?
- [ ] Yes
- [ ] No
122. If yes, on how many occasions?

- 1
- 2
- 3
- 4 or more

123. If yes, did you speak to a health professional for advice?

- Yes
- No

If did not speak to a health professional, why was that?

124. If yes, did you attend hospital?

- Yes
- No

If you did not attend hospital, why was that?

125. If you did attend hospital, what did they do?

126. In the last 2 weeks did the strength of your baby's movements: (The two weeks before your baby died) (Please tick one answer only).

- Increase
- Decrease
- Stay the same
- Unsure

127. In the last 2 weeks did the frequency of your baby's movements: (The two weeks before your baby died) (Please tick one answer only).

- Increase
- Decrease
- Stay the same
- Unsure

128. During the last 2 weeks, did you notice anytime that your baby was more vigorous than usual? (The two weeks before your baby died).

- Yes
- No

129. If yes, how many times?

- Once
- More than once
130. During the last 2 weeks, did you feel your baby having hiccups? (The two weeks before your baby died).

- Yes
- No
- Unsure

131. If yes, how often?

- Once
- Occasionally
- Daily
- Unsure

132. During the last 2 weeks, did you feel uterine contractions (tightenings/ pre-labour contractions/ Braxton Hicks contractions/ false labour) for longer than an hour? (The two weeks before your baby died).

- Yes
- No
- Unsure
133. Did you experience any physical injury at any time during your pregnancy? (Please tick all relevent boxes).

- No injury
- Slips and falls
- Road traffic accident
- Blow to abdomen
- Self-harm
- Other non-accidental injury
- Other accidental injury

134. If yes, please describe the physical injury.

[Text box for description]

135. If yes, was this during the last two weeks of your pregnancy?

- Yes
- No

136. Did you see a health professional about your injury?

- Yes
- No
These questions must be asked only if the woman is on her own

Family Violence

137. Family violence questions not asked as woman was not on her own?
- Yes

138. Family violence questions not asked for other reason (specify)

139. Woman declined to answer family violence questions?
- Yes

140. In the past year have you been hurt or frightened by someone close to you?
- Yes

141. In the past year have you felt controlled or always criticized in your relationship?
- Yes

142. In the past year have you been made to do anything sexual that you did not want to do?
- Yes

143. Who in your family controls the money?
- You
- Your partner
- Joint - you and your partner
- Other family member

144. If disclosure of domestic abuse made, have you followed your local protocol.
- Yes
Finally I would like to ask you some questions about when your baby died.

145. What was the first reason that you thought something was wrong with you pregnancy or that your baby was dying/ had died? (Please tick one answer only).

- I felt a reduction of kicks/ movements
- I felt kicks/ movements stop
- I felt abdominal pain
- I had vaginal bleeding/ haemorrhage
- I had discharge of amniotic fluid/ the membranes ruptured/ my waters had broken
- I had a “feeling that something was wrong”, but cannot specify
- I had a trauma (involved in a physical accident)
- I had other symptoms (specify below if possible)
- I was told at an antenatal appointment
- I was told when I was admitted in labour
- I was told during labour
- It was not discovered before my baby was born
- I do not remember/ know

Other (please specify)

146. When do you think your baby died?

DD/MM/YYYY

I do not know when my baby died

147. What time of day do you think your baby died? (Please tick one answer only).

- During the night
- During a daytime nap
- In the morning
- In the afternoon
- In the evening
- Not sure
148. What was the reason you saw a health practitioner at the time that your baby was found to have died? 
(Please tick one answer only).
- Routine scheduled pregnancy visit
- Routine scan
- Decreased baby movements
- In labour
- In hospital
- Vaginal bleeding
- Rupture of membranes
- Unwell
- Not recorded/ unknown
Other (please specify)

149. Were you asked if you would like a post-mortem for your baby? 
- Yes
- No

150. If yes, did you choose to have a post-mortem? 
- Yes
- No

151. If no, what was the main reason you decided against a post-mortem? (Please tick one answer only).
- We already knew why baby had died
- It would not bring baby back
- Did not want baby to be taken away
- Did not want baby to be cut
- Wanted to bury baby as quickly as possible
Other (please specify)

152. Would you make the same decision about the post-mortem now? 
- Yes
- No

153. Is there anything else that you think might be important you would like to tell us about your pregnancy?
Thank you very much for your time and thoughts.

154. How did you feel about being involved in this study?

155. Is there anything else that you would like to add (Anything that you feel was significant, but was not discussed)?
Clinical Data Collection

This data is to be collected FROM THE ANTENATAL RECORD.

Current pregnancy

156. Study Number:

157. Date:

DD/MM/YYYY

158. EDD by LMP:

- DD/MM/YYYY
- EDD not known

159. EDD by USS:

- DD/MM/YYYY
- USS not done

160. Gestation by first USS:

Weeks

Days

161. Best agreed EDD:

162. Height recorded in notes:

- Cms
- Not recorded

Cms
163. First weight in pregnancy:

- Kgs
- Not recorded

Kgs: [ ]
164. Body Mass Index at booking

165. Gestation at first weight:

   Weeks

166. Last weight:

   ○ Kgs
   ○ Not recorded

   Kgs

167. Gestation at last weight:

   ○ Weeks
   ○ N/A

   Weeks

168. Date of first visit with health care professional:

   DD MM YYYY
   DD/MM/YYYY

169. Estimated gestational age at first visit with health care professional:

   Weeks
   Days

170. Initial type of maternity care? (Please tick one answer only).

   ○ Midwifery-led care
   ○ Consultant-led care
   ○ Shared care (between consultant and midwife)
   ○ Private Obstetrician
   ○ Private Midwife

   Other (please specify)

171. Referal to obstetric/ medical specialist?

   ○ Yes
   ○ No
172. If yes: (Please tick one answer only).

- Pre-existing condition
- Complication of pregnancy
- Maternal request
- Other (please specify)

173. Transfer of care during pregnancy? (e.g. from midwifery-led care to consultant-led care).

- Yes
- No

174. Booked place of birth? (Please tick one answer only).

- Tertiary hospital
- Secondary hospital
- Primary birthing unit
- Home
- Other (please specify)

175. Number of antenatal visits in 1st trimester (0-12 weeks)? (From antenatal records).

- No.

176. Number of antenatal visits in 2nd trimester (13-28 weeks)? (From antenatal records).

- No.

177. Number of antenatal visits in 3rd trimester (29-42 weeks)? (From antenatal records).

- Number

178. If no antenatal records available, please give details.

179. Ultrasound this pregnancy? (Please tick all relevant answers).

- First trimester
- Anomaly scan 18-22 weeks
- Doppler studies
- Growth scan
- None
180. Medical conditions in pregnancy? (Please tick all relevant answers).

- None
- Anaemia
- Asthma
- Cervix surgery
- Depression
- Diabetes - before pregnancy
- Epilepsy
- Essential hypertension
- Gestational diabetes - developed during pregnancy
- Heart condition - congenital
- Heart condition - rheumatic
- Hypertension / Pre-eclampsia
- Hyperthyroid
- Hypothyroid
- Inflammatory bowel
- Laparotomy
- Other autoimmune
- Renal disease
- Rheumatic heart
- Major psychiatric disorder (Other than depression)
- Sickle cell crisis
- Systemic lupus erythematosus
- Thalassaemia trait
- Urinary tract infection
- Uterine abnormality
- Venous thromboembolism

Other (please specify)

181. Blood pressure at booking?

Systolic

Diastolic

182. Last blood pressure prior to interview (controls) or when baby was last known to be alive (cases)?

Weeks

Days
183. Was a customized growth chart used?
- Yes
- No
- Don't know

184. Was fetal growth restriction clinically suspected?
- Yes
- No

185. If yes, gestation first suspected?
- Weeks
- Days

186. If yes, were growth scan(s) done?
- Yes
- No

187. Was there evidence on the growth scan of fetal growth restriction?
- Yes AC < 10%
- Yes EFW < 10%
- No

188. If yes, what was the management? (Please tick all relevent answers).
- No change
- Increased antenatal visits
- Serial cardiotocography (CTG's)
- Ultrasound scan
- Doppler's
- Admitted
- Delivered
- Other (please specify)

189. Admitted with threatened preterm labour in this pregnancy?
- Yes
- No
- Don't know
**190. Blood group?**
- A Pos
- B Pos
- AB Pos
- O Pos
- A Neg
- B Neg
- AB Neg
- O Neg
- Not known

**191. Hep B status?**
- Positive
- Negative
- Not known

If not known

**192. HIV status?**
- Positive
- Negative
- Not known

If not known

**193. HbA1c performed?**
- Yes
- No

**194. If yes:**
- Result
- Gestation

**195. GTT performed?**
- Yes
- No

**196. If yes:**
- Fasting
- 1 hour
- 2 hour
- Gestation
- Fasting
- 1 hour
- 2 hour
- Gestation
197. Baby's date of birth?

DD/MM/YYYY

198. Place of birth?

- Tertiary/ secondary hospital
- Birthing unit
- Home
- Other (please specify)

199. Birth weight in grams?

Grains

200. Gestation at birth (for controls) or at DIAGNOSIS of stillbirth (for cases):

- Weeks
- Days

201. Sex of baby?

- Male
- Female

202. Examination of the cord? (Please tick all relevent answers).

- Normal
- Tight knot/ occulded
- Loose knot
- Cord round neck tightly
- Cord round neck loosely
- Cord round limbs/ body tightly
- Cord round limbs/ body loosely
- Torsion or spring like cord
- Marginal/ velamentous insertion
- Hypocoiled
- Thin cord
- Meconium stained
- Tear
- 2 vessels
- Other (please specify)
203. Placenta? (Please tick all relevant answers).

- [ ] Normal
- [ ] Retroplacental clot
- [ ] Gritty/ calcified
- [ ] Vasa praevia
- [ ] Offensive odour
- [ ] Succenturiate lobe
- [ ] Extrachorial/ Circumvallate
- [ ] Bilobate/ Bilpartite placenta
- [ ] Placenta accreta
- [ ] Not examined
- Other (please specify)

204. Placental weight in grams?

- Grams
- Placenta not weighed

205. If placenta was weighed, was it trimmed weight or full weight?

- [ ] Trimmed weight
- [ ] Full weight
- [ ] Unsure
<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>206. Date of diagnosis of fetal death?</strong></td>
<td>DD/MM/YYYY</td>
</tr>
<tr>
<td><strong>207. Date of last consult prior to death where fetus confirmed alive?</strong></td>
<td>DD/MM/YYYY</td>
</tr>
<tr>
<td><strong>208. New findings at last consult prior to diagnosis of fetal death?</strong></td>
<td>- No new findings</td>
</tr>
<tr>
<td></td>
<td>- SGA</td>
</tr>
<tr>
<td></td>
<td>- LGA</td>
</tr>
<tr>
<td></td>
<td>- Hypertension</td>
</tr>
<tr>
<td></td>
<td>- Oligohydramnios</td>
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<tr>
<td></td>
<td>- Polyhydramnios</td>
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<tr>
<td></td>
<td>- APH</td>
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<tr>
<td></td>
<td>- Diabetes</td>
</tr>
<tr>
<td></td>
<td>- Decreased fetal movements</td>
</tr>
<tr>
<td></td>
<td>- Urinary tract infection</td>
</tr>
<tr>
<td></td>
<td>- Other (please specify)</td>
</tr>
<tr>
<td><strong>209. When did death occur?</strong></td>
<td>- Antepartum</td>
</tr>
<tr>
<td></td>
<td>- Intrapartum</td>
</tr>
<tr>
<td></td>
<td>- Unknown whether antepartum/ intrapartum</td>
</tr>
<tr>
<td><strong>210. Post-mortem?</strong></td>
<td>- Yes</td>
</tr>
<tr>
<td></td>
<td>- No</td>
</tr>
<tr>
<td><strong>211. If yes, where was it done? (Attach copy of results if available).</strong></td>
<td>Attach copy of results if available.</td>
</tr>
<tr>
<td><strong>212. Placental pathology?</strong></td>
<td>- Yes</td>
</tr>
<tr>
<td></td>
<td>- No</td>
</tr>
</tbody>
</table>
213. If yes, where was it done? (Attach copy of results if available).

<p>| | | | | | |</p>
<table>
<thead>
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</tbody>
</table>
214. During the night how often do you have to get up to use the toilet?

Before you were pregnant?

The last four weeks (before your baby died)?

The last week of your pregnancy?

Last night (the night before your baby died)?

215. Since you became pregnant did your level of physical exercise:

☐ Stay the same

☐ Become less

☐ Become more

216. How often have you engaged in vigorous exercise in the last month (the month before your baby died)? Exercise which made you breathe harder or puff or pant, such as tennis, jogging, aerobics, heavy gardening, cycling?

☐ Never

☐ Once a week

☐ 2-3 times a week

☐ 4-6 times a week

☐ Daily

☐ More than once a day

217. If you have engaged in vigorous exercise, on average how long did your exercise last for (in minutes)?

Minutes

218. What type of vigorous exercise have you done?

☐ Jogging

☐ Tennis

☐ Cycling

☐ Gym class- aerobics

☐ Spinning

☐ Weight training- gym

☐ Swimming

Other (please specify)
219. How often have you engaged in less vigorous exercise for recreation, sport or health fitness purposes in the last month (the month before your baby died) which did not make you breathe harder or puff or pant?

- Never
- Once a week
- 2-3 times a week
- 4-6 times a week
- Daily
- More than once a day

220. If you did engage in less vigorous exercise, what type of exercise have you done?

- 

221. From the anomaly scan, please record placental position.

- Anterior- high
- Anterior- low
- Posterior- high
- Posterior- low
- Fundal
- Lateral
- Low lying
- Other (please specify)

- 

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
## STROBE Statement—Checklist of items that should be included in reports of *case-control studies*

<table>
<thead>
<tr>
<th>Item No</th>
<th>Recommendation</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title and abstract</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td><em>(a)</em> Indicate the study’s design with a commonly used term in the title or the abstract</td>
<td>Lines 1-2 + 27</td>
</tr>
<tr>
<td></td>
<td><em>(b)</em> Provide in the abstract an informative and balanced summary of what was done and what was found</td>
<td>Lines 25-49</td>
</tr>
<tr>
<td><strong>Introduction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Explain the scientific background and rationale for the investigation being reported</td>
<td>Lines 72-94</td>
</tr>
<tr>
<td><strong>Objectives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>State specific objectives, including any prespecified hypotheses</td>
<td>Lines 94-96</td>
</tr>
<tr>
<td><strong>Methods</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Present key elements of study design early in the paper</td>
<td>Lines 93-108</td>
</tr>
<tr>
<td>5</td>
<td>Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection</td>
<td>Lines 98-102 and Ref #13</td>
</tr>
<tr>
<td>6</td>
<td><em>(a)</em> Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls</td>
<td>Lines 102-108 and Ref #13</td>
</tr>
<tr>
<td></td>
<td><em>(b)</em> For matched studies, give matching criteria and the number of controls per case</td>
<td>N/A</td>
</tr>
<tr>
<td>7</td>
<td>Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable</td>
<td>Lines 109-116</td>
</tr>
<tr>
<td>8*</td>
<td>For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group</td>
<td>Lines 109-116 and 127-136 (Derivation of FM variable)</td>
</tr>
<tr>
<td><strong>Bias</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Describe any efforts to address potential sources of bias</td>
<td>Lines 137-144 and Lines 227-246</td>
</tr>
<tr>
<td><strong>Study size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Explain how the study size was arrived at</td>
<td>In Ref #13</td>
</tr>
<tr>
<td><strong>Quantitative variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Statistical methods</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td><em>(a)</em> Describe all statistical methods, including those used to control for confounding</td>
<td>Lines 137 – 144</td>
</tr>
<tr>
<td></td>
<td><em>(b)</em> Describe any methods used to examine subgroups and interactions</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td><em>(c)</em> Explain how missing data were addressed</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td><em>(d)</em> If applicable, explain how matching of cases and controls was addressed</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td><em>(g)</em> Describe any sensitivity analyses</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Results</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13*</td>
<td><em>(a)</em> Report numbers of individuals at each stage of study—eg numbers</td>
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**Discussion**

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**Other information**

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Alterations in maternally-perceived fetal movement and their association with late stillbirth – findings from the Midland and North of England Stillbirth Case-Control Study

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Budd, Jayne; University of Manchester, Maternal and Fetal Health Research Centre  
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| Primary Subject Heading: | Obstetrics and gynaecology |
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Alterations in maternally-perceived fetal movement and their association with late stillbirth – findings from the Midland and North of England Stillbirth Case-Control Study

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Running Title – Fetal movements and late stillbirth
Abstract

Objective - To report perception of fetal movements in women who experienced a stillbirth compared to controls at a similar gestation with a live birth.

Design - Case-control study.

Setting – 41 maternity units in the United Kingdom.

Participants – Cases were women who had a late stillbirth ≥28 weeks’ gestation (n=291) and controls were women with an ongoing pregnancy at the time of interview (n=733). Controls were frequency matched to cases by obstetric unit and gestational age.

Methods - Data were collected using an interviewer-administered questionnaire which included questions on maternal perception of fetal movement (frequency, strength, increased and decreased movements and hiccups) in the two weeks before the interview/stillbirth. Five fetal movement patterns were identified incorporating the changes in strength and frequency in the last two weeks by combining groups of similar pattern and risk. Multivariable analysis adjusted for known confounders.

Primary outcome measure – Association of maternally-perceived fetal movements in relation to late stillbirth.

Results – In multivariable analyses women who reported increased strength of movements in the last two weeks had decreased risk of late stillbirth compared to those whose movements were unchanged (adjusted OR 0.18, 95%CI 0.13-0.26). Women with decreased frequency (without increase in strength) of fetal movements were at increased risk (aOR 4.51, 95%CI 2.38-8.55). Daily perception of fetal hiccups was protective (aOR 0.31, 95%CI 0.17-0.56).

Conclusions – Increased strength of fetal movements and fetal hiccups are associated with decreased risk of stillbirth. Alterations in frequency of fetal movements are important in identifying
pregnancies at increased risk of stillbirth, with the greatest risk in women noting a reduction in fetal activity. Clinical guidance should be updated to reflect that increase in strength and frequency of fetal movements is associated with the lowest risk of stillbirth, and that decreased fetal movements are associated with stillbirth.

Trial Registration – ClinicalTrials.gov registration NCT02025530

Strengths and Limitations

• This is the largest case-control study reporting detailed information about maternal perception of fetal movements in relation to stillbirth
• This study addressed different aspects of fetal activity including frequency and strength and hiccups
• Case control studies can be affected by measurement error, though this is not likely to differ between groups.
• Attempts were made to reduce recall bias including: using a structured questionnaire and no explicit hypotheses communicated to participants.
• The recruitment rate was lower than initially expected, 44.1% for cases and 25.9% for controls., which may introduce selection bias.

Disclosure of Interests - All authors declare that they have no competing interests.

Funding – The Midland and North of England Stillbirth Study was funded by grant GN2156 from Action Medical Research, Cure Kids and Sands.

Keywords

Maternal Perception; Fetal movement; Reduced Fetal Movement; Exaggerated Fetal Movement; Stillbirth; Risk Factor.
Introduction

Maternal perception of fetal activity is an accepted marker of fetal wellbeing. Conversely, maternal perception of changes in activity can indicate fetal compromise; the most commonly reported change is a reduction in fetal movement. Maternal perception of reduced fetal movements (RFM) is associated with adverse pregnancy outcomes including fetal growth restriction, oligohydramnios, and stillbirth. These conditions are associated with placental dysfunction, which is observed in women with reduced fetal movements. Despite the known association between RFM and stillbirth, two Confidential Enquiries into antepartum stillbirth in the United Kingdom (UK) conducted 15 years apart highlighted suboptimal care in terms of the information given to mothers about fetal movements and clinical management when mothers attend with RFM as factors contributing to stillbirth.

In comparison to a reduction in frequency of fetal movements little is known about other aspects of maternally-perceived fetal activity, such as: strength of movements, an episode of vigorous movement and fetal hiccups and how these relate to risk of stillbirth. Data from two case-control studies and a large international cohort study have both suggested that any significant deviation from a mother’s usual pattern of fetal movement is a risk factor for stillbirth. Importantly, existing data suggest that an increase in both strength and frequency of fetal movements in late pregnancy was reported significantly less frequently by women who had a stillbirth. Due to this paucity of data it is important to better understand maternal perception of altered fetal activity and whether these perceptions can be used to identify fetuses at high risk of antepartum stillbirth. Furthermore, women report receiving mixed messages about the importance of fetal movements and the significance of RFM, indicating the need for clear information regarding these symptoms. To address these needs, we conducted a case-control study to explore modifiable risk factors associated with late stillbirth. The objective of this manuscript is to report maternally-perceived fetal
movements in women who experienced a recent stillbirth compared to a control group of women at similar gestation who had a live baby.

**Methods**

The Midlands and North of England Stillbirth Study (MiNESS) was conducted in 41 maternity units in the UK. Ethical and research approvals were obtained (Ref 13/NW/0874). The study was registered on www.clinicaltrials.gov (NCT02025530) and the study protocol was published. Participants were recruited between April 2014 and March 2016. The study methodology has been described in detail elsewhere. Cases were included if the stillbirth occurred at or after 28 weeks’ gestation and the fetus did not have a congenital anomaly. The cause of stillbirth was assigned using the ReCoDe classification system. Controls were women with an ongoing pregnancy. To ensure that controls would be at a similar gestation to cases, the gestation at interview was frequency matched to the expected distribution of stillbirths based on the prior four years of data from that unit. Potential controls were randomly selected from the booking lists and the gestation for interview calculated from the expected date of delivery. Women with multiple pregnancies, maternal age less than 16 years and inability to give consent were excluded from the study.

The primary outcome reported here was the association of maternal perception of fetal movements with late stillbirth. Maternal perception of fetal movements were classified as increased, reduced or stayed the same. Data specific to this analysis relates to questions asked about fetal movements and more specifically about changes in strength and frequency in the last 2 weeks (before the baby died for cases and last 2 weeks before interview for controls). Additional information was collected on fetal hiccups. Data on uterine contractions were also collected as it has been argued elsewhere that women may interpret uterine contractions as fetal movements. All questions as asked are reported in Table 1.
Statistical methods

Univariable analyses were carried out using logistic regression to estimate the effect of each variable. Due to likely relationships between the variables, bivariate models were fitted between each pair of movement variables to assess (by changes in effect size) which variables were able to be placed in multivariable analyses together. There was a strong association between reduced movements after 26 weeks’ gestation and the variables for strength and frequency of movements in the last 2 weeks, meaning these variables could not be included in the same multivariable model. Additionally the question relating to reduced fetal movements since 26 weeks is complicated by the fact that the timeframe relating to this question varies by subjects, i.e. 2 weeks for a women at 28 weeks gestation and 15 weeks at 41 weeks gestation.

Although the strength and frequency variables were also associated with each other they measure different aspects of movement. However, as using 16 potential combinations (derived from 4 different levels of both strength and frequency) independently would greatly reduce the statistical power, a combined strength/frequency variable was developed to describe the relationship between the changes in strength and frequency of movements in the last two weeks before the interview/stillbirth. The variable was prioritised based upon the prevalence of the perception in controls and the magnitude of the associated risk. Groups of similar pattern and risk were then combined (see Supplementary Table 1). Thus, the prioritised strength/frequency variable used the following rule:

1. Increase in strength of movements
2. Increase in frequency but not strength of movements
3. Decrease in frequency of movements
4. Unsure of change in strength or frequency
5. No change in strength or frequency (reference category based on current guidelines)
Multivariable analyses were carried out by adding the variables identified as not showing significant co-linearity (prioritised strength/frequency variable, frequency of increased fetal movements, and frequency of feeling hiccups) to the model previously developed in relation to the risk of stillbirth in this study (maternal: age, ethnicity, parity, education, smoking in pregnancy, marital status, customised birthweight centile, sleep factors on the last night before stillbirth/interview (position went to sleep in, sleep duration, number of times got up to toilet), naps in the daytime, gestation and study centre). All analyses were carried out using the logistic procedure in SAS v9.4 (SAS Institute, Cary, N.C.).

Results

In total 3490 women were identified as potentially eligible participants (660 cases and 2830 controls, Figure 1). 760 women could not be contacted (77 cases, and 683 controls) and 1700 women did not consent to participate in the study (287 cases and 1413 controls). Six cases were excluded after data collection (five stillbirths had previously unidentified congenital abnormalities detected on post-mortem and one control participant had a stillbirth). Cases were more likely to participate than controls (p<0.0001), 291 cases (44.1%) and 733 controls (25.9%) were included in the analysis (Figure 1).

The demographic characteristics of the study population have been presented in detail previously. Briefly, the majority of participants were from white ethnic background (80.4% of cases and 81.0% of controls), with a significant proportion of participants from South Asian (13.4% of cases and 13.0% controls) and Black ethnic groups (4.1% of cases and 4.0% of controls). Participants’ ages were distributed across the reproductive lifespan, with the largest group between 30-34 years of age in both groups (29.6% cases, 36.6% controls). There was no different in mean body mass index (Cases 26.9 kg/m², Controls 26.0 kg/m²). The median gestation at interview was 36 weeks 3 days for controls (Interquartile Range (IQR) 32 weeks 6 days to 38 weeks 5 days). In cases, the median gestation at diagnosis of stillbirth was 37 weeks 4 days (IQR 33 weeks 4 days to 39 weeks 5 days,
p=0.003 compared to controls). The median interval between the presumed date of death in utero and diagnosis was 0 days (IQR 0-1) and the median time between the diagnosis of stillbirth and interview was 25 days (IQR 17-35). The most frequent factors associated with stillbirth were fetal growth restriction (45.2%), placental insufficiency (16.4%), placental abruption (6.5%) and acute infection (4.5%).

The prevalence of each variable relating to fetal movements and their univariable odds ratios (OR) associated with stillbirth are presented in Table 1. Women who reported RFM any time after 26 weeks’ gestation were at increased risk of having a stillbirth with the risk increasing with the number of times that they reported that decreased movements had occurred ranging from an OR of 2.36 for one episode to an OR of 5.11 for 3 or more episodes. Similarly, women who reported a decrease in either strength (OR 1.61) or even more so frequency (OR 3.54) of fetal movements in the last 2 weeks were at increased risk of having a stillbirth compared to those who reported no change.

Conversely, increasing strength (OR 0.15) or frequency (OR 0.38) of fetal movement were associated with reduced stillbirth risk compared to those who reported no change. There was a significantly decreased stillbirth risk in those reporting more than one episode of vigorous movement (OR 0.34) and a trend towards increased stillbirth risk in women who felt a single episode of vigorous movement (OR 1.47) compared to those who never perceived movements to be more vigorous than usual. The combined variable derived from the strength and frequency variables showed that compared to no change in frequency or strength of movement, those who reported increased strength in the last two weeks had a decreased risk of stillbirth (OR 0.18), which was the most commonly reported scenario in controls (62%), whilst those reporting decreased frequency of movements were at increased risk (OR 3.45).

Maternal perception of fetal hiccups in the last two weeks was associated with a decreased risk of stillbirth (OR 0.41). The magnitude of this reduced risk increased as the frequency of feeling hiccups increased, with the lowest risk for daily perception of hiccups (OR 0.32). There was no association between feeling contractions in the last two weeks and stillbirth (OR 0.97).
The multivariable model (Table 2) showed that a decrease in frequency of fetal movements remained associated with increased risk of stillbirth (aOR 4.51) and increasing strength of fetal movements was still associated with decreased risk of stillbirth (aOR 0.14) compared to no change in perception of frequency or strength of movement in the last two weeks. The decreased risk associated with feeling vigorous movements on more than one occasion in the last two weeks remained statistically significant (aOR 0.59), but the association between a single episode of vigorous movement in the preceding two weeks and stillbirth became statistically significant (aOR 2.10). Compared to not feeling hiccups in the last two weeks, feeling hiccups daily was associated with a significant reduction in risk (aOR 0.31).

When baby’s movements were reported as less than usual in the preceding two weeks, mothers of cases were significantly more likely to have spoken to a health professional (79% vs 70%, p=0.02) and tended to have attended hospital due to reduced fetal movements more frequently than controls although this did not achieve statistical significance (68% vs 60%, p=0.07).

Discussion

Main Findings

This study shows that the majority of women with a live birth after 28 weeks’ gestation perceive an increase in strength of fetal movements and feel fetal hiccups in the previous two weeks; perception of these patterns of fetal movements is associated with a substantial reduction in the risk of late stillbirth (aORs 0.14 and 0.31 respectively). Conversely, a decrease in the strength or frequency of fetal movements is associated with an increased risk of late stillbirth particularly if this is a recurrent phenomenon (OR 2.36 rising to 5.11). A single episode of vigorous fetal activity is also associated with an increased risk of stillbirth.

Strengths and Limitations
This study is the largest case control study that has reported detailed information about maternal perception of fetal movements in relation to the risk of late stillbirth. A comparatively novel feature of this study is that analysis of fetal activity was not restricted to the frequency of fetal movements, but also addressed changes in strength of fetal activity as well as fetal hiccups. Apart from the Auckland Stillbirth Study (TASS) most recent publications evaluating the significance of fetal movements have comprised small cohort studies of women with reduced frequency of fetal movements in centres where intervention may be employed to prevent stillbirth.\textsuperscript{17, 18} By including a broader description of fetal activity this study has been able to report the frequency and strength of fetal movements in ongoing pregnancy and describe changes that are related to late stillbirth.

A case-control design was considered the most practical means to identify late stillbirth, as a prospective cohort study is not feasible, requiring almost 108,000 women to identify 291 late stillbirths (at the current frequency of 2.9 per 1,000 births in the UK). However, it is important to consider the potential influence of recall bias, a limitation of case-control studies. This study attempted to minimise recall bias in several ways. Firstly, all participants were asked the same series of questions about fetal movements embedded in a questionnaire about many different factors (e.g. smoking, diet, stress, social situation, sleep position and fetal movements). Secondly, women who experienced a stillbirth were interviewed within a median of 25 days, a time when events surrounding the death of a baby are likely to be clearly recalled.\textsuperscript{19} As women in the control group were pregnant at the time they completed the survey their experiences or concerns could not have been biased by knowledge of the outcome of their pregnancy. Finally, this study described novel findings of vigorous fetal movements and fetal hiccups, which are rarely addressed in prior studies, reducing the possibility that respondents may have read about these symptoms in advance of the questionnaire. While recall bias cannot be completely discounted, responses from participants’ who had a stillbirth do not universally show a deviation from controls e.g. there was no different in maternal perception of uterine contractions between the two groups.
The possibility of selection bias was minimised by recruiting controls who were frequency matched to cases over the duration of the study period which resulted in similar ages and ethnicities in both groups. The recruitment rate of MiNESS was lower than that of the TASS case control study (Cases 45.3% vs. 72%; Controls 26.2% vs. 72% respectively). This may have resulted in part from random selection of controls from booking lists which meant that some of these women could not be contacted and others were approached with no prior knowledge of the study, which given the sensitive subject matter, may have been reduced participation rates. A qualitative sub-study was undertaken to further understand the barriers and facilitators to participation in this study for both cases and controls, this will be reported separately.

**Interpretation**

Data regarding the pattern of fetal movements in late pregnancy are limited. Previous literature has suggested that the frequency of fetal movements increases until the 32nd week of pregnancy and then plateaus. Studies also note that the type and quality of fetal movements change with advancing gestation. In this study the majority of controls reported that the frequency of fetal movements stayed the same (54.3%) but that there was increased strength of fetal movements in most controls (62.8%) in the preceding two weeks. Interestingly, an increase in strength of fetal movements had a greater protective effect for stillbirth than increase in frequency (OR 0.15 vs. 0.38). These findings are similar to those reported in TASS. As ultrasound studies suggest that mothers are more likely to feel larger movements of trunk and limbs, an increase in strength may also be perceived as an increase in frequency. Critically, for a reduction in frequency of fetal movements can only be judged in retrospect, whereas, increased strength may be easier to judge in real time which could prompt more rapid reporting of maternal concerns. We were not able to stratify levels of fetal activity by gestation due to insufficient sample size, this will be addressed in a planned individual participant data (IPD) meta-analysis. The other studies within the IPD can also
be used to determine whether the interaction between strength and frequency is similar, and has
similar association with late stillbirth.

Although regular vigorous movements are important and protective, a one-off episode of excessive
fetal activity may be a warning sign of fetal compromise although the effect size in this study was
less than in TASS (aOR 2.10 vs. 6.81). The repeated identification of this association here
strengthens the relationship between a single episode of excessive fetal activity and stillbirth.

However, practical application of this association is challenging as a woman cannot know at the time
whether an episode of vigorous movement is isolated or will become a part of regular fetal activity.
Furthermore, the origin of the excessive movement is unclear. Therefore, this association requires
further investigation in our planned IPD meta-analysis to establish whether it is consistently
observed, and whether there are any clues to the aetiology of this symptom.

In agreement with many studies since the mid-1970s we have confirmed that decreased frequency
of fetal movements is a major risk factor for late stillbirth. Furthermore, this study agrees with data
from other UK units that recurrent presentation with RFM is associated with an even greater risk of
adverse outcome. This link is biologically plausible as RFM is associated with abnormal placental
structure and function which may deteriorate as pregnancy progresses. Notably, mothers with
recurrent episodes of RFM have been shown to have an increased likelihood of abnormal uterine
artery Doppler waveforms in the second trimester and delivery of a small for gestational age
infant, both of which are associated with abnormal placental morphology. This study did not
have sufficient power to determine whether maternal perception of RFM was related to stillbirths
associated with a specific cause (e.g. placental dysfunction) but this will be addressed in the IPD
meta-analysis.

Our data regarding the protective effect of fetal hiccups are an important observation which is
consistent with findings from TASS. This finding contrasts with a single case report which proposed
that hiccups are linked to umbilical cord complications. Fetal hiccups appear on ultrasound to be
interspersed with normal breaths and are considered physiological. Mothers are aware of fetal hiccups throughout pregnancy, one study of 45 women suggested that they were perceived more frequently prior to 26 weeks’ gestation and remained constant after that with an average of 0.4 episodes per hour. Although another study found 36.6% of women perceived hiccups in pregnancy, and this increased with gestational age. Fetal hiccups do not appear to relate to other aspects of fetal movement, although they are associated with active fetal behavioural states.

Women in this study with RFM who went on to have a stillbirth were more likely to have spoken to a healthcare professional about the symptom but only 68% attended hospital because of RFM, indicating that contacting a health professional does not appear to prevent stillbirth. This may be because a significant proportion of women do not attend hospital, management of RFM is variable, or that the baby was already dead at the time of presentation. Critically, management is presently not informed by high-quality evidence as there are insufficient data from randomised trials to guide practice. It is anticipated that the AFFIRM study, a multi-centre stepped-wedge cluster randomised trial will address whether standardised information for women and a standardised management strategy (employing antepartum cardiotocography and ultrasound for fetal biometry and liquor volume) following attendance with RFM will reduce stillbirth.

**Conclusion**

This study demonstrates that maternal perception of increased strength of fetal movements in late pregnancy is protective of late stillbirth. Decreased frequency of fetal movements is associated with risk of stillbirth as is decreased strength. Clinical guidelines and health promotion information currently suggest that fetal movements tend to increase until the 32nd week of pregnancy and then plateau. However, data from this study and TASS show that an increase in strength and frequency of fetal movements is associated with the lowest risk of stillbirth suggesting that guidance should be altered to indicate that maternal perception of fetal movement normally increases throughout pregnancy. This study adds to the evidence base that when fetal movements are reduced there is an
increased risk of late stillbirth. Thus, women should contact their maternity care provider and be managed according to current clinical guidance. Importantly, development of an effective strategy for the investigation and management of RFM in late pregnancy has the potential to reduce the incidence of late stillbirth.

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- Airedale NHS Foundation Trust, Birmingham Women’s NHS Trust, Blackpool Teaching Hospitals NHS Foundation Trust, Bradford Teaching Hospitals NHS Foundation Trust, Buckinghamshire Healthcare NHS Trust, Burton Hospitals NHS Foundation Trust, Calderdale and Huddersfield NHS Foundation Trust, Central Manchester Hospitals NHS Foundation Trust, Countess of Chester Hospitals NHS Foundation Trust, County Durham and Darlington NHS Foundation Trust, East Lancashire Hospitals NHS Trust, Harrogate and District NHS Foundation Trust, Heart of England NHS Foundation Trust, Hull & East Yorkshire Hospitals NHS Trust, Lancashire Teaching Hospitals NHS Foundation Trust, Leeds Teaching Hospitals NHS Trust, Liverpool Women’s NHS Foundation Trust, Mid Cheshire Hospitals NHS Foundation Trust, Mid-Yorkshire Hospitals NHS Trust, Northern Lincolnshire and Goole NHS Foundation Trust, Portsmouth Hospitals NHS Trust, Royal Wolverhampton Hospitals NHS Trust, Sandwell and West Birmingham NHS Trust, Sheffield Teaching Hospitals NHS Foundation Trust, Sherwood Forest Hospitals NHS Foundation Trust, St Helens and Knowsley Teaching Hospitals, South NHS Trust, Stockport NHS Foundation Trust, Southport and Ormskirk Hospitals NHS Trust, South Warwickshire NHS Foundation Trust, The Dudley Group NHS Foundation Trust, United Lincolnshire Hospitals NHS Trust, University Hospitals of Coventry and Warwickshire NHS Trust, University Hospitals of North Midlands NHS Trust, University of Morecambe Bay NHS Foundation Trust, Walsall...
Contribution to Authorship

AH, TS, BM, DR, EM & LM contributed to all aspects of the study design and obtained funding. AH had overall responsibility for the study. JB coordinated the running of the study. ML & JT analysed the data with input from AH, JB, RC, BB, EM and LM. All authors were responsible for the drafting of the manuscript. All authors gave approval for the final version of the manuscript.

Details of Ethical Approval

This study was reviewed by NRES Committee North West - Greater Manchester Central Reference (13/NW/0874) on 24th January 2014.
References


Figure Legend

**Figure 1** - Flow diagram reporting the numbers of women eligible for the study, women who did not participate and those included in the final analysis.

Table Legends

**Table 1** - Univariable risks associated with perception of fetal movements and late stillbirth risk.

**Table 2** - Univariable and multivariable odds of late stillbirth associated with perceptions of fetal movements.
Supplementary Table 1 - Prevalence and risk of stillbirth associated with the 16 possible combinations of change in strength and frequency of movement in the last 2 weeks.

Supplementary File 1 – Questionnaire used to obtain data from participants in the Midlands and North of England Stillbirth Study
<table>
<thead>
<tr>
<th>Was there any time from 26 weeks of pregnancy that your baby’s movements were less than usual?</th>
<th>Cases n (%)</th>
<th>Controls n (%)</th>
<th>Odds ratio (95% Confidence Interval)</th>
<th>χ², p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>112 (38.7%)</td>
<td>469 (64.2%)</td>
<td>Reference: χ²=66.69, p&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>Once</td>
<td>88 (30.5%)</td>
<td>156 (21.3%)</td>
<td>2.36 (1.69-3.30)</td>
<td></td>
</tr>
<tr>
<td>Twice</td>
<td>39 (13.5%)</td>
<td>65 (9.9%)</td>
<td>2.51 (1.61-3.93)</td>
<td></td>
</tr>
<tr>
<td>Three or more times</td>
<td>50 (17.3%)</td>
<td>41 (5.6%)</td>
<td>5.11 (3.22-8.10)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>In the last two weeks did the strength of your baby’s movements increase?</th>
<th>Cases n (%)</th>
<th>Controls n (%)</th>
<th>Odds ratio (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase</td>
<td>53 (18.3%)</td>
<td>455 (62.8%)</td>
<td>0.15 (0.11-0.22)</td>
</tr>
<tr>
<td>Decrease</td>
<td>62 (21.4%)</td>
<td>50 (6.9%)</td>
<td>1.61 (1.05-2.46)</td>
</tr>
<tr>
<td>Stay the same</td>
<td>153 (52.8%)</td>
<td>198 (27.3%)</td>
<td>Reference: χ²=169.96, p&lt;0.0001</td>
</tr>
<tr>
<td>Unsure</td>
<td>22 (7.6%)</td>
<td>22 (3.0%)</td>
<td>1.29 (0.69-2.42)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>In the last two weeks did the frequency of your baby’s movements increase?</th>
<th>Cases n (%)</th>
<th>Controls n (%)</th>
<th>Odds ratio (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase</td>
<td>37 (12.7%)</td>
<td>254 (34.8%)</td>
<td>0.38 (0.26-0.56)</td>
</tr>
<tr>
<td>Decrease</td>
<td>86 (29.6%)</td>
<td>63 (8.6%)</td>
<td>3.54 (2.44-5.15)</td>
</tr>
<tr>
<td>Stay the same</td>
<td>153 (52.6%)</td>
<td>397 (54.3%)</td>
<td>Reference: χ²=103.49, p&lt;0.0001</td>
</tr>
<tr>
<td>Unsure</td>
<td>15 (5.2%)</td>
<td>17 (2.3%)</td>
<td>2.29 (1.12-4.70)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>During the last 2 weeks did you notice anytime that your baby was more vigourous than usual?</th>
<th>Cases n (%)</th>
<th>Controls n (%)</th>
<th>Odds ratio (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>182 (62.5%)</td>
<td>326 (44.7%)</td>
<td>Reference: χ²=57.39, p&lt;0.0001</td>
</tr>
<tr>
<td>Once</td>
<td>41 (14.1%)</td>
<td>50 (6.9%)</td>
<td>1.47 (0.94-2.31)</td>
</tr>
<tr>
<td>More than once</td>
<td>68 (23.4%)</td>
<td>354 (48.5%)</td>
<td>0.34 (0.25-0.47)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>During the last two weeks did you feel your baby having hiccups?</th>
<th>Cases n (%)</th>
<th>Controls n (%)</th>
<th>Odds ratio (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>126 (43.5%)</td>
<td>460 (62.9%)</td>
<td>0.41 (0.30-0.54)</td>
</tr>
<tr>
<td>No</td>
<td>141 (48.6%)</td>
<td>209 (28.6%)</td>
<td>Reference: χ²=38.10, p&lt;0.0001</td>
</tr>
<tr>
<td>Unsure</td>
<td>23 (7.9%)</td>
<td>62 (8.5%)</td>
<td>0.55 (0.33-0.93)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How often did you feel hiccups in the last two weeks?</th>
<th>Cases n (%)</th>
<th>Controls n (%)</th>
<th>Odds ratio (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not felt hiccups</td>
<td>141 (48.5%)</td>
<td>209 (28.6%)</td>
<td>Reference: χ²=42.01, p&lt;0.0001</td>
</tr>
<tr>
<td>Frequency</td>
<td>Yes</td>
<td>No</td>
<td>Reference: $\chi^2=0.12$, $p=0.94$</td>
</tr>
<tr>
<td>----------------------------</td>
<td>---------</td>
<td>--------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>Unsure if felt</td>
<td>23 (7.9%)</td>
<td>62 (8.5%)</td>
<td>0.73 (0.39-1.35)</td>
</tr>
<tr>
<td>Once</td>
<td>17 (5.8%)</td>
<td>36 (4.9%)</td>
<td>0.69 (0.37-1.27)</td>
</tr>
<tr>
<td>Occasionally</td>
<td>69 (23.7%)</td>
<td>235 (32.2%)</td>
<td>0.44 (0.32-0.62)</td>
</tr>
<tr>
<td>Daily</td>
<td>38 (13.1%)</td>
<td>177 (24.3%)</td>
<td>0.32 (0.21-0.48)</td>
</tr>
<tr>
<td>Unsure of frequency</td>
<td>3 (1.0%)</td>
<td>11 (1.5%)</td>
<td>0.37 (0.17-0.80)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During the last two weeks did you feel uterine contractions (tightenings/pre-labour contractions/Braxton Hicks contractions/false labour) for longer than an hour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>94 (32.3%)</td>
<td>241 (33.0%)</td>
<td>0.97 (0.72-1.29)</td>
</tr>
<tr>
<td>No</td>
<td>191 (65.6%)</td>
<td>473 (64.7%)</td>
<td></td>
</tr>
<tr>
<td>Unsure</td>
<td>6 (2.1%)</td>
<td>17 (2.3%)</td>
<td>0.87 (0.34-2.25)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combination of strength and frequency changes in the last 2 weeks (prioritised variable)*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased strength</td>
<td>53 (18.2%)</td>
<td>455 (62.1%)</td>
<td>0.18 (0.13-0.26)</td>
</tr>
<tr>
<td>Increased frequency but not strength</td>
<td>8 (2.8%)</td>
<td>22 (3.0%)</td>
<td>0.57 (0.25-1.32)</td>
</tr>
<tr>
<td>Decreased frequency</td>
<td>79 (27.2%)</td>
<td>36 (4.9%)</td>
<td>3.45 (2.20-5.43)</td>
</tr>
<tr>
<td>Unsure strength or frequency</td>
<td>22 (7.6%)</td>
<td>17 (2.3%)</td>
<td>2.04 (1.04-3.98)</td>
</tr>
<tr>
<td>Same</td>
<td>129 (44.3%)</td>
<td>203 (27.7%)</td>
<td>Reference: $\chi^2=205.34$, $p&lt;0.0001$</td>
</tr>
</tbody>
</table>

† $\chi^2$ and associated p-values are given for the overall effect of each variable.

*See Supplementary table 1 for detailed description of category’s included in prioritised variable categories.
**Table 2** - Univariable and multivariable odds of late stillbirth associated with perceptions of fetal movements

<table>
<thead>
<tr>
<th>Combination of strength and frequency changes in the last 2 weeks (prioritised variable)</th>
<th>Univariable Odds Ratio (95% Confidence Interval)</th>
<th>Multivariable* Odds Ratio (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased strength</td>
<td>0.18 (0.13-0.26)</td>
<td>0.14 (0.08-0.24)</td>
</tr>
<tr>
<td>Increased frequency but not strength</td>
<td>0.57 (0.25-1.32)</td>
<td>0.86 (0.30-2.52)</td>
</tr>
<tr>
<td>Decreased frequency</td>
<td>3.45 (2.20-5.43)</td>
<td>4.51 (2.38-8.55)</td>
</tr>
<tr>
<td>Unsure strength or frequency</td>
<td>2.04 (1.04-3.98)</td>
<td>2.02 (0.77-5.25)</td>
</tr>
<tr>
<td>Same</td>
<td>Reference</td>
<td>Reference: χ²=104.90, p&lt;0.0001</td>
</tr>
</tbody>
</table>

During the last 2 weeks did you notice **anytime** that your baby was **more vigorous** than usual

<table>
<thead>
<tr>
<th>No</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once</td>
<td>1.47 (0.94-2.31)</td>
</tr>
<tr>
<td>More than once</td>
<td>0.34 (0.25-0.47)</td>
</tr>
</tbody>
</table>

During the last 2 weeks, how often did you feel your baby having hiccups in the last two weeks

<table>
<thead>
<tr>
<th>Never</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsure if felt</td>
<td>0.73 (0.39-1.35)</td>
</tr>
<tr>
<td>Once</td>
<td>0.69 (0.37-1.27)</td>
</tr>
<tr>
<td>Occasionally</td>
<td>0.44 (0.32-0.62)</td>
</tr>
<tr>
<td>Daily</td>
<td>0.32 (0.21-0.48)</td>
</tr>
<tr>
<td>Unsure of frequency</td>
<td>0.37 (0.17-0.80)</td>
</tr>
</tbody>
</table>

Reference: χ²=5.95, p=0.007

*Controls for age, ethnicity, parity, education, marital status, smoking in pregnancy, customised birthweight centile, going-to-sleep position, sleep duration, got up to toilet in the night, naps in the daytime, gestation and study centre
Figure 1 - Flow diagram reporting the numbers of women eligible for the study, women who did not participate and those included in the final analysis.
**Supplementary Table 1 -** Prevalence and risk of stillbirth associated with the 16 possible combinations of change in strength and frequency of movement in the last 2 weeks

<table>
<thead>
<tr>
<th>Strength</th>
<th>Frequency</th>
<th>Stillbirths N=290 (missing=1)</th>
<th>Controls N=724 (missing=9)</th>
<th>Univariable OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase</td>
<td>Increase</td>
<td>29 (10.0%)</td>
<td>232 (32.0%)</td>
<td>0.18 (0.11, 0.28)</td>
</tr>
<tr>
<td>Increase</td>
<td>Decrease</td>
<td>7 (2.4%)</td>
<td>27 (3.7%)</td>
<td>0.37 (0.16, 0.88)</td>
</tr>
<tr>
<td>Increase</td>
<td>Same</td>
<td>16 (5.5%)</td>
<td>190 (26.2%)</td>
<td>0.12 (0.07, 0.21)</td>
</tr>
<tr>
<td>Increase</td>
<td>Unknown</td>
<td>1 (0.3%)</td>
<td>6 (0.8%)</td>
<td>0.24 (0.03, 2.01)</td>
</tr>
<tr>
<td>Decrease</td>
<td>Increase</td>
<td>1 (0.3%)</td>
<td>2 (0.3%)</td>
<td>0.72 (0.06, 7.97)</td>
</tr>
<tr>
<td>Same</td>
<td>Increase</td>
<td>5 (1.7%)</td>
<td>13 (1.8%)</td>
<td>0.55 (0.19, 1.58)</td>
</tr>
<tr>
<td>Unknown</td>
<td>Increase</td>
<td>2 (0.7%)</td>
<td>6 (0.8%)</td>
<td>0.48 (0.10, 2.40)</td>
</tr>
<tr>
<td>Decrease</td>
<td>Decrease</td>
<td>51 (17.5%)</td>
<td>23 (3.2%)</td>
<td>3.17 (1.84, 5.46)</td>
</tr>
<tr>
<td>Same</td>
<td>Decrease</td>
<td>22 (7.6%)</td>
<td>10 (1.4%)</td>
<td>3.15 (1.44, 6.88)</td>
</tr>
<tr>
<td>Unknown</td>
<td>Decrease</td>
<td>5 (1.7%)</td>
<td>3 (0.4%)</td>
<td>2.38 (0.56, 10.16)</td>
</tr>
<tr>
<td>Decrease</td>
<td>Unknown</td>
<td>2 (0.7%)</td>
<td>2 (0.3%)</td>
<td>1.43 (0.20, 10.29)</td>
</tr>
<tr>
<td>Same</td>
<td>Unknown</td>
<td>5 (1.7%)</td>
<td>2 (0.3%)</td>
<td>3.57 (0.68, 18.73)</td>
</tr>
<tr>
<td>Unknown</td>
<td>Same</td>
<td>8 (2.7%)</td>
<td>6 (0.8%)</td>
<td>1.91 (0.65, 5.63)</td>
</tr>
<tr>
<td>Unknown</td>
<td>Unknown</td>
<td>7 (2.4%)</td>
<td>7 (1.0%)</td>
<td>1.43 (0.49, 4.18)</td>
</tr>
<tr>
<td>Decrease</td>
<td>Same</td>
<td>8 (2.7%)</td>
<td>23 (3.2%)</td>
<td>0.50 (0.22, 1.15)</td>
</tr>
<tr>
<td>Same</td>
<td>Same</td>
<td>121 (41.6%)</td>
<td>172 (23.5%)</td>
<td>Reference</td>
</tr>
</tbody>
</table>
Maternal Interview

1. Study arm?
   - Case
   - Control

2. Hospital

3. Study Number:

4. Date of Interview:
   DD/MM/YYYY

5. Interviewer

6. Who else is present during the interview?
Inclusion Criteria

7. Cases: Is gestation greater than or equal to 28 weeks at the time of the stillbirth? (Not at time of birth)
   ○ Yes  ○ No

8. Cases: Did the stillbirth occur 1-6 weeks prior to the interview? (Not eligible if more than 6 weeks previously)
   ○ Yes  ○ No

9. Controls: Is the gestation within 2 weeks of the gestation specified at the time of interview (or at birth if already given birth)?
   ○ Yes  ○ No

10. Gestational age?
    
    | Weeks | Days |
    |-------|------|

11. Singleton pregnancy?
    ○ Yes  ○ No

12. Major fetal abnormality?
    ○ Yes  ○ No

13. Consent form signed?
    ○ Yes  ○ No

14. Fluent in English?
    ○ Yes  ○ No

If not fluent in English, was an interpreter used?

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Maternal Demographics

15. What is your date of birth?
   DD/MM/YYYY

16. Which country were you born in?

17. If not the United Kingdom: how many years have you lived in the UK?

   Years
   Months

18. If not the United Kingdom: what is your immigration status?

   UK National
   EEA National
   Discretionary leave to remain
   Indefinite leave to remain
   Study Visa
   Work Visa
   Husband/ Wife Sponsorship
   Asylum seeker awaiting decision
   Refugee
   Humanitarian Protection
   Declined to answer

19. How do you describe your ethnicity?

   White- British
   Irish
   Gypsy or Irish traveller
   Any other white background
   Black/ Black British
   African
   Caribbean
   Any other black background
   Asian/ Asian British
   Indian
   Pakistani
   Banladeshi
   Chinese
   Any other Asian background
   Multiple ethnic group
   White & Black Caribbean
   White & Black African
   White & Asian
   Any other multiple ethnic background
   Declined to answer
20. What is the postcode of your usual residential address? (At the time of the interview).

21. Which of the following best describes the place you live in? (Lived in most of the time during your pregnancy).

- Own house
- Private rental
- Council/ Housing Association rental
- Stay with family or friends
- No fixed address
- Other (please specify)

22. How many people usually live in your house? (The house you lived in during your pregnancy).

- Couples (including yourself)
- Children under 10 years
- Other adults and children over 10 years

23. How many bedrooms does your house have? (The house you lived in during your pregnancy).

Number of bedrooms

24. Do you feel your house is large enough for your family's needs? (The house you lived in during your pregnancy).

- Yes
- No

25. What is your highest educational qualification? (Please tick one answer only).

- None
- GCSE level (GCSE, O Level, Standards)
- A level (A, AS, S-level, Highers)
- Undergraduate (Diploma)
- Graduate (Degree, BSc, BA)
- Post-graduate (MSc, MA, PhD)
- Vocational education (NVQ, HNC, HND)
26. What was your work situation prior to this pregnancy? (Please tick one answer only).

- Full time work (over 30 hours per week)
- Part time work (includes casual work)
- Student
- Housewife
- Unemployed
- Long-term sickness benefit

Other (please specify)

27. What was your work situation in the last month? (before your baby died). (Please tick one answer only).

- Full time work (over 30 hours per week)
- Part time work (includes casual work)
- Student
- Housewife
- Unemployed
- Long-term sickness benefit
- Off-work due to pregnancy complications
- Maternity leave

Other (please specify)

28. If you are currently on maternity leave, how many weeks were you when you began your maternity leave?

Weeks

29. Do you or have you ever worked regular night shifts?

- Yes
- No

Please give details

30. Do you consider your work to be of a physical nature?

- Yes
- No

Please add details
31. What was your partner's (not necessarily father of your baby) work situation in the last month? (before your baby died) (Please tick one answer only).

- Full time work (over 30 hours per week)
- Part time work (includes casual work)
- Student
- Home maker
- Unemployed
- Long term sickness benefit
- Other/unknown/no partner

32. What is your combined household income?

- £<10,000
- £10,000-£14,999
- £15,000-£19,999
- £20,000-£24,999
- £25,000-£29,999
- £30,000-£39,999
- £40,000-£49,999
- £50,000-£59,999
- £60,000-£74,999
- £75,000+
### Relationships

33. What is your marital status? (Please tick one answer only).

- [ ] Single
- [ ] Married
- [ ] Cohabiting

34. How old is the father of your baby?
- [ ] Don’t know

35. How would he describe his ethnicity?

- [ ] Unknown
- [ ] White-British
- [ ] Irish
- [ ] Gypsy or Irish Traveller
- [ ] Any other white background
- [ ] Black/Black British
- [ ] African
- [ ] Caribbean
- [ ] Any other black background
- [ ] Asian/Asian British
- [ ] Indian
- [ ] Pakistani
- [ ] Bangladeshi
- [ ] Chinese
- [ ] Any other Asian background
- [ ] Multiple ethnic group
- [ ] White & Black Caribbean
- [ ] White & Black African
- [ ] White & Asian
- [ ] Any other multiple ethnic background
- [ ] Declined to answer

36. Is this your first pregnancy with this father?

- [ ] Yes
- [ ] No
37. How long had you had a relationship with the father of your baby when you conceived?

- Conceived on first episode of intercourse
- Less than 6 months
- 6-12 months
- More than 1 year
- Declined to answer

38. Are you related to the father of your baby? (Other than by marriage).

- Yes
- No

If yes what relation are you to each other?

[Blank space]
### General Health and Past History

39. **Did you have any medical conditions before the start of your pregnancy? (Please tick all relevant answers).**

- [ ] None
- [ ] Anaemia (prior to booking Hb<10g/L)
- [ ] Asthma
- [ ] Cervical surgery
- [ ] Depression
- [ ] Diabetes type 1 - Insulin dependent
- [ ] Diabetes type 2
- [ ] Epilepsy
- [ ] Heart condition - congenital
- [ ] Heart condition - rheumatic
- [ ] Hypertension - Essential
- [ ] Hyperthyroid
- [ ] Hypothyroid
- [ ] Inflammatory bowel disease (Crohn's disease or ulcerative colitis)
- [ ] Polycystic ovarian syndrome
- [ ] Psychiatric disorder (other than depression)
- [ ] Renal disease
- [ ] Sickle cell disease
- [ ] Systemic lupus erythematosus
- [ ] Thalassaemia
- [ ] Thrombophilia
- [ ] Urinary tract infections (recurrent)
- [ ] Uterine abnormality
- [ ] Uterine surgery
- [ ] Venous thromboembolism
- [ ] Other medical condition

**Other medical condition**

---

40. **Did you have fertility treatment to get pregnant with your baby?**

- [ ] Yes
- [ ] No
41. If yes, what was the treatment? (Please tick one answer only).
- [ ] Artificial insemination
- [ ] Ovulation induction
- [ ] IVF
- [ ] GIFT
- [ ] ICSI
- [ ] Other (please specify)

42. Have you ever been pregnant before?
- [ ] Yes
- [ ] No
### Pregnancy History

**43. If yes how many pregnancies were:**

- Miscarriages or ectopic pregnancies in the first 12 weeks of pregnancy
- Miscarriages or ectopic pregnancies between 13 and 24 weeks of pregnancy
- Surgical termination of pregnancy below 14 weeks
- Medical termination of pregnancy below 14 weeks
- Surgical termination of pregnancy between 15 and 24 weeks of pregnancy
- Medical termination of pregnancy between 15 and 24 weeks of pregnancy
- Termination of pregnancy after 24 weeks

**44. How many other pregnancies have you had?**

**45. If yes, can you tell me about your other pregnancies and births?**

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>Gestation</th>
<th>Birth weight (in grams)</th>
<th>Mode of delivery</th>
<th>Outcome (LB/SB/NND)</th>
<th>Were there any complications?</th>
</tr>
</thead>
</table>

**46. If yes, can you tell me about your other pregnancies and births?**

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>Gestation</th>
<th>Birth weight (in grams)</th>
<th>Mode of delivery</th>
<th>Outcome (LB/SB/NND)</th>
<th>Were there any complications?</th>
</tr>
</thead>
</table>
47. If yes, can you tell me about your other pregnancies and births?

<table>
<thead>
<tr>
<th>Year of birth</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth weight (in grams)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mode of delivery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome (LB/SB/NND)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Were there any complications?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

48. If yes, can you tell me about your other pregnancies and births?

<table>
<thead>
<tr>
<th>Year of birth</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth weight (in grams)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mode of delivery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome (LB/SB/NND)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Were there any complications?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

49. If yes, can you tell me about your other pregnancies and births?

<table>
<thead>
<tr>
<th>Year of birth</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth weight (in grams)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mode of delivery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome (LB/SB/NND)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Were there any complications?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

50. If yes, can you tell me about your other pregnancies and births?

<table>
<thead>
<tr>
<th>Year of birth</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth weight (in grams)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mode of delivery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome (LB/SB/NND)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Were there any complications?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Antenatal care in this pregnancy

51. How many weeks pregnant were you when you first saw a health professional about this pregnancy?

<table>
<thead>
<tr>
<th>Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

52. Who did you first see? (Please tick one answer only).

- GP
- Midwife
- Infertility specialist
- Hospital obstetrician
- Family planning clinic
- Pharmacist
- Nurse
- Private obstetrician

Other (please specify)

53. Did you have morning sickness during this pregnancy?

- Yes
- No

54. If yes, were you admitted to hospital due to your vomiting?

- Yes
- No

If yes, how many times?

55. Did you have any of these common illnesses/problems during your pregnancy? (Please tick all relevant answers).

<table>
<thead>
<tr>
<th>Anytime during your pregnancy</th>
<th>In the last two weeks of your pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>High fever</td>
<td></td>
</tr>
<tr>
<td>If high fever, was it confirmed to be higher than 38°C by thermometer</td>
<td></td>
</tr>
<tr>
<td>Runny nose/sore throat/swollen glands</td>
<td></td>
</tr>
<tr>
<td>Cough with phlegm</td>
<td></td>
</tr>
<tr>
<td>Diarrhoea and/or vomiting</td>
<td></td>
</tr>
<tr>
<td>Frequent urge to urinate and/or pain on urinating</td>
<td></td>
</tr>
</tbody>
</table>

56. Were you unwell in any other way in the last 2 weeks of your pregnancy?

- Yes
- No

If yes, please describe
57. Did you have any vaginal bleeding in your pregnancy? (Please tick one answer only).

- No bleeding
- Single episode <20 weeks gestation
- Recurrent bleeds <20 weeks gestation
- Single episode >20 weeks gestation
- Recurrent bleeds >20 weeks gestation
- Recurrent bleeds throughout
- Unsure

58. During your pregnancy, did you take any antibiotics?

- Yes
- No
- Unsure

If yes, what antibiotics and what did you have them for?

59. How many weeks pregnant were you when you took the antibiotics? (If more than one course of antibiotics, record gestation of the most recent course).

Weeks
**Personal Habits**

60. Do you currently smoke? (Please tick one answer only)

- Yes
- No, stopped in pregnancy
- No, stopped prior to pregnancy
- No, never smoked

61. If yes, what do you smoke and what is the average amount per day?

<table>
<thead>
<tr>
<th>Smoke cigarettes</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoke roll ups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoke cannabis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chew tobacco</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use shisha</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Average amount per day

62. If you smoked at any time during pregnancy, how much a day on average did you smoke?

Amount per day

63. If you stopped smoking during pregnancy, how many weeks pregnant were you when you stopped?

Weeks

64. Did you use any nicotine-replacement products during pregnancy?

- Electronic cigarettes
- Nicotine microtabs
- Nicotine gum
- Nicotine nasal spray
- Nicotine inhalators
- Nicotine patches
- Nicotine lozenges
- Other (please specify)

65. Have you changed your smoking habits during your pregnancy?

- Yes
- No

If so, what have you changed?
66. If you have stopped or reduced smoking during pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

- [ ] Midwife
- [ ] GP
- [ ] Hospital doctor
- [ ] Friend/relative
- [ ] Internet
- [ ] Magazine
- [ ] Pregnancy book
- [ ] TV

Please add details: __________________________

67. Does your partner smoke?

- [ ] Yes
- [ ] No
- [ ] No partner

68. Does anyone else living in your house smoke?

- [ ] Yes
- [ ] No
- [ ] No partner

69. On average, how many standard alcoholic drinks (if any) do you have each week during your pregnancy?

- [ ] < 1 std drink/wk
- [ ] 1-2 std drinks/wk
- [ ] 3-4 std drinks/wk
- [ ] ≥5 std drinks/wk

In the first 3 months of your pregnancy:

- [ ] < 1 std drink/wk
- [ ] 1-2 std drinks/wk
- [ ] 3-4 std drinks/wk
- [ ] ≥5 std drinks/wk

In the last month of your pregnancy:

- [ ] < 1 std drink/wk
- [ ] 1-2 std drinks/wk
- [ ] 3-4 std drinks/wk
- [ ] ≥5 std drinks/wk

70. What was the highest number of standard alcoholic drinks that you had on any one occasion during your pregnancy? (Please tick one answer only).

- [ ] None
- [ ] 1 to 2
- [ ] 3 to 4
- [ ] 5 to 10
- [ ] greater than 10

71. How many weeks pregnant were you when you had the most drinks?

- Weeks: __________________________
- Not Known: __________________________

72. Have you changed your drinking habits during your pregnancy?

- [ ] Yes
- [ ] No

If so, what have you changed?

______________________________
73. If you have changed your alcohol intake during pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

- [ ] Midwife
- [ ] GP
- [ ] Hospital doctor
- [ ] Friend/relative
- [ ] Internet
- [ ] Magazine
- [ ] Pregnancy book
- [ ] TV

Please add details

74. Have you taken any street drugs during pregnancy?

- [ ] Yes
- [ ] No

75. If yes, have you used any of the following, if so when?

<table>
<thead>
<tr>
<th>Drug</th>
<th>In the first 3 months of pregnancy</th>
<th>In the last month of pregnancy</th>
<th>In the last week of pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphetamine</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Amyl Nitrites</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Cannabis</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Cocaine</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Ecstasy</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Gas</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Glue</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Heroin</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Ketamine</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Magic Mushrooms</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Methadone</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Tranquilisers</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

Other (please specify)

76. If yes, how often did you use these drugs?

- [ ] Daily use
- [ ] Weekly use
- [ ] Occasional use
- [ ] Once only

Other (please specify)
77. Have you changed your drug habits during your pregnancy?

☐ Yes  ☐ No

If so, what have you changed?

78. If you have changed your drug use during pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

☐ Midwife
☐ GP
☐ Hospital doctor
☐ Friend/relative
☐ Internet
☐ Magazine
☐ Pregnancy book
☐ TV

Please add details

79. Have you taken any prescribed medication during your pregnancy?

☐ Yes  ☐ No

80. If yes, please list all the prescribed medication you have taken during your pregnancy?

81. Have you taken any vitamins? If so, which ones.

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Prior to pregnancy</th>
<th>During the first 3 months of pregnancy</th>
<th>During the last month of pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Folic Acid 400mcg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Folic Acid 5mg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron supplement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-vitamin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-vitamin for pregnant women</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Omega-3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin D 10mcg</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comment

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
### Perceived Stress Scale

#### 82. The questions in this scale ask you about your feelings and thoughts during the LAST MONTH (before your baby died).

<table>
<thead>
<tr>
<th>Question</th>
<th>Never 0</th>
<th>Almost Never 1</th>
<th>Sometimes 2</th>
<th>Fairly Often 3</th>
<th>Very Often 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How often have you been upset because of something that happened unexpectedly?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. How often have you felt that you were unable to control the important things in your life?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. How often have you felt nervous and &quot;stressed&quot;?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. How often have you felt confident about your ability to handle your personal problems?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. How often have you felt that things were going your way?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. How often have you found that you could not cope with all the things that you had to do?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. How often have you been able to control irritations in your life?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. How often have you felt that you were on top of things?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. How often have you been angered because of things that were outside your control?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. How often have you felt difficulties were piling up so high that you could not overcome them?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other (please specify)
### Diet

**83. On average, how often did you eat the following foods in the month before you were pregnant and during the last 4 weeks (before your baby died)?**

<table>
<thead>
<tr>
<th>Food Description</th>
<th>Pre pregnancy</th>
<th>Within the last 4 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice and pasta (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White bread (1 slice)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wholemeal bread (1 slice)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crisps (1 bag)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processed meat (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salad vegetables (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green vegetables (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other vegetables (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetable dishes/ foods (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soft drinks (1 glass)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diet soft drinks (1 glass)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chips (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full fat spread (for 1 slice of bread)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**84. Please write how many per day.**

- Total teaspoons of sugar added each day to cereals, tea, coffee etc (tsp)
- Full-fat milk on average consumed per day in drinks, cereals etc (pints)
- Semi-skimmed milk on average consumed per day in drinks, cereals etc (pints)
- Skimmed milk on average consumed per day in drinks, cereals etc (pints)
85. How many cups (190mls) of coffee/tea do you drink per day?

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of servings/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instant coffee</td>
<td></td>
</tr>
<tr>
<td>Brewed coffee (filter/percolated)</td>
<td></td>
</tr>
<tr>
<td>Decaffeinated coffee (brewed/instant)</td>
<td></td>
</tr>
<tr>
<td>Tea</td>
<td></td>
</tr>
<tr>
<td>Chai tea</td>
<td></td>
</tr>
<tr>
<td>Green tea</td>
<td></td>
</tr>
<tr>
<td>Drinking chocolate</td>
<td></td>
</tr>
<tr>
<td>Energy drinks/250ml serving</td>
<td></td>
</tr>
<tr>
<td>Cola (regular/diet)/330ml serving</td>
<td></td>
</tr>
<tr>
<td>Chocolate/50g bar</td>
<td></td>
</tr>
</tbody>
</table>

86. Have you changed any aspects of your diet or caffeine intake during your pregnancy?

- Yes
- No

If so, what have you changed?

87. If you have changed your diet or caffeine intake during pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

- [ ] Midwife
- [ ] GP
- [ ] Hospital doctor
- [ ] Friend/relative
- [ ] Internet
- [ ] Magazine
- [ ] Pregnancy book
- [ ] TV

Please add details
Sleep Practices

If the main period of sleep is in the day (such as for shift workers) then use the day time for the following questions.

88. On average how many hours actual sleep did you usually get at night? (Hours).
   Before pregnancy
   In the last four weeks(*) before your baby died
   In the last week*
   Last night*

89. What size bed did you sleep in last night? (the last night before your baby died).
   (Please tick one answer only).
   - Small single
   - Single
   - Small double
   - Double
   - King size
   - Superking
   - Other - didn't sleep in bed (specify)

90. Did anyone else sleep in the same bed as you last night? (The last night before your baby died).
   - Yes, partner
   - No
   - Yes, other
   - Other (please specify)

91. What side of the bed do you usually sleep on?
   - Left
   - Middle
   - Right
   - Unsure
92. Which side of the bed did you sleep in last night? (The last night before your baby died).

- Left
- Middle
- Right
- Unsure

93. How many pillows did you usually use at night in the last few weeks? (Before your baby died).

No. of pillows

94. What position did you usually fall asleep in? (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Left side</th>
<th>Back</th>
<th>Right side</th>
<th>Tummy</th>
<th>Variable</th>
<th>Propped up</th>
<th>Don’t remember</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last night (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

95. What position did you usually wake up in? (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Left side</th>
<th>Back</th>
<th>Right side</th>
<th>Tummy</th>
<th>Variable</th>
<th>Propped up</th>
<th>Don’t remember</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last night (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

96. Did you change sleep position during the night? (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Possibly once</th>
<th>Possibly twice</th>
<th>More than twice but not lots</th>
<th>Lots of times</th>
<th>Don’t remember</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>In the last 4 weeks (before your baby died)</td>
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<tr>
<td>Last night (before your baby died)</td>
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</tr>
</tbody>
</table>

97. Would you describe yourself as a restless sleeper (i.e move a lot during the night)? (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Not at all</th>
<th>A little</th>
<th>Average</th>
<th>More than average</th>
<th>Very restless</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last night (before your baby died)</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

98. Have you EVER been told that you snore, or are you aware that you snore?

- Yes
- No
99. If you have been told you snore, or you have woken yourself up snoring, how often has this happened? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During the last 4 weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(the 4 weeks before your</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>baby died)</td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

100. Did you snore last night? (The last night before your baby died).

- Yes
- No
- Don't know

101. Has your snoring ever bothered other people?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>baby died)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

102. Did your snoring bother anyone last night? (The last night before your baby died).

- Yes
- No
- Don't know

103. How loud is your snoring reported to be? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Slightly louder than breathing</th>
<th>As loud as talking</th>
<th>Very loud, can be heard in adjacent rooms</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last 4 weeks (before your</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

104. Have you been told you briefly stop breathing when you are asleep? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Every night</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 weeks ago (before your</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

105. Were you told you briefly stopped breathing when asleep last night? (The night before your baby died).

- Yes
- No

106. Have you been told that you cough or choke during sleep? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Every night</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 weeks ago (before your</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
107. Were you told you coughed or choked last night? (The last night before your baby died).
   - Yes
   - No

108. Do your legs twitch or jerk often while you sleep? (Do not count the sudden jerk that sometimes occurs as you fall asleep). (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

109. Did your legs twitch or jerk often while you slept last night? (The last night before your baby died).
   - Yes
   - No
   - Don't know

110. Did you take medication for sleep? (Prescribed medication NOT herbal remedies). (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 weeks ago (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

111. Did you take medication for sleep last night? (The night before your baby died).
   - Yes
   - No

112. How would you rate your sleep quality overall? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Very good</th>
<th>Fairly good</th>
<th>Average</th>
<th>Fairly bad</th>
<th>Very bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

113. How often do you feel tired or fatigued AFTER your night’s sleep? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>Last 4 weeks (before your baby died)</td>
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<td></td>
</tr>
</tbody>
</table>

114. During your WAKE TIME do you feel tired, fatigued or not up to par? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every night</th>
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<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Last 4 weeks (before your baby died)</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
115. BEFORE YOUR PREGNANCY how likely were you to doze off or fall asleep in the following situations, in contrast to just feeling tired? (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Activity</th>
<th>Would never doze</th>
<th>Slight chance of dozing</th>
<th>Moderate chance of dozing</th>
<th>High chance of dozing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting and reading</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watching TV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting inactive in a public place (eg cinema, meeting)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As a passenger in a car for an hour without a break</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lying or sitting down to rest in the afternoon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting and talking to someone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting quietly after lunch without alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In a car, while stopped for a few minutes in the traffic</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

116. IN THE LAST 4 WEEKS (of pregnancy) how likely were you to doze off or fall asleep in the following situations, in contrast to just feeling tired?

Even if you have not done some of these things recently try and work out how they would have affected you.

(Please tick one answer per line).

<table>
<thead>
<tr>
<th>Activity</th>
<th>Would never doze</th>
<th>Slight chance of dozing</th>
<th>Moderate chance of dozing</th>
<th>High chance of dozing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting and reading</td>
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<td></td>
<td></td>
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<td>Watching TV</td>
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<td>As a passenger in a car for an hour without a break</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lying or sitting down to rest in the afternoon</td>
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</tr>
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<td>Sitting and talking to someone</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In a car, while stopped for a few minutes in the traffic</td>
<td></td>
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</tr>
</tbody>
</table>

117. On average how many times would you take a nap during the day? (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Never</th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every day</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
118. Have you changed your sleeping habits during your pregnancy?

- Yes
- No

If so, what have you changed?

119. If you have changed your sleeping habits during your pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

- Midwife
- GP
- Hospital doctor
- Friend/relative
- Internet
- Magazine
- Pregnancy book
- TV

Please add details
Fetal Movements

120. Did anyone give you information about fetal movements during your pregnancy?

- No information was given
- Verbal information
- Written information
- Other (please specify)

121. Was there anytime from 26 weeks of pregnancy that your baby’s movements were less than usual?

- Yes
- No
122. If yes, on how many occasions?

- 1
- 2
- 3
- 4 or more

123. If yes, did you speak to a health professional for advice?

- Yes
- No

If did not speak to a health professional, why was that?

124. If yes, did you attend hospital?

- Yes
- No

If you did not attend hospital, why was that?

125. If you did attend hospital, what did they do?

126. In the last 2 weeks did the strength of your baby's movements: (The two weeks before your baby died) (Please tick one answer only).

- Increase
- Decrease
- Stay the same
- Unsure

127. In the last 2 weeks did the frequency of your baby's movements: (The two weeks before your baby died) (Please tick one answer only).

- Increase
- Decrease
- Stay the same
- Unsure

128. During the last 2 weeks, did you notice anytime that your baby was more vigorous than usual? (The two weeks before your baby died).

- Yes
- No

129. If yes, how many times?

- Once
- More than once
130. During the last 2 weeks, did you feel your baby having hiccups? (The two weeks before your baby died).

- Yes
- No
- Unsure

131. If yes, how often?

- Once
- Occasionally
- Daily
- Unsure

132. During the last 2 weeks, did you feel uterine contractions (tightenings/ pre-labour contractions/ Braxton Hicks contractions/ false labour) for longer than an hour? (The two weeks before your baby died).

- Yes
- No
- Unsure
### Injury

133. Did you experience any physical injury at any time during your pregnancy? (Please tick all relevant boxes).

- [ ] No injury
- [ ] Slips and falls
- [ ] Road traffic accident
- [ ] Blow to abdomen
- [ ] Self-harm
- [ ] Other non-accidental injury
- [ ] Other accidental injury

134. If yes, please describe the physical injury.

[ ]

135. If yes, was this during the last two weeks of your pregnancy?

- [ ] Yes
- [ ] No

136. Did you see a health professional about your injury?

- [ ] Yes
- [ ] No
These questions must be asked only if the woman is on her own

Family Violence

137. Family violence questions not asked as woman was not on her own?
   ○ Yes

138. Family violence questions not asked for other reason (specify)

139. Woman declined to answer family violence questions?
   ○ Yes

140. In the past year have you been hurt or frightened by someone close to you?
   ○ Yes  ○ No

141. In the past year have you felt controlled or always criticized in your relationship?
   ○ Yes  ○ No

142. In the past year have you been made to do anything sexual that you did not want to do?
   ○ Yes  ○ No

143. Who in your family controls the money?
   ○ You  ○ Joint- you and your partner
   ○ Your partner  ○ Other family member

144. If disclosure of domestic abuse made, have you followed your local protocol.
   ○ Yes
Finally I would like to ask you some questions about when your baby died.

145. What was the first reason that you thought something was wrong with your pregnancy or that your baby was dying/ had died? (Please tick one answer only).

- I felt a reduction of kicks/ movements
- I felt kicks/ movements stop
- I felt abdominal pain
- I had vaginal bleeding/ haemorrhage
- I had discharge of amniotic fluid/ the membranes ruptured/ my waters had broken
- I had a “feeling that something was wrong”, but cannot specify
- I had a trauma (involved in a physical accident)
- I had other symptoms (specify below if possible)
- I was told at an antenatal appointment
- I was told when I was admitted in labour
- I was told during labour
- It was not discovered before my baby was born
- I do not remember/ know

Other (please specify)

146. When do you think your baby died?

DD/MM/YYYY

I do not know when my baby died

147. What time of day do you think your baby died? (Please tick one answer only).

- During the night
- During a daytime nap
- In the morning
- In the afternoon
- In the evening
- Not sure
148. What was the reason you saw a health practitioner at the time that your baby was found to have died? (Please tick one answer only).
- Routine scheduled pregnancy visit
- Routine scan
- Decreased baby movements
- In labour
- In hospital
- Vaginal bleeding
- Rupture of membranes
- Unwell
- Not recorded/unknown

Other (please specify)

149. Were you asked if you would like a post-mortem for your baby?
- Yes
- No

150. If yes, did you choose to have a post-mortem?
- Yes
- No

151. If no, what was the main reason you decided against a post-mortem? (Please tick one answer only).
- We already knew why baby had died
- It would not bring baby back
- Did not want baby to be taken away
- Did not want baby to be cut
- Wanted to bury baby as quickly as possible

Other (please specify)

152. Would you make the same decision about the post-mortem now?
- Yes
- No

153. Is there anything else that you think might be important you would like to tell us about your pregnancy?
Thank you very much for your time and thoughts.

154. How did you feel about being involved in this study?

155. Is there anything else that you would like to add (Anything that you feel was significant, but was not discussed)?
Clinical Data Collection

This data is to be collected FROM THE ANTENATAL RECORD.

Current pregnancy

156. Study Number: 

157. Date: DD/MM/YYYY

158. EDD by LMP: 
- DD/MM/YYYY
- EDD not known

159. EDD by USS: 
- DD/MM/YYYY
- USS not done

160. Gestation by first USS: 
Weeks
Days

161. Best agreed EDD:

162. Height recorded in notes: 
- Cms
- Not recorded

Cms
163. First weight in pregnancy:

- [ ] Kgs
- [ ] Not recorded

Kgs
164. Body Mass Index at booking

165. Gestation at first weight:

Weeks

166. Last weight:

- Kgs
- Not recorded

Kgs

167. Gestation at last weight:

- Weeks
- N/A

Weeks

168. Date of first visit with health care professional:

DD-MM-YYYY

169. Estimated gestational age at first visit with health care professional:

Weeks

Days

170. Initial type of maternity care? (Please tick one answer only).

- Midwifery-led care
- Consultant-led care
- Shared care (between consultant and midwife)
- Private Obstetrician
- Private Midwife

Other (please specify)

171. Referal to obstetric/ medical specialist?

- Yes
- No
172. If yes: (Please tick one answer only).

- Pre-existing condition
- Complication of pregnancy
- Maternal request
- Other (please specify)

173. Transfer of care during pregnancy? (e.g. from midwifery-led care to consultant-led care).

  - Yes
  - No

174. Booked place of birth? (Please tick one answer only).

  - Tertiary hospital
  - Secondary hospital
  - Primary birthing unit
  - Home
  - Other (please specify)

175. Number of antenatal visits in 1st trimester (0-12 weeks)? (From antenatal records).

  No.

176. Number of antenatal visits in 2nd trimester (13-28 weeks)? (From antenatal records).

  No.

177. Number of antenatal visits in 3rd trimester (29-42 weeks)? (From antenatal records).

  Number

178. If no antenatal records available, please give details.

179. Ultrasound this pregnancy? (Please tick all relevant answers).

- First trimester
- Anomaly scan 18-22 weeks
- Doppler studies
- Growth scan
- None
180. Medical conditions in pregnancy? (Please tick all relevant answers).

- None
- Anaemia
- Asthma
- Cervix surgery
- Depression
- Diabetes - before pregnancy
- Epilepsy
- Essential hypertension
- Gestational diabetes - developed during pregnancy
- Heart condition- congenital
- Heart condition- rheumatic
- Hypertension / Pre-eclampsia
- Hyperthyroid
- Hypothyroid
- Inflammatory bowel
- Laparotomy
- Other autoimmune
- Renal disease
- Rheumatic heart
- Major psychiatric disorder (Other than depression)
- Sickle cell crisis
- Systemic lupus erythematosus
- Thalassaemia trait
- Urinary tract infection
- Uterine abnormality
- Venous thromboembolism

Other (please specify)

181. Blood pressure at booking?

<table>
<thead>
<tr>
<th>Systolic</th>
<th>Diastolic</th>
</tr>
</thead>
</table>

182. Last blood pressure prior to interview (controls) or when baby was last known to be alive (cases)?

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Days</th>
</tr>
</thead>
</table>
183. Was a customized growth chart used?  
- Yes  
- No  
- Don't know

184. Was fetal growth restriction clinically suspected?  
- Yes  
- No

185. If yes, gestation first suspected?  
<table>
<thead>
<tr>
<th>Weeks</th>
<th>Days</th>
</tr>
</thead>
</table>

186. If yes, were growth scan(s) done?  
- Yes  
- No

187. Was there evidence on the growth scan of fetal growth restriction?  
- Yes AC < 10%  
- Yes EFW < 10%  
- No

188. If yes, what was the management? (Please tick all relevant answers).  
- No change  
- Increased antenatal visits  
- Serial cardiotocography (CTG's)  
- Ultrasound scan  
- Doppler's  
- Admitted  
- Delivered  
- Other (please specify) 

189. Admitted with threatened preterm labour in this pregnancy?  
- Yes  
- No  
- Don't know
### 190. Blood group?
- [ ] A Pos
- [ ] B Pos
- [ ] AB Pos
- [ ] O Pos
- [ ] A Neg
- [ ] B Neg
- [ ] AB Neg
- [ ] O Neg
- [ ] Not known

### 191. Hep B status?
- [ ] Positive
- [ ] Negative
- [ ] Not known

If not know

### 192. HIV status?
- [ ] Positive
- [ ] Negative
- [ ] Not known

If not known

### 193. HbA1c performed?
- [ ] Yes
- [ ] No

### 194. If yes:

**Result**

**Gestation**

### 195. GTT performed?
- [ ] Yes
- [ ] No

### 196. If yes:

**Fasting**

**Gestation**

**1 hour**

**2 hour**

**Fasting**

**Gestation**

**1 hour**

**2 hour**
197. Baby’s date of birth?

DD/MM/YYYY

198. Place of birth?

- Tertiary/ secondary hospital
- Birthing unit
- Home
- Other (please specify)

199. Birth weight in grams?

Grams

200. Gestation at birth (for controls) or at DIAGNOSIS of stillbirth (for cases):

- Weeks
- Days

201. Sex of baby?

- Male
- Female

202. Examination of the cord? (Please tick all relevent answers).

- Normal
- Tight knot/ occluded
- Loose knot
- Cord round neck tightly
- Cord round neck loosely
- Cord round limbs/ body tightly
- Cord round limbs/ body loosely
- Torsion or spring like cord
- Marginal/ velamentous insertion
- Hypocoiled
- Thin cord
- Meconium stained
- Tear
- 2 vessels
- Other (please specify)
203. Placenta? (Please tick all relevant answers).

- [ ] Normal
- [ ] Retroplacental clot
- [ ] Gritty/ calcified
- [ ] Vasa praevia
- [ ] Offensive odour
- [ ] Succenturiate lobe
- [ ] Extrachorial/ Circumvallate
- [ ] Bilobate/ Bilpartite placenta
- [ ] Placenta accreta
- [ ] Not examined

Other (please specify)

204. Placental weight in grams?

Grams: [ ]

Placenta not weighed: [ ]

205. If placenta was weighed, was it trimmed weight or full weight?

- [ ] Trimmed weight
- [ ] Full weight
- [ ] Unsure
Details of Stillbirth (Cases only)

206. Date of diagnosis of fetal death?

DD/ MM/ YYYY

207. Date of last consult prior to death where fetus confirmed alive?

DD/ MM/ YYYY

208. New findings at last consult prior to diagnosis of fetal death? (Please tick all relevant answers).

☐ No new findings
☐ SGA
☐ LGA
☐ Hypertension
☐ Oligohydramnios
☐ Polyhydramnios
☐ APH
☐ Diabetes
☐ Decreased fetal movements
☐ Urinary tract infection
☐ Other (please specify)

209. When did death occur?

☐ Antepartum
☐ Intrapartum
☐ Unknown whether antepartum/ intrapartum

210. Post-mortem?

☐ Yes
☐ No

211. If yes, where was it done? (Attach copy of results if available).

212. Placental pathology?

☐ Yes
☐ No
213. If yes, where was it done? (Attach copy of results if available).
### Appendix 1 (amendment 22.07.14)

214. During the night how often do you have to get up to use the toilet?

<table>
<thead>
<tr>
<th>Question</th>
<th>Before you were pregnant?</th>
<th>The last four weeks (before your baby died)?</th>
<th>The last week of your pregnancy?</th>
<th>Last night (the night before your baby died)?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

215. Since you became pregnant did your level of physical exercise:

- Stay the same
- Become less
- Become more

216. How often have you engaged in vigorous exercise in the last month (the month before your baby died)? Exercise which made you breathe harder or puff or pant, such as tennis, jogging, aerobics, heavy gardening, cycling?

- Never
- Once a week
- 2-3 times a week
- 4-6 times a week
- Daily
- More than once a day

217. If you have engaged in vigorous exercise, on average how long did your exercise last for (in minutes)?

<table>
<thead>
<tr>
<th>Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

218. What type of vigorous exercise have you done?

- Jogging
- Tennis
- Cycling
- Gym class- aerobics
- Spinning
- Weight training- gym
- Swimming
- Other (please specify)
219. How often have you engaged in less vigorous exercise for recreation, sport or health fitness purposes in the last month (the month before your baby died) which did not make you breathe harder or puff or pant?

- Never
- Once a week
- 2-3 times a week
- 4-6 times a week
- Daily
- More than once a day

220. If you did engage in less vigorous exercise, what type of exercise have you done?

[Blank Space]

221. From the anomaly scan, please record placental position.

- Anterior- high
- Anterior- low
- Posterior- high
- Posterior- low
- Fundal
- Lateral
- Low lying

Other (please specify):

[Blank Space]
## STROBE Statement—Checklist of items that should be included in reports of case-control studies

<table>
<thead>
<tr>
<th>Item No</th>
<th>Item</th>
<th>Recommendation</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Title and abstract</td>
<td>(a) Indicate the study’s design with a commonly used term in the title or the abstract</td>
<td>Page 1 Lines 1-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Provide in the abstract an informative and balanced summary of what was done and what was found</td>
<td>Page 2-3 Lines 25-49</td>
</tr>
<tr>
<td>2</td>
<td>Introduction</td>
<td>Explain the scientific background and rationale for the investigation being reported</td>
<td>Page 4-5 Lines 72-94</td>
</tr>
<tr>
<td>3</td>
<td>Objectives</td>
<td>State specific objectives, including any prespecified hypotheses</td>
<td>Page 4-5 Lines 94-96</td>
</tr>
<tr>
<td>4</td>
<td>Methods</td>
<td>Present key elements of study design early in the paper</td>
<td>Page 4-5 Lines 93-108</td>
</tr>
<tr>
<td>5</td>
<td>Setting</td>
<td>Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection</td>
<td>Page 5 Lines 98-102 and Ref #13</td>
</tr>
<tr>
<td>6</td>
<td>Participants</td>
<td>(a) Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls</td>
<td>Page 5 Lines 102-109 and Ref #14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) For matched studies, give matching criteria and the number of controls per case</td>
<td>N/A</td>
</tr>
<tr>
<td>7</td>
<td>Variables</td>
<td>Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable</td>
<td>Page 5 Lines 110-117</td>
</tr>
<tr>
<td>8</td>
<td>Data sources/ measurement</td>
<td>For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group</td>
<td>Page 5 Lines 110-117 and Page 6 129-137 (Derivation of FM variable)</td>
</tr>
<tr>
<td>9</td>
<td>Bias</td>
<td>Describe any efforts to address potential sources of bias</td>
<td>Page 7 Lines 143-149 and Page 10-11 Lines 229-244</td>
</tr>
<tr>
<td>10</td>
<td>Study size</td>
<td>Explain how the study size was arrived at</td>
<td>In Ref #14</td>
</tr>
<tr>
<td>11</td>
<td>Quantitative variables</td>
<td>Explain how quantitative variables were handled in the analyses. If not, state</td>
<td>N/A</td>
</tr>
</tbody>
</table>
For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

applicable, describe which groupings were chosen and why

<table>
<thead>
<tr>
<th>Statistical methods</th>
<th>12</th>
<th>(a) Describe all statistical methods, including those used to control for confounding</th>
<th>Page 6-7 Lines 120–150</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(b) Describe any methods used to examine subgroups and interactions</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) Explain how missing data were addressed</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(d) If applicable, explain how matching of cases and controls was addressed</td>
<td>N/A</td>
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<tr>
<td></td>
<td></td>
<td>(e) Describe any sensitivity analyses</td>
<td>N/A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Results</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>13*</td>
<td>(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed</td>
<td>Page 7 Lines 152–158, Figure 1 and Ref #14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Give reasons for non-participation at each stage</td>
<td>See above</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) Consider use of a flow diagram</td>
<td>Figure 1</td>
</tr>
<tr>
<td>Descriptive data</td>
<td>14*</td>
<td>(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders</td>
<td>Page 7-8 Lines 159-172 &amp; Table 1 in Ref #14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Indicate number of participants with missing data for each variable of interest</td>
<td>Table 1</td>
</tr>
<tr>
<td>Outcome data</td>
<td>15*</td>
<td>Report numbers in each exposure category, or summary measures of exposure</td>
<td>Page 7 Lines 156–157</td>
</tr>
<tr>
<td>Main results</td>
<td>16</td>
<td>(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included</td>
<td>Tables 1 and 2 Pages 8-9 Lines 174-202</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Report category boundaries when continuous variables were categorized</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period</td>
<td>N/A</td>
</tr>
<tr>
<td>Other analyses</td>
<td>17</td>
<td>Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses</td>
<td>N/A</td>
</tr>
</tbody>
</table>

<p>| Discussion          |    |                                                                                  |                        |
| Key results         | 18 | Summarise key results with reference to study objectives                         | Page 9 Lines 209–215   |
| Limitations         | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | Page 10 Lines 217–250  |
| Interpretation      | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other | Page 11 Lines 252-      |</p>
<table>
<thead>
<tr>
<th>Other information</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Funding</td>
<td>22</td>
</tr>
</tbody>
</table>
*Give information separately for cases and controls.*

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobeanimated.org.
Alterations in maternally-perceived fetal movement and their association with late stillbirth – findings from the Midland and North of England Stillbirth Case-Control Study

<table>
<thead>
<tr>
<th>Journal:</th>
<th>BMJ Open</th>
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<tbody>
<tr>
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<td>bmjopen-2017-020031.R2</td>
</tr>
<tr>
<td>Article Type:</td>
<td>Research</td>
</tr>
<tr>
<td>Date Submitted by the Author:</td>
<td>06-Apr-2018</td>
</tr>
</tbody>
</table>
| Complete List of Authors: | Heazell, Alexander; University of Manchester, Maternal and Fetal Health Research Centre
Budd, Jayne; University of Manchester, Maternal and Fetal Health Research Centre
Li, Minglan; University of Auckland, Department of Obstetrics and Gynaecology
Cronin, Robin; University of Auckland, Department of Obstetrics and Gynaecology
Bradford, Billie; University of Auckland, Department of Obstetrics and Gynaecology
McCowan, Lesley; University of Auckland
Mitchell, Edwin; University of Auckland, Paediatrics
Stacey, Tomasina; University of Leeds, School of Healthcare
Martin, Bill; Birmingham Women's NHS Foundation Trust, Obstetrics
Roberts, Devender; Liverpool Womens NHS Foundation Trust, Department of Obstetrics
Thompron, John; University of Auckland, Paediatrics: Child and Youth Health |
| Primary Subject Heading: | Obstetrics and gynaecology |
| Secondary Subject Heading: | Epidemiology |
| Keywords: | Maternal Perception, Fetal movement, Reduced Fetal Movement, Exaggerated Fetal Movement, Stillbirth, Risk Factor |
Alterations in maternally-perceived fetal movement and their association with late stillbirth – findings from the Midland and North of England Stillbirth Case-Control Study

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4 Department of Paediatrics: Child Health and Youth Health, University of Auckland, Auckland, New Zealand
5 School of Healthcare, University of Leeds, Leeds, United Kingdom
6 Birmingham Women’s Hospital NHS Foundation Trust, Mindelsohn Way, Edgbaston, Birmingham, United Kingdom
7 Liverpool Women’s Hospital NHS Foundation Trust, Crown Street, Liverpool, United Kingdom.

Corresponding Author – Professor Alexander Heazell, Maternal and Fetal Health Research Centre, 5th floor (Research), St Mary’s Hospital, Oxford Road, Manchester, M13 9WL.

Phone – 0161 701 0889 Email – alexander.heazell@manchester.ac.uk

Running Title – Fetal movements and late stillbirth
Abstract

Objective - To report perception of fetal movements in women who experienced a stillbirth compared to controls at a similar gestation with a live birth.

Design - Case-control study.

Setting – 41 maternity units in the United Kingdom.

Participants – Cases were women who had a late stillbirth ≥28 weeks’ gestation (n=291) and controls were women with an ongoing pregnancy at the time of interview (n=733). Controls were frequency matched to cases by obstetric unit and gestational age.

Methods - Data were collected using an interviewer-administered questionnaire which included questions on maternal perception of fetal movement (frequency, strength, increased and decreased movements and hiccups) in the two weeks before the interview/stillbirth. Five fetal movement patterns were identified incorporating the changes in strength and frequency in the last two weeks by combining groups of similar pattern and risk. Multivariable analysis adjusted for known confounders.

Primary outcome measure – Association of maternally-perceived fetal movements in relation to late stillbirth.

Results – In multivariable analyses women who reported increased strength of movements in the last two weeks had decreased risk of late stillbirth compared to those whose movements were unchanged (adjusted OR 0.18, 95%CI 0.13-0.26). Women with decreased frequency (without increase in strength) of fetal movements were at increased risk (aOR 4.51, 95%CI 2.38-8.55). Daily perception of fetal hiccups was protective (aOR 0.31, 95%CI 0.17-0.56).

Conclusions – Increased strength of fetal movements and fetal hiccups are associated with decreased risk of stillbirth. Alterations in frequency of fetal movements are important in identifying...
pregnancies at increased risk of stillbirth, with the greatest risk in women noting a reduction in fetal activity. Clinical guidance should be updated to reflect that increase in strength and frequency of fetal movements is associated with the lowest risk of stillbirth, and that decreased fetal movements are associated with stillbirth.

Trial Registration – ClinicalTrials.gov registration NCT02025530

Strengths and Limitations

• This is the largest case-control study reporting detailed information about maternal perception of fetal movements in relation to stillbirth

• This study addressed different aspects of fetal activity including frequency and strength and hiccups

• Case control studies can be affected by measurement error, though this is not likely to differ between groups.

• Attempts were made to reduce recall bias including: using a structured questionnaire and no explicit hypotheses communicated to participants.

• The recruitment rate was lower than initially expected, 44.1% for cases and 25.9% for controls., which may introduce selection bias.

Disclosure of Interests - All authors declare that they have no competing interests.

Funding – The Midland and North of England Stillbirth Study was funded by grant GN2156 from Action Medical Research, Cure Kids and Sands.

Keywords

Maternal Perception; Fetal movement; Reduced Fetal Movement; Exaggerated Fetal Movement; Stillbirth; Risk Factor.
Introduction

Maternal perception of fetal activity is an accepted marker of fetal wellbeing. Conversely, maternal perception of changes in activity can indicate fetal compromise; the most commonly reported change is a reduction in fetal movement. Maternal perception of reduced fetal movements (RFM) is associated with adverse pregnancy outcomes including fetal growth restriction, oligohydramnios, and stillbirth. These conditions are associated with placental dysfunction, which is observed in women with reduced fetal movements. Despite the known association between RFM and stillbirth, two Confidential Enquiries into antepartum stillbirth in the United Kingdom (UK) conducted 15 years apart highlighted suboptimal care in terms of the information given to mothers about fetal movements and clinical management when mothers attend with RFM as factors contributing to stillbirth.

In comparison to a reduction in frequency of fetal movements little is known about other aspects of maternally-perceived fetal activity, such as: strength of movements, an episode of vigorous movement and fetal hiccups and how these relate to risk of stillbirth. Data from two case-control studies and a large international cohort study have both suggested that any significant deviation from a mother’s usual pattern of fetal movement is a risk factor for stillbirth. Importantly, existing data suggest that an increase in both strength and frequency of fetal movements in late pregnancy was reported significantly less frequently by women who had a stillbirth. Due to this paucity of data it is important to better understand maternal perception of altered fetal activity and whether these perceptions can be used to identify fetuses at high risk of antepartum stillbirth. Furthermore, women report receiving mixed messages about the importance of fetal movements and the significance of RFM, indicating the need for clear information regarding these symptoms. To address these needs, we conducted a case-control study to explore modifiable risk factors associated with late stillbirth. The objective of this manuscript is to report maternally-perceived fetal
movements in women who experienced a recent stillbirth compared to a control group of women at
similar gestation who had a live baby.

Methods

The Midlands and North of England Stillbirth Study (MiNESS) was conducted in 41 maternity units in
the UK. Ethical and research approvals were obtained (Ref 13/NW/0874). The study was registered
on www.clinicaltrials.gov (NCT02025530) and the study protocol was published. Participants were
recruited between April 2014 and March 2016. The study methodology has been described in detail
elsewhere. Cases were included if the stillbirth occurred at or after 28 weeks’ gestation and the
fetus did not have a congenital anomaly. The cause of stillbirth was assigned using the ReCoDe
classification system. Controls were women with an ongoing pregnancy. To ensure that controls
would be at a similar gestation to cases, the gestation at interview was frequency matched to the
expected distribution of stillbirths based on the prior four years of data from that unit. Potential
controls were randomly selected from the booking lists and the gestation for interview calculated
from the expected date of delivery. Women with multiple pregnancies, maternal age less than 16
years and inability to give consent were excluded from the study.

The primary outcome reported here was the association of maternal perception of fetal movements
with late stillbirth. Maternal perception of fetal movements were classified as increased, reduced or
stayed the same. Data specific to this analysis relates to questions asked about fetal movements and
more specifically about changes in strength and frequency in the last 2 weeks (before the baby died
for cases and last 2 weeks before interview for controls). Additional information was collected on
fetal hiccups. Data on uterine contractions were also collected as it has been argued elsewhere that
women may interpret uterine contractions as fetal movements. All questions as asked are reported
in Table 1 (The questionnaire is included as Supplementary file 1).
Statistical methods

Univariable analyses were carried out using logistic regression to estimate the effect of each variable. Due to likely relationships between the variables, bivariate models were fitted between each pair of movement variables to assess (by changes in effect size) which variables were able to be placed in multivariable analyses together. There was a strong association between reduced movements after 26 weeks’ gestation and the variables for strength and frequency of movements in the last 2 weeks, meaning these variables could not be included in the same multivariable model. Additionally the question relating to reduced fetal movements since 26 weeks is complicated by the fact that the timeframe relating to this question varies by subjects, i.e. 2 weeks for a women at 28 weeks gestation and 15 weeks at 41 weeks gestation.

Although the strength and frequency variables were also associated with each other they measure different aspects of movement. However, as using 16 potential combinations (derived from 4 different levels of both strength and frequency) independently would greatly reduce the statistical power, a combined strength/frequency variable was developed to describe the relationship between the changes in strength and frequency of movements in the last two weeks before the interview/stillbirth. The variable was prioritised based upon the prevalence of the perception in controls and the magnitude of the associated risk. Groups of similar pattern and risk were then combined (see Supplementary Table 1). Thus, the prioritised strength/frequency variable used the following rule:

1. Increase in strength of movements
2. Increase in frequency but not strength of movements
3. Decrease in frequency of movements
4. Unsure of change in strength or frequency
5. No change in strength or frequency (reference category based on current guidelines)
Multivariable analyses were carried out by adding the variables identified as not showing significant co-linearity (prioritised strength/frequency variable, frequency of increased fetal movements, and frequency of feeling hiccups) to the model previously developed in relation to the risk of stillbirth in this study (maternal: age, ethnicity, parity, education, smoking in pregnancy, marital status, customised birthweight centile, sleep factors on the last night before stillbirth/interview (position went to sleep in, sleep duration, number of times got up to toilet), naps in the daytime, gestation and study centre). All analyses were carried out using the logistic procedure in SAS v9.4 (SAS Institute, Cary, N.C.).

Patient and Public Involvement

MiNESS was developed in response to research questions prioritised in the Stillbirth Priority Setting Partnership according to methodology developed by the James Lind Alliance. These included: “Do modifiable ‘lifestyle’ factors (e.g. diet, vitamin deficiency, obesity, sleep position, sleep apnoea, lifting and bending) cause or contribute to stillbirth?” and “Would empowering women to know about relevant evidence-based signs and symptoms and raise them with healthcare professionals reduce stillbirth?” Study design and participant materials were designed in conjunction with the Maternal and Fetal Health Research Centre Patient and Public Involvement Group. Participants were not involved in recruitment to or conduct of the study.

Results

In total 3490 women were identified as potentially eligible participants (660 cases and 2830 controls, Figure 1). 760 women could not be contacted (77 cases, and 683 controls) and 1700 women did not consent to participate in the study (287 cases and 1413 controls). Six cases were excluded after data collection (five stillbirths had previously unidentified congenital abnormalities detected on post-mortem and one control participant had a stillbirth). Cases were more likely to participate than
controls (p<0.0001), 291 cases (44.1%) and 733 controls (25.9%) were included in the analysis (Figure 1).

The demographic characteristics of the study population have been presented in detail previously. Briefly, the majority of participants were from white ethnic background (80.4% of cases and 81.0% of controls), with a significant proportion of participants from South Asian (13.4% of cases and 13.0% controls) and Black ethnic groups (4.1% of cases and 4.0% of controls). Participants’ ages were distributed across the reproductive lifespan, with the largest group between 30-34 years of age in both groups (29.6% cases, 36.6% controls). There was no different in mean body mass index (Cases 26.9 kg/m², Controls 26.0 kg/m²). The median gestation at interview was 36 weeks 3 days for controls (Interquartile Range (IQR) 32 weeks 6 days to 38 weeks 5 days). In cases, the median gestation at diagnosis of stillbirth was 37 weeks 4 days (IQR 33 weeks 4 days to 39 weeks 5 days, p=0.003 compared to controls). The median interval between the presumed date of death in utero and diagnosis was 0 days (IQR 0-1) and the median time between the diagnosis of stillbirth and interview was 25 days (IQR 17-35). The most frequent factors associated with stillbirth were fetal growth restriction (45.2%), placental insufficiency (16.4%), placental abruption (6.5%) and acute infection (4.5%).

The prevalence of each variable relating to fetal movements and their univariable odds ratios (OR) associated with stillbirth are presented in Table 1. Women who reported RFM any time after 26 weeks’ gestation were at increased risk of having a stillbirth with the risk increasing with the number of times that they reported that decreased movements had occurred ranging from an OR of 2.36 for one episode to an OR of 5.11 for 3 or more episodes. Similarly, women who reported a decrease in either strength (OR 1.61) or even more so frequency (OR 3.54) of fetal movements in the last 2 weeks were at increased risk of having a stillbirth compared to those who reported no change. Conversely, increasing strength (OR 0.15) or frequency (OR 0.38) of fetal movement were associated with reduced stillbirth risk compared to those who reported no change. There was a significantly decreased stillbirth risk in those reporting more than one episode of vigorous movement (OR 0.34).
and a trend towards increased stillbirth risk in women who felt a single episode of vigorous
movement (OR 1.47) compared to those who never perceived movements to be more vigorous than
usual. The combined variable derived from the strength and frequency variables showed that
compared to no change in frequency or strength of movement, those who reported increased
strength in the last two weeks had a decreased risk of stillbirth (OR 0.18), which was the most
commonly reported scenario in controls (62%), whilst those reporting decreased frequency of
movements were at increased risk (OR 3.45).

Maternal perception of fetal hiccups in the last two weeks was associated with a decreased risk of
stillbirth (OR 0.41). The magnitude of this reduced risk increased as the frequency of feeling hiccups
increased, with the lowest risk for daily perception of hiccups (OR 0.32). There was no association
between feeling contractions in the last two weeks and stillbirth (OR 0.97).

The multivariable model (Table 2) showed that a decrease in frequency of fetal movements
remained associated with increased risk of stillbirth (aOR 4.51) and increasing strength of fetal
movements was still associated with decreased risk of stillbirth (aOR 0.14) compared to no change in
perception of frequency or strength of movement in the last two weeks. The decreased risk
associated with feeling vigorous movements on more than one occasion in the last two weeks
remained statistically significant (aOR 0.59), but the association between a single episode of
vigorous movement in the preceding two weeks and stillbirth became statistically significant (aOR
2.10). Compared to not feeling hiccups in the last two weeks, feeling hiccups daily was associated
with a significant reduction in risk (aOR 0.31).

When baby’s movements were reported as less than usual in the preceding two weeks, mothers of
cases were significantly more likely to have spoken to a health professional (79% vs 70%, p=0.02)
and tended to have attended hospital due to reduced fetal movements more frequently than
controls although this did not achieve statistical significance (68% vs 60%, p=0.07).
Discussion

Main Findings

This study shows that the majority of women with a live birth after 28 weeks’ gestation perceive an increase in strength of fetal movements and feel fetal hiccups in the previous two weeks; perception of these patterns of fetal movements is associated with a substantial reduction in the risk of late stillbirth (aORs 0.14 and 0.31 respectively). Conversely, a decrease in the strength or frequency of fetal movements is associated with an increased risk of late stillbirth particularly if this is a recurrent phenomenon (OR 2.36 rising to 5.11). A single episode of vigorous fetal activity is also associated with an increased risk of stillbirth.

Strengths and Limitations

This study is the largest case control study that has reported detailed information about maternal perception of fetal movements in relation to the risk of late stillbirth. A comparatively novel feature of this study is that assessment of analysis of fetal activity was not restricted to the frequency of fetal movements, but also addressed changes in strength of fetal activity as well as fetal hiccups. Apart from the Auckland Stillbirth Study (TASS) most recent publications evaluating the significance of fetal movements have comprised small cohort studies of women with reduced frequency of fetal movements in centres where intervention may be employed to prevent stillbirth. By including a broader description of fetal activity this study has been able to report the frequency and strength of fetal movements in ongoing pregnancy and describe changes that are related to late stillbirth.

A case-control design was considered the most practical means to identify late stillbirth, as a prospective cohort study is not feasible, requiring almost 108,000 women to identify 291 late stillbirths (at the current frequency of 2.9 per 1,000 births in the UK). However, it is important to consider the potential influence of recall bias, a limitation of case-control studies. This study attempted to minimise recall bias in several ways. Firstly, all participants were asked the same series
of questions about fetal movements embedded in a questionnaire about many different factors (e.g. smoking, diet, stress, social situation, sleep position and fetal movements). Secondly, women who experienced a stillbirth were interviewed within a median of 25 days, a time when events surrounding the death of a baby are likely to be clearly recalled. As women in the control group were pregnant at the time they completed the survey their experiences or concerns could not have been biased by knowledge of the outcome of their pregnancy. Finally, this study described novel findings of vigorous fetal movements and fetal hiccups, which are rarely addressed in prior studies, reducing the possibility that respondents may have read about these symptoms in advance of the questionnaire. While recall bias cannot be completely discounted, responses from participants’ who had a stillbirth do not universally show a deviation from controls e.g. there was no different in maternal perception of uterine contractions between the two groups.

The possibility of selection bias was minimised by recruiting controls who were frequency matched to cases over the duration of the study period which resulted in similar ages and ethnicities in both groups. The recruitment rate of MiNESS was lower than that of the TASS case control study (Cases 45.3% vs. 72%; Controls 26.2% vs. 72% respectively). This may have resulted in part from random selection of controls from booking lists which meant that some of these women could not be contacted and others were approached with no prior knowledge of the study, which given the sensitive subject matter, may have been reduced participation rates. A qualitative sub-study was undertaken to further understand the barriers and facilitators to participation in this study for both cases and controls, this will be reported separately.

Another potential bias in the multivariate model is the inclusion of a prioritised variable that was partially derived from the data obtained in the study. This approach was taken to reduce the number of combinations of strength and frequency by placing them in like groups (e.g. increased strength, increased frequency) which had similar risk estimates. This approach could introduce bias and
consequently requires replication in further independent data sets, which is currently underway using data from the Multi-centre Stillbirth Study from New Zealand.\(^2\)

**Interpretation**

Data regarding the pattern of fetal movements in late pregnancy are limited. Previous literature has suggested that the frequency of fetal movements increases until the 32nd week of pregnancy and then plateaus.\(^2\)\(^4\)\(^5\) Studies also note that the type and quality of fetal movements change with advancing gestation.\(^2\)\(^4\)-\(^2\)\(^7\) In this study the majority of controls reported that the frequency of fetal movements stayed the same (54.3%) but that there was increased strength of fetal movements in most controls (62.8%) in the preceding two weeks. Interestingly, an increase in strength of fetal movements had a greater protective effect for stillbirth than increase in frequency (OR 0.15 vs. 0.38). These findings are similar to those reported in TASS.\(^9\) As ultrasound studies suggest that mothers are more likely to feel larger movements of trunk and limbs,\(^2\)\(^8\) an increase in strength may also be perceived as an increase in frequency. Critically, for a reduction in frequency of fetal movements can only be judged in retrospect, whereas, increased strength may be easier to judge in real time which could prompt more rapid reporting of maternal concerns. We were not able to stratify levels of fetal activity by gestation due to insufficient sample size, this will be addressed in a planned individual participant data (IPD) meta-analysis.\(^2\)\(^9\) The other studies within the IPD can also be used to determine whether the interaction between strength and frequency is similar, and has similar association with late stillbirth.

Although regular vigorous movements are important and protective, a one-off episode of excessive fetal activity may be a warning sign of fetal compromise although the effect size in this study was less than in TASS (aOR 2.10 vs. 6.81).\(^1\)\(^0\) The repeated identification of this association here strengthens the relationship between a single episode of excessive fetal activity and stillbirth. However, practical application of this association is challenging as a woman cannot know at the time whether an episode of vigorous movement is isolated or will become a part of regular fetal activity.
Furthermore, the origin of the excessive movement is unclear.\textsuperscript{30} Therefore, this association requires further investigation in our planned IPD meta-analysis to establish whether it is consistently observed,\textsuperscript{29} and whether there are any clues to the aetiology of this symptom.

In agreement with many studies since the mid-1970s we have confirmed that decreased frequency of fetal movements is a major risk factor for late stillbirth.\textsuperscript{31} Furthermore, this study agrees with data from other UK units that recurrent presentation with RFM is associated with an even greater risk of adverse outcome.\textsuperscript{32,33} This link is biologically plausible as RFM is associated with abnormal placental structure and function which may deteriorate as pregnancy progresses.\textsuperscript{5,6} Notably, mothers with recurrent episodes of RFM have been shown to have an increased likelihood of abnormal uterine artery Doppler waveforms in the second trimester and delivery of a small for gestational age infant,\textsuperscript{32} both of which are associated with abnormal placental morphology.\textsuperscript{34,35} This study did not have sufficient power to determine whether maternal perception of RFM was related to stillbirths associated with a specific cause (e.g. placental dysfunction) but this will be addressed in the IPD meta-analysis.

Our data regarding the protective effect of fetal hiccups are an important observation which is consistent with findings from TASS.\textsuperscript{10} This finding contrasts with a single case report which proposed that hiccups are linked to umbilical cord complications.\textsuperscript{36} Fetal hiccups appear on ultrasound to be interspersed with normal breaths and are considered physiological.\textsuperscript{37,38} Mothers are aware of fetal hiccups throughout pregnancy, one study of 45 women suggested that they were perceived more frequently prior to 26 weeks’ gestation and remained constant after that with an average of 0.4 episodes per hour.\textsuperscript{39} Although another study found 36.6% of women perceived hiccups in pregnancy, and this increased with gestational age.\textsuperscript{40} Fetal hiccups do not appear to relate to other aspects of fetal movement, although they are associated with active fetal behavioural states.\textsuperscript{39}

Women in this study with RFM who went on to have a stillbirth were more likely to have spoken to a healthcare professional about the symptom but only 68% attended hospital because of RFM,
indicating that contacting a health professional does not appear to prevent stillbirth. This may be because a significant proportion of women do not attend hospital, management of RFM is variable, or that the baby was already dead at the time of presentation. Critically, management is presently not informed by high-quality evidence as there are insufficient data from randomised trials to guide practice. It is anticipated that the AFFIRM study, a multi-centre stepped-wedge cluster randomised trial will address whether standardised information for women and a standardised management strategy (employing antepartum cardiotocography and ultrasound for fetal biometry and liquor volume) following attendance with RFM will reduce stillbirth.

Conclusion

This study demonstrates that maternal perception of increased strength of fetal movements in late pregnancy is protective of late stillbirth. Decreased frequency of fetal movements is associated with risk of stillbirth as is decreased strength. Clinical guidelines and health promotion information currently suggest that fetal movements tend to increase until the 32nd week of pregnancy and then plateau. However, data from this study and TASS show that an increase in strength and frequency of fetal movements is associated with the lowest risk of stillbirth suggesting that guidance should be altered to indicate that maternal perception of fetal movement normally increases throughout pregnancy. This study adds to the evidence base that when fetal movements are reduced there is an increased risk of late stillbirth. Thus, women should contact their maternity care provider and be managed according to current clinical guidance. Importantly, development of an effective strategy for the investigation and management of RFM in late pregnancy has the potential to reduce the incidence of late stillbirth.

Acknowledgements

The authors thank all the participants who participated in interviews in order to help us better understand stillbirth. The authors would also like to thank the Principal Investigators, Research...
Midwives and Nurses at the following institutions for their hard work and dedication to this study:

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- Buckinghamshire Healthcare NHS Trust
- Burton Hospitals NHS Foundation Trust
- Calderdale and Huddersfield NHS Foundation Trust
- Central Manchester Hospitals NHS Foundation Trust
- Countess of Chester Hospitals NHS Foundation Trust
- County Durham and Darlington NHS Foundation Trust
- East Lancashire Hospitals NHS Trust
- Harrogate and District NHS Foundation Trust
- Heart of England NHS Foundation Trust
- Hull & East Yorkshire Hospitals NHS Trust
- Lancashire Teaching Hospitals NHS Foundation Trust
- Leeds Teaching Hospitals NHS Trust
- Liverpool Women’s NHS Foundation Trust
- Mid Cheshire Hospitals NHS Foundation Trust
- Mid-Yorkshire Hospitals NHS Trust
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- Royal Wolverhampton Hospitals NHS Trust
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- Sherwood Forest Hospitals NHS Foundation Trust
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**Contribution to Authorship**

AH, TS, BM, DR, EM & LM contributed to all aspects of the study design and obtained funding. AH had overall responsibility for the study. JB coordinated the running of the study. ML & JT analysed the data with input from AH, JB, RC, BB, EM and LM. All authors were responsible for the drafting of the manuscript. All authors gave approval for the final version of the manuscript.
Details of Ethical Approval

This study was reviewed by NRES Committee North West - Greater Manchester Central Reference (13/NW/0874) on 24th January 2014.

Data Sharing Statement

No additional data from the MiNESS study are available from a repository. Anonymised data is available on request to the corresponding author.
References


Figure 1 - Flow diagram reporting the numbers of women eligible for the study, women who did not participate and those included in the final analysis.
Table Legends

Table 1 - Univariable risks associated with perception of fetal movements and late stillbirth risk.

Table 2 - Univariable and multivariable odds of late stillbirth associated with perceptions of fetal movements.

Supplementary Table 1 - Prevalence and risk of stillbirth associated with the 16 possible combinations of change in strength and frequency of movement in the last 2 weeks.

Supplementary File 1 – Questionnaire used to obtain data from participants in the Midlands and North of England Stillbirth Study.
Table 1 - Univariable risks associated with perception of fetal movements and late stillbirth risk.

<table>
<thead>
<tr>
<th></th>
<th>Cases n (%)</th>
<th>Controls n (%)</th>
<th>Odds ratio (95% Confidence Interval) †χ², p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Was there any time from 26 weeks of pregnancy that your baby’s movements were less than usual?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>112 (38.7%)</td>
<td>469 (64.2%)</td>
<td>Reference: χ²=66.69, p&lt;0.0001</td>
</tr>
<tr>
<td>Once</td>
<td>88 (30.5%)</td>
<td>156 (21.3%)</td>
<td>2.36 (1.69-3.30)</td>
</tr>
<tr>
<td>Twice</td>
<td>39 (13.5%)</td>
<td>65 (9.9%)</td>
<td>2.51 (1.61-3.93)</td>
</tr>
<tr>
<td>Three or more times</td>
<td>50 (17.3%)</td>
<td>41 (5.6%)</td>
<td>5.11 (3.22-8.10)</td>
</tr>
</tbody>
</table>

| **In the last two weeks did the strength of your baby’s movements** |             |                |                                                  |
| Increase                                                        | 53 (18.3%)  | 455 (62.8%)    | 0.15 (0.11-0.22)                                 |
| Decrease                                                        | 62 (21.4%)  | 50 (6.9%)      | 1.61 (1.05-2.46)                                 |
| Stay the same                                                   | 153 (52.8%) | 198 (27.3%)    | Reference: χ²=169.96, p<0.0001                   |
| Unsure                                                          | 22 (7.6%)   | 22 (3.0%)      | 1.29 (0.69-2.42)                                 |

| **In the last two weeks did the frequency of your baby’s movements** |             |                |                                                  |
| Increase                                                        | 37 (12.7%)  | 254 (34.8%)    | 0.38 (0.26-0.56)                                 |
| Decrease                                                        | 86 (29.6%)  | 63 (8.6%)      | 3.54 (2.44-5.15)                                 |
| Stay the same                                                   | 153 (52.6%) | 397 (54.3%)    | Reference: χ²=103.49, p<0.0001                   |
| Unsure                                                          | 15 (5.2%)   | 17 (2.3%)      | 2.29 (1.12-4.70)                                 |

| **During the last two weeks did you notice anytime that your baby was more vigourous than usual?** |             |                |                                                  |
| No                                                              | 182 (62.5%) | 326 (44.7%)    | Reference: χ²=57.39, p<0.0001                     |
| Once                                                            | 41 (14.1%)  | 50 (6.9%)      | 1.47 (0.94-2.31)                                 |
| More than once                                                  | 68 (23.4%)  | 354 (48.5%)    | 0.34 (0.25-0.47)                                 |

| **During the last two weeks did you feel you baby having hiccups?** |             |                |                                                  |
| Yes                                                             | 126 (43.5%) | 460 (62.9%)    | 0.41 (0.30-0.54)                                 |
| No                                                              | 141 (48.6%) | 209 (28.6%)    | Reference: χ²=38.10, p<0.0001                    |
| Unsure                                                          | 23 (7.9%)   | 62 (8.5%)      | 0.55 (0.33-0.93)                                 |

| **How often did you feel hiccups in the last two weeks?**         |             |                |                                                  |
| Not felt hiccups                                                | 141 (48.5%) | 209 (28.6%)    | Reference: χ²=42.01, p<0.0001                    |
During the last two weeks did you feel uterine contractions (tightenings/pre-labour contractions/Braxton Hicks contractions/false labour) for longer than an hour

|                | Yes (%) | No (%) | Reference: χ² = 0.12, p = 0.94
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsure if felt</td>
<td>23 (7.9%)</td>
<td>62 (8.5%)</td>
<td>0.73 (0.39-1.35)</td>
</tr>
<tr>
<td>Once</td>
<td>17 (5.8%)</td>
<td>36 (4.9%)</td>
<td>0.69 (0.37-1.27)</td>
</tr>
<tr>
<td>Occasionally</td>
<td>69 (23.7%)</td>
<td>235 (32.2%)</td>
<td>0.44 (0.32-0.62)</td>
</tr>
<tr>
<td>Daily</td>
<td>38 (13.1%)</td>
<td>177 (24.3%)</td>
<td>0.32 (0.21-0.48)</td>
</tr>
<tr>
<td>Unsure of frequency</td>
<td>3 (1.0%)</td>
<td>11 (1.5%)</td>
<td>0.37 (0.17-0.80)</td>
</tr>
</tbody>
</table>

Combination of strength and frequency changes in the last 2 weeks (prioritised variable)*

| Combination of strength and frequency changes in the last 2 weeks | Yes (%) | No (%) | Reference: χ² = 205.34, p < 0.0001
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased strength</td>
<td>53 (18.2%)</td>
<td>455 (62.1%)</td>
<td>0.18 (0.13-0.26)</td>
</tr>
<tr>
<td>Increased frequency but not strength</td>
<td>8 (2.8%)</td>
<td>22 (3.0%)</td>
<td>0.57 (0.25-1.32)</td>
</tr>
<tr>
<td>Decreased frequency</td>
<td>79 (27.2%)</td>
<td>36 (4.9%)</td>
<td>3.45 (2.20-5.43)</td>
</tr>
<tr>
<td>Unsure strength or frequency</td>
<td>22 (7.6%)</td>
<td>17 (2.3%)</td>
<td>2.04 (1.04-3.98)</td>
</tr>
<tr>
<td>Same</td>
<td>129 (44.3%)</td>
<td>203 (27.7%)</td>
<td></td>
</tr>
</tbody>
</table>

† χ² and associated p-values are given for the overall effect of each variable

*See Supplementary table 1 for detailed description of category’s included in prioritised variable categories.
### Table 2 - Univariable and multivariable odds of late stillbirth associated with perceptions of fetal movements

<table>
<thead>
<tr>
<th></th>
<th>Univariable Odds Ratio (95% Confidence Interval)</th>
<th>Multivariable* Odds Ratio (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combination of strength and frequency changes in the last 2 weeks (prioritised variable)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased strength</td>
<td>0.18 (0.13-0.26)</td>
<td>0.14 (0.08-0.24)</td>
</tr>
<tr>
<td>Increased frequency but not strength</td>
<td>0.57 (0.25-1.32)</td>
<td>0.86 (0.30-2.52)</td>
</tr>
<tr>
<td>Decreased frequency</td>
<td>3.45 (2.20-5.43)</td>
<td>4.51 (2.38-8.55)</td>
</tr>
<tr>
<td>Unsure strength or frequency</td>
<td>2.04 (1.04-3.98)</td>
<td>2.02 (0.77-5.25)</td>
</tr>
<tr>
<td>Same</td>
<td>Reference</td>
<td>Reference: $\chi^2=104.90, p&lt;0.0001$</td>
</tr>
<tr>
<td>During the last 2 weeks did you notice anytime that your baby was more vigorous than usual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Reference</td>
<td>Reference: $\chi^2=12.43, p=0.002$</td>
</tr>
<tr>
<td>Once</td>
<td>1.47 (0.94-2.31)</td>
<td>2.10 (1.06-4.17)</td>
</tr>
<tr>
<td>More than once</td>
<td>0.34 (0.25-0.47)</td>
<td>0.59 (0.37-0.96)</td>
</tr>
<tr>
<td>How often did you feel your baby having hiccups in the last two weeks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>Reference</td>
<td>Reference: $\chi^2=5.95, p=0.007$</td>
</tr>
<tr>
<td>Unsure if felt</td>
<td>0.73 (0.39-1.35)</td>
<td>0.90 (0.42-1.93)</td>
</tr>
<tr>
<td>Once</td>
<td>0.69 (0.37-1.27)</td>
<td>0.85 (0.35-2.05)</td>
</tr>
<tr>
<td>Occasionally</td>
<td>0.44 (0.32-0.62)</td>
<td>0.75 (0.45-1.26)</td>
</tr>
<tr>
<td>Daily</td>
<td>0.32 (0.21-0.48)</td>
<td>0.31 (0.17-0.56)</td>
</tr>
<tr>
<td>Unsure of frequency</td>
<td>0.37 (0.17-0.80)</td>
<td>0.50 (0.07-3.44)</td>
</tr>
</tbody>
</table>

*Controls for age, ethnicity, parity, education, marital status, smoking in pregnancy, customised birthweight centile, going-to-sleep position, sleep duration, got up to toilet in the night, naps in the daytime, gestation and study centre.
Figure 1 - Flow diagram reporting the numbers of women eligible for the study, women who did not participate and those included in the final analysis.

Potential Cases
N=660

Could not be contacted
N=77

Cases receiving study information
N=583

Non-participants
N=287

Completed Questionnaire
N=296

Excluded:
5 cases had lethal abnormality diagnosed by post-mortem

Analysed Cases
N=291

Potential Controls
N=2830

Could not be contacted
N=683

Controls receiving study information
N=2147

Non-participants
N=1413

Completed Questionnaire
N=734

Excluded:
1 control had a stillbirth after interview

Analysed Controls
N=733

254x338mm (300 x 300 DPI)
**Supplementary Table 1** - Prevalence and risk of stillbirth associated with the 16 possible combinations of change in strength and frequency of movement in the last 2 weeks

<table>
<thead>
<tr>
<th>Strength</th>
<th>Frequency</th>
<th>Stillbirths N=290 (missing=1)</th>
<th>Controls N=724 (missing=9)</th>
<th>Univariable OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase</td>
<td>Increase</td>
<td>29 (10.0%)</td>
<td>232 (32.0%)</td>
<td>0.18 (0.11, 0.28)</td>
</tr>
<tr>
<td>Increase</td>
<td>Decrease</td>
<td>7 (2.4%)</td>
<td>27 (3.7%)</td>
<td>0.37 (0.16, 0.88)</td>
</tr>
<tr>
<td>Increase</td>
<td>Same</td>
<td>16 (5.5%)</td>
<td>190 (26.2%)</td>
<td>0.12 (0.07, 0.21)</td>
</tr>
<tr>
<td>Increase</td>
<td>Unknown</td>
<td>1 (0.3%)</td>
<td>6 (0.8%)</td>
<td>0.24 (0.03, 2.01)</td>
</tr>
<tr>
<td>Decrease</td>
<td>Increase</td>
<td>1 (0.3%)</td>
<td>2 (0.3%)</td>
<td>0.72 (0.06, 7.97)</td>
</tr>
<tr>
<td>Same</td>
<td>Increase</td>
<td>5 (1.7%)</td>
<td>13 (1.8%)</td>
<td>0.55 (0.19, 1.58)</td>
</tr>
<tr>
<td>Unknown</td>
<td>Increase</td>
<td>2 (0.7%)</td>
<td>6 (0.8%)</td>
<td>0.48 (0.10, 2.40)</td>
</tr>
<tr>
<td>Decrease</td>
<td>Decrease</td>
<td>51 (17.5%)</td>
<td>23 (3.2%)</td>
<td>3.17 (1.84, 5.46)</td>
</tr>
<tr>
<td>Same</td>
<td>Decrease</td>
<td>22 (7.6%)</td>
<td>10 (1.4%)</td>
<td>3.15 (1.44, 6.88)</td>
</tr>
<tr>
<td>Unknown</td>
<td>Decrease</td>
<td>5 (1.7%)</td>
<td>3 (0.4%)</td>
<td>2.38 (0.56, 10.16)</td>
</tr>
<tr>
<td>Decrease</td>
<td>Unknown</td>
<td>2 (0.7%)</td>
<td>2 (0.3%)</td>
<td>1.43 (0.20, 10.29)</td>
</tr>
<tr>
<td>Same</td>
<td>Unknown</td>
<td>5 (1.7%)</td>
<td>2 (0.3%)</td>
<td>3.57 (0.68, 18.73)</td>
</tr>
<tr>
<td>Unknown</td>
<td>Same</td>
<td>8 (2.7%)</td>
<td>6 (0.8%)</td>
<td>1.91 (0.65, 5.63)</td>
</tr>
<tr>
<td>Unknown</td>
<td>Unknown</td>
<td>7 (2.4%)</td>
<td>7 (1.0%)</td>
<td>1.43 (0.49, 4.18)</td>
</tr>
<tr>
<td>Decrease</td>
<td>Same</td>
<td>8 (2.7%)</td>
<td>23 (3.2%)</td>
<td>0.50 (0.22, 1.15)</td>
</tr>
<tr>
<td>Same</td>
<td>Same</td>
<td>121 (41.6%)</td>
<td>172 (23.5%)</td>
<td>Reference</td>
</tr>
</tbody>
</table>
1. Study arm?
   - Case
   - Control

2. Hospital

3. Study Number:

4. Date of Interview:
   DD/MM/YYYY

5. Interviewer

6. Who else is present during the interview?
Inclusion Criteria

7. Cases: Is gestation greater than or equal to 28 weeks at the time of the stillbirth? (Not at time of birth)
   - Yes
   - No

8. Cases: Did the stillbirth occur 1-6 weeks prior to the interview? (Not eligible if more than 6 weeks previously)
   - Yes
   - No

9. Controls: Is the gestation within 2 weeks of the gestation specified at the time of interview (or at birth if already given birth)?
   - Yes
   - No

10. Gestational age?
    
    | Weeks | Days |
    |-------|------|
    |        |      |

11. Singleton pregnancy?
    - Yes
    - No

12. Major fetal abnormality?
    - Yes
    - No

13. Consent form signed?
    - Yes
    - No

14. Fluent in English?
    - Yes
    - No
    If not fluent in English, was an interpreter used?
    
    |     |
    |-----|
### Maternal Demographics

15. **What is your date of birth?**

   DD/MM/YYYY

16. **Which country were you born in?**

17. **If not the United Kingdom: how many years have you lived in the UK?**

   Years

   Months

18. **If not the United Kingdom: what is your immigration status?**

   - UK National
   - EEA National
   - Discretionary leave to remain
   - Indefinite leave to remain
   - Study Visa
   - Work Visa
   - Husband/ Wife Sponsorship
   - Asylum seeker awaiting decision
   - Refugee
   - Humanitarian Protection
   - Declined to answer

19. **How do you describe your ethnicity?**

   - White- British
   - Irish
   - Gypsy or Irish traveller
   - Any other white background
   - Black/ Black British
   - African
   - Caribbean
   - Any other black background
   - Asian/ Asian British
   - Indian
   - Pakistani
   - Bangladeshi
   - Chinese
   - Any other Asian background
   - Multiple ethnic group
   - White & Black Caribbean
   - White & Black African
   - White & Asian
   - Any other multiple ethnic background
   - Declined to answer
20. What is the postcode of your usual residential address? (At the time of the interview).

21. Which of the following best describes the place you live in? (Lived in most of the time during your pregnancy).

- Own house
- Private rental
- Council/ Housing Association rental
- Stay with family or friends
- No fixed address
- Other (please specify)

22. How many people usually live in your house? (The house you lived in during your pregnancy).

- Couples (including yourself)
- Children under 10 years
- Other adults and children over 10 years

23. How many bedrooms does your house have? (The house you lived in during your pregnancy).

Number of bedrooms

24. Do you feel your house is large enough for your family’s needs? (The house you lived in during your pregnancy).

- Yes
- No

25. What is your highest educational qualification? (Please tick one answer only).

- None
- GCSE level (GCSE, O Level, Standards)
- A level (A, AS, S-level, Highers)
- Undergraduate (Diploma)
- Graduate (Degree, BSc, BA)
- Post-graduate (MSc, MA, PhD)
- Vocational education (NVQ, HNC, HND)
26. What was your work situation prior to this pregnancy? (Please tick one answer only).

- Full time work (over 30 hours per week)
- Part time work (includes casual work)
- Student
- Housewife
- Unemployed
- Long-term sickness benefit
- Other (please specify)

27. What was your work situation in the last month? (before your baby died). (Please tick one answer only).

- Full time work (over 30 hours per week)
- Part time work (includes casual work)
- Student
- Housewife
- Unemployed
- Long-term sickness benefit
- Off-work due to pregnancy complications
- Maternity leave
- Other (please specify)

28. If you are currently on maternity leave, how many weeks were you when you began your maternity leave?

Weeks

29. Do you or have you ever worked regular night shifts?

- Yes
- No

Please give details

30. Do you consider your work to be of a physical nature?

- Yes
- No

Please add details
31. What was your partner’s (not necessarily father of your baby) work situation in the last month? (before your baby died) (Please tick one answer only).

- Full time work (over 30 hours per week)
- Part time work (includes casual work)
- Student
- Home maker
- Unemployed
- Long term sickness benefit
- Other/ unknown/ no partner

32. What is your combined household income?

- < £10,000
- £10,000-£14,999
- £15,000-£19,999
- £20,000-£24,999
- £25,000-£29,999
- £30,000-£39,999
- £40,000-£49,999
- £50,000-£59,999
- £60,000-£74,999
- £75,000 +
33. What is your marital status? (Please tick one answer only).

- Single
- Married
- Cohabiting

34. How old is the father of your baby?

Age in years: 

Don't know:

35. How would he describe his ethnicity?

- Unknown
- White/British
- Irish
- Gypsy or Irish traveller
- Any other white background
- Black/Black British
- African
- Caribbean
- Any other black background
- Asian/Asian British
- Indian
- Pakistani
- Bangladeshi
- Chinese
- Any other Asian background
- Multiple ethnic group
- White & Black Caribbean
- White & Black African
- White & Asian
- Any other multiple ethnic background
- Declined to answer

36. Is this your first pregnancy with this father?

- Yes
- No
37. How long had you had a relationship with the father of your baby when you conceived?

- Conceived on first episode of intercourse
- Less than 6 months
- 6-12 months
- More than 1 year
- Declined to answer

38. Are you related to the father of your baby? (Other than by marriage).

- Yes
- No

If yes what relation are you to each other?
39. Did you have any medical conditions before the start of your pregnancy? (Please tick all relevant answers).

- None
- Anaemia (prior to booking Hb<10g/L)
- Asthma
- Cervical surgery
- Depression
- Diabetes type 1 - Insulin dependent
- Diabetes type 2
- Epilepsy
- Heart condition - congenital
- Heart condition - rheumatic
- Hypertension - Essential
- Hyperthyroid
- Hypothyroid
- Inflammatory bowel disease (Crohn's disease or ulcerative colitis)
- Polycystic ovarian syndrome
- Psychiatric disorder (other than depression)
- Renal disease
- Sickle cell disease
- Systemic lupus erythematosus
- Thalassaemia
- Thrombophilia
- Urinary tract infections (recurrent)
- Uterine abnormality
- Uterine surgery
- Venous thromboembolism
- Other medical condition

40. Did you have fertility treatment to get pregnant with your baby?

- Yes
- No
41. If yes, what was the treatment? (Please tick one answer only).

- Artificial insemination
- Ovulation induction
- IVF
- GIFT
- ICSI

Other (please specify)

42. Have you ever been pregnant before?

- Yes
- No
### Pregnancy History

#### 43. If yes how many pregnancies were:
- Miscarriages or ectopic pregnancies in the first 12 weeks of pregnancy
- Miscarriages or ectopic pregnancies between 13 and 24 weeks of pregnancy
- Surgical termination of pregnancy below 14 weeks
- Medical termination of pregnancy below 14 weeks
- Surgical termination of pregnancy between 15 and 24 weeks of pregnancy
- Medical termination of pregnancy between 15 and 24 weeks of pregnancy
- Termination of pregnancy after 24 weeks

#### 44. How many other pregnancies have you had?

#### 45. If yes, can you tell me about your other pregnancies and births?

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>Gestation</th>
<th>Birth weight (in grams)</th>
<th>Mode of delivery</th>
<th>Outcome (LB/SB/NND)</th>
<th>Were there any complications?</th>
</tr>
</thead>
</table>

#### 46. If yes, can you tell me about your other pregnancies and births?

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>Gestation</th>
<th>Birth weight (in grams)</th>
<th>Mode of delivery</th>
<th>Outcome (LB/SB/NND)</th>
<th>Were there any complications?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of birth</td>
<td>Gestation</td>
<td>Birth weight (in grams)</td>
<td>Mode of delivery</td>
<td>Outcome (LB/SB/NND)</td>
<td>Were there any complications?</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
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<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**48. If yes, can you tell me about your other pregnancies and births?**

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>Gestation</th>
<th>Birth weight (in grams)</th>
<th>Mode of delivery</th>
<th>Outcome (LB/SB/NND)</th>
<th>Were there any complications?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**49. If yes, can you tell me about your other pregnancies and births?**

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>Gestation</th>
<th>Birth weight (in grams)</th>
<th>Mode of delivery</th>
<th>Outcome (LB/SB/NND)</th>
<th>Were there any complications?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**50. If yes, can you tell me about your other pregnancies and births?**

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>Gestation</th>
<th>Birth weight (in grams)</th>
<th>Mode of delivery</th>
<th>Outcome (LB/SB/NND)</th>
<th>Were there any complications?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Antenatal care in this pregnancy

**51. How many weeks pregnant were you when you first saw a health professional about this pregnancy?**

Weeks

**52. Who did you first see? (Please tick one answer only).**

- [ ] GP
- [ ] Midwife
- [ ] Infertility specialist
- [ ] Hospital obstetrician
- [ ] Family planning clinic
- [ ] Pharmacist
- [ ] Nurse
- [ ] Private obstetrician
- [ ] Other (please specify)

**53. Did you have morning sickness during this pregnancy?**

- [ ] Yes
- [ ] No

**54. If yes, were you admitted to hospital due to your vomiting?**

- [ ] Yes
- [ ] No

If yes, how many times?

**55. Did you have any of these common illnesses/problems during your pregnancy? (Please tick all relevant answers).**

<table>
<thead>
<tr>
<th>Illness/Problem</th>
<th>Anytime during your pregnancy</th>
<th>In the last two weeks of your pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>High fever</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>If high fever, was it confirmed to be higher than 38°C by thermometer</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Runny nose/ sore throat/ swollen glands</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Cough with phlegm</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Diarrhoea and/or vomiting</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Frequent urge to urinate and/or pain on urinating</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

**56. Were you unwell in any other way in the last 2 weeks of your pregnancy?**

- [ ] Yes
- [ ] No

If yes, please describe
57. Did you have any vaginal bleeding in your pregnancy? (Please tick one answer only).

- No bleeding
- Single episode <20 weeks gestation
- Recurrent bleeds <20 weeks gestation
- Single episode >20 weeks gestation
- Recurrent bleeds >20 weeks gestation
- Recurrent bleeds throughout
- Unsure

58. During your pregnancy, did you take any antibiotics?

- Yes
- No
- Unsure

If yes, what antibiotics and what did you have them for?

59. How many weeks pregnant were you when you took the antibiotics? (If more than one course of antibiotics, record gestation of the most recent course).

Weeks
**Personal Habits**

60. Do you currently smoke? (Please tick one answer only)

- Yes
- No, stopped in pregnancy
- No, stopped prior to pregnancy
- No, never smoked

61. If yes, what do you smoke and what is the average amount per day?

<table>
<thead>
<tr>
<th>Smoke</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>cigarettes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>roll ups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cannabis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>tobacco</td>
<td></td>
<td></td>
</tr>
<tr>
<td>shisha</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Average amount per day

62. If you smoked at any time during pregnancy, how much a day on average did you smoke?

Amount per day

63. If you stopped smoking during pregnancy, how many weeks pregnant were you when you stopped?

Weeks

64. Did you use any nicotine-replacement products during pregnancy?

- Electronic cigarettes
- Nicotine microtabs
- Nicotine gum
- Nicotine nasal spray
- Nicotine inhalators
- Nicotine patches
- Nicotine lozenges
- Other (please specify)

65. Have you changed your smoking habits during your pregnancy?

- Yes
- No

If so, what have you changed?
66. If you have stopped or reduced smoking during pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

- Midwife
- GP
- Hospital doctor
- Friend/relative
- Internet
- Magazine
- Pregnancy book
- TV

Please add details

67. Does your partner smoke?

- Yes
- No
- No partner

68. Does anyone else living in your house smoke?

- Yes
- No
- No partner

69. On average, how many standard alcoholic drinks (if any) do you have each week during your pregnancy?

<table>
<thead>
<tr>
<th>In the first 3 months of your pregnancy</th>
<th>1-2 std drinks/wk</th>
<th>3-4 std drinks/wk</th>
<th>≥5 std drinks/wk</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 std drink/wk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the last month of your pregnancy</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

70. What was the highest number of standard alcoholic drinks that you had on any one occasion during your pregnancy? (Please tick one answer only).

- None
- 1 to 2
- 3 to 4
- 5 to 10
- greater than 10

71. How many weeks pregnant were you when you had the most drinks?

- Weeks
- Not Known

72. Have you changed your drinking habits during your pregnancy?

- Yes
- No

If so, what have you changed?
73. If you have changed your alcohol intake during pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

- Midwife
- GP
- Hospital doctor
- Friend/relative
- Internet
- Magazine
- Pregnancy book
- TV

Please add details

74. Have you taken any street drugs during pregnancy?

- Yes
- No

75. If yes, have you used any of the following, if so when?

<table>
<thead>
<tr>
<th>Drug</th>
<th>In the first 3 months of pregnancy</th>
<th>In the last month of pregnancy</th>
<th>In the last week of pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphetamine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amyl Nitrites</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cannabis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cocaine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecstasy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heroin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ketamine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magic Mushrooms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methadone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tranquillisers</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other (please specify)

76. If yes, how often did you use these drugs?

- Daily use
- Weekly use
- Occasional use
- Once only

Other (please specify)
77. Have you changed your drug habits during your pregnancy?

- Yes
- No

If so, what have you changed?

78. If you have changed your drug use during pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

- Midwife
- GP
- Hospital doctor
- Friend/relative
- Internet
- Magazine
- Pregnancy book
- TV

Please add details

79. Have you taken any prescribed medication during your pregnancy?

- Yes
- No

80. If yes, please list all the prescribed medication you have taken during your pregnancy?

81. Have you taken any vitamins? If so, which ones.

<table>
<thead>
<tr>
<th></th>
<th>Prior to pregnancy</th>
<th>During the first 3 months of pregnancy</th>
<th>During the last month of pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Folic Acid 400mcg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Folic Acid 5mg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron supplement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-vitamin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-vitamin for pregnant women</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Omega-3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin D 10mcg</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comment


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### Perceived Stress Scale

82. The questions in this scale ask you about your feelings and thoughts during the LAST MONTH (before your baby died).

<table>
<thead>
<tr>
<th>Question</th>
<th>Never 0</th>
<th>Almost Never 1</th>
<th>Sometimes 2</th>
<th>Fairly Often 3</th>
<th>Very Often 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How often have you been upset because of something that happened unexpectedly?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. How often have you felt that you were unable to control the important things in your life?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. How often have you felt nervous and &quot;stressed&quot;?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. How often have you felt confident about your ability to handle your personal problems?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. How often have you felt that things were going your way?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. How often have you found that you could not cope with all the things that you had to do?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. How often have you been able to control irritations in your life?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. How often have you felt that you were on top of things?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. How often have you been angered because of things that were outside your control?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. How often have you felt difficulties were piling up so high that you could not overcome them?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other (please specify)
### Diet

83. On average, how often did you eat the following foods in the month before you were pregnant and during the last 4 weeks (before your baby died)?

<table>
<thead>
<tr>
<th>Food Description</th>
<th>Pre pregnancy</th>
<th>Within the last 4 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice and pasta (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White bread (1 slice)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wholemeal bread (1 slice)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crisps (1 bag)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processed meat (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salad vegetables (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green vegetables (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other vegetables (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetable dishes/ foods (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soft drinks (1 glass)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diet soft drinks (1 glass)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chips (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full fat spread (for 1 slice of bread)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

84. Please write how many per day.

- Total teaspoons of sugar added each day to cereals, tea, coffee etc (tsp)
- Full-fat milk on average consumed per day in drinks, cereals etc (pints)
- Semi-skimmed milk on average consumed per day in drinks, cereals etc (pints)
- Skimmed milk on average consumed per day in drinks, cereals etc (pints)
### 85. How many cups (190mls) of coffee/ tea do you drink per day?

<table>
<thead>
<tr>
<th>Drink Type</th>
<th>Number of Servings/Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instant coffee</td>
<td></td>
</tr>
<tr>
<td>Brewed coffee (filter/ percolated)</td>
<td></td>
</tr>
<tr>
<td>Decaffeinated coffee (brewed/instant)</td>
<td></td>
</tr>
<tr>
<td>Tea</td>
<td></td>
</tr>
<tr>
<td>Chai tea</td>
<td></td>
</tr>
<tr>
<td>Green tea</td>
<td></td>
</tr>
<tr>
<td>Drinking chocolate</td>
<td></td>
</tr>
<tr>
<td>Energy drinks/ 250ml serving</td>
<td></td>
</tr>
<tr>
<td>Cola (regular/ diet)/ 330ml serving</td>
<td></td>
</tr>
<tr>
<td>Chocolate/ 50g bar</td>
<td></td>
</tr>
</tbody>
</table>

### 86. Have you changed any aspects of your diet or caffeine intake during your pregnancy?

- [ ] Yes
- [ ] No

If so, what have you changed?

---

### 87. If you have changed your diet or caffeine intake during pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

- [ ] Midwife
- [ ] GP
- [ ] Hospital doctor
- [ ] Friend/ relative
- [ ] Internet
- [ ] Magazine
- [ ] Pregnancy book
- [ ] TV

Please add details

---
**Sleep Practices**

If the main period of sleep is in the day (such as for shift workers) then use the day time for the following questions.

88. On average how many hours actual sleep did you usually get at night? (Hours).

<table>
<thead>
<tr>
<th>Question</th>
<th>Before pregnancy</th>
<th>In the last four weeks*</th>
<th>In the last week*</th>
<th>Last night*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

89. What size bed did you sleep in last night? (the last night before your baby died). (Please tick one answer only).

- Small single
- Single
- Small double
- Double
- King size
- Superking
- Other - didn’t sleep in bed (specify)

90. Did anyone else sleep in the same bed as you last night? (The last night before your baby died).

- Yes, partner
- No
- Yes, other
- Other (please specify)

91. What side of the bed do you usually sleep on?

- Left
- Middle
- Right
- Unsure
92. Which side of the bed did you sleep in last night? (The last night before your baby died).

- Left
- Middle
- Right
- Unsure

93. How many pillows did you usually use at night in the last few weeks? (Before your baby died).

No. of pillows

94. What position did you usually fall asleep in? (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Before pregnancy</th>
<th>Left side</th>
<th>Back</th>
<th>Right side</th>
<th>Tummy</th>
<th>Variable</th>
<th>Propped up</th>
<th>Don't remember</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last night (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

95. What position did you usually wake up in? (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Before pregnancy</th>
<th>Left side</th>
<th>Back</th>
<th>Right side</th>
<th>Tummy</th>
<th>Variable</th>
<th>Propped up</th>
<th>Don't remember</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Last night (before your baby died)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

96. Did you change sleep position during the night? (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Before pregnancy</th>
<th>Not at all</th>
<th>Possibly once</th>
<th>Possibly twice</th>
<th>More than twice but not lots</th>
<th>Lots of times</th>
<th>Don't remember</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last night (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

97. Would you describe yourself as a restless sleeper (i.e move a lot during the night)? (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Before pregnancy</th>
<th>Not at all</th>
<th>A little</th>
<th>Average</th>
<th>More than average</th>
<th>Very restless</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last night (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

98. Have you EVER been told that you snore, or are you aware that you snore?

- Yes
- No
99. If you have been told you snore, or you have woken yourself up snoring, how often has this happened? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During the last 4 weeks (the 4 weeks before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

100. Did you snore last night? (The last night before your baby died).

- Yes
- No
- Don't know

101. Has your snoring ever bothered other people?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

102. Did your snoring bother anyone last night? (The last night before your baby died).

- Yes
- No
- Don't know

103. How loud is your snoring reported to be? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Slightly louder than breathing</th>
<th>As loud as talking</th>
<th>Very loud, can be heard in adjacent rooms</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last night (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

104. Have you been told you briefly stop breathing when you are asleep? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Every night</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 weeks ago (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

105. Were you told you briefly stopped breathing when asleep last night? (The night before your baby died).

- Yes
- No

106. Have you been told that you cough or choke during sleep? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Every night</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 weeks ago (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
107. Were you told you coughed or choked last night? (The last night before your baby died).

- Yes
- No

108. Do your legs twitch or jerk often while you sleep? (Do not count the sudden jerk that sometimes occurs as you fall asleep). (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

109. Did your legs twitch or jerk often while you slept last night? (The last night before your baby died).

- Yes
- No
- Don't know

110. Did you take medication for sleep? (Prescribed medication NOT herbal remedies). (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>4 weeks ago (before your baby died)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

111. Did you take medication for sleep last night? (The night before your baby died).

- Yes
- No

112. How would you rate your sleep quality overall? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Very good</th>
<th>Fairly good</th>
<th>Average</th>
<th>Fairly bad</th>
<th>Very bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

113. How often do you feel tired or fatigued AFTER your night’s sleep? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

114. During your WAKE TIME do you feel tired, fatigued or not up to par? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
115. **BEFORE YOUR PREGNANCY** how likely were you to doze off or fall asleep in the following situations, in contrast to just feeling tired? (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Sitting and reading</th>
<th>Would never doze</th>
<th>Slight chance of dozing</th>
<th>Moderate chance of dozing</th>
<th>High chance of dozing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watching TV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting inactive in a public place (eg cinema, meeting)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As a passenger in a car for an hour without a break</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lying or sitting down to rest in the afternoon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting and talking to someone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting quietly after lunch without alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In a car, while stopped for a few minutes in the traffic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

116. **IN THE LAST 4 WEEKS** (of pregnancy) how likely were you to doze off or fall asleep in the following situations, in contrast to just feeling tired?  
Even if you have not done some of these things recently try and work out how they would have affected you.  
(Please tick one answer per line).

<table>
<thead>
<tr>
<th>Sitting and reading</th>
<th>Would never doze</th>
<th>Slight chance of dozing</th>
<th>Moderate chance of dozing</th>
<th>High chance of dozing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watching TV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting inactive in a public place (eg cinema, meeting)</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>As a passenger in a car for an hour without a break</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lying or sitting down to rest in the afternoon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting and talking to someone</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In a car, while stopped for a few minutes in the traffic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

117. On average how many times would you take a nap during the day? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every day</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
118. Have you changed your sleeping habits during your pregnancy?

☐ Yes  ☐ No

If so, what have you changed?

119. If you have changed your sleeping habits during your pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

☐ Midwife
☐ GP
☐ Hospital doctor
☐ Friend/ relative
☐ Internet
☐ Magazine
☐ Pregnancy book
☐ TV

Please add details
### Fetal Movements

120. Did anyone give you information about fetal movements during your pregnancy?

- [ ] No information was given
- [ ] Verbal information
- [ ] Written information
- [ ] Other (please specify)

121. Was there anytime from 26 weeks of pregnancy that your baby's movements were less than usual?

- [ ] Yes
- [ ] No
122. If yes, on how many occasions?

- 1
- 2
- 3
- 4 or more

123. If yes, did you speak to a health professional for advice?

- Yes
- No

If did not speak to a health professional, why was that?

124. If yes, did you attend hospital?

- Yes
- No

If you did not attend hospital, why was that?

125. If you did attend hospital, what did they do?

126. In the last 2 weeks did the strength of your baby's movements: (The two weeks before your baby died) (Please tick one answer only).

- Increase
- Decrease
- Stay the same
- Unsure

127. In the last 2 weeks did the frequency of your baby's movements: (The two weeks before your baby died) (Please tick one answer only).

- Increase
- Decrease
- Stay the same
- Unsure

128. During the last 2 weeks, did you notice anytime that your baby was more vigorous than usual? (The two weeks before your baby died).

- Yes
- No

129. If yes, how many times?

- Once
- More than once
130. During the last 2 weeks, did you feel your baby having hiccups? (The two weeks before your baby died).

☐ Yes  ☐ No  ☐ Unsure

131. If yes, how often?

☐ Once  ☐ Daily

☐ Occasionally  ☐ Unsure

132. During the last 2 weeks, did you feel uterine contractions (tightenings/ pre-labour contractions/ Braxton Hicks contractions/ false labour) for longer than an hour? (The two weeks before your baby died).

☐ Yes  ☐ No  ☐ Unsure
133. Did you experience any physical injury at any time during your pregnancy? (Please tick all relevant boxes).

- No injury
- Slips and falls
- Road traffic accident
- Blow to abdomen
- Self-harm
- Other non-accidental injury
- Other accidental injury

134. If yes, please describe the physical injury.

135. If yes, was this during the last two weeks of your pregnancy?

- Yes
- No

136. Did you see a health professional about your injury?

- Yes
- No
### These questions must be asked only if the woman is on her own

**Family Violence**

137. Family violence questions not asked as woman was not on her own?
- [ ] Yes

138. Family violence questions not asked for other reason (specify)

139. Woman declined to answer family violence questions?
- [ ] Yes

140. In the past year have you been hurt or frightened by someone close to you?
- [ ] Yes
- [ ] No

141. In the past year have you felt controlled or always criticized in your relationship?
- [ ] Yes
- [ ] No

142. In the past year have you been made to do anything sexual that you did not want to do?
- [ ] Yes
- [ ] No

143. Who in your family controls the money?
- [ ] You
- [ ] Your partner
- [ ] Joint - you and your partner
- [ ] Other family member

144. If disclosure of domestic abuse made, have you followed your local protocol.
- [ ] Yes
Finally I would like to ask you some questions about when your baby died.

145. What was the first reason that you thought something was wrong with you pregnancy or that your baby was dying/ had died? (Please tick one answer only).

- I felt a reduction of kicks/ movements
- I felt kicks/ movements stop
- I felt abdominal pain
- I had vaginal bleeding/ haemorrhage
- I had discharge of amniotic fluid/ the membranes ruptured/ my waters had broken
- I had a "feeling that something was wrong", but cannot specify
- I had a trauma (involved in a physical accident)
- I had other symptoms (specify below if possible)
- I was told at an antenatal appointment
- I was told when I was admitted in labour
- I was told during labour
- It was not discovered before my baby was born
- I do not remember/ know

Other (please specify)

146. When do you think your baby died?

- DD/MM/YYYY
- I do not know when my baby died

147. What time of day do you think your baby died? (Please tick one answer only).

- During the night
- During a daytime nap
- In the morning
- In the afternoon
- In the evening
- Not sure
148. What was the reason you saw a health practitioner at the time that your baby was found to have died? (Please tick one answer only).

- Routine scheduled pregnancy visit
- Routine scan
- Decreased baby movements
- In labour
- In hospital
- Vaginal bleeding
- Rupture of membranes
- Unwell
- Not recorded/unknown

Other (please specify)

149. Were you asked if you would like a post-mortem for your baby?

- Yes
- No

150. If yes, did you choose to have a post-mortem?

- Yes
- No

151. If no, what was the main reason you decided against a post-mortem? (Please tick one answer only).

- We already knew why baby had died
- It would not bring baby back
- Did not want baby to be taken away
- Did not want baby to be cut
- Wanted to bury baby as quickly as possible

Other (please specify)

152. Would you make the same decision about the post-mortem now?

- Yes
- No

153. Is there anything else that you think might be important you would like to tell us about your pregnancy?
Thank you very much for your time and thoughts.

154. How did you feel about being involved in this study?

[Blank space for response]

155. Is there anything else that you would like to add (Anything that you feel was significant, but was not discussed)?

[Blank space for response]
# Clinical Data Collection

This data is to be collected FROM THE ANTENATAL RECORD.

## Current pregnancy

### 156. Study Number:

---

### 157. Date:

DD / MM / YYYY

### 158. EDD by LMP:

- DD/MM/YYYY
- EDD not known

### 159. EDD by USS:

- DD/MM/YYYY
- USS not done

### 160. Gestation by first USS:

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 161. Best agreed EDD:

- 

### 162. Height recorded in notes:

- Cms
- Not recorded

Cms
163. First weight in pregnancy:

- [ ] Kgs
- [ ] Not recorded

Kgs
164. Body Mass Index at booking

165. Gestation at first weight:
Weeks

166. Last weight:

- Kgs
- Not recorded

Kgs

167. Gestation at last weight:

- Weeks
- N/A

Weeks

168. Date of first visit with health care professional:

DD/MM/YYYY

169. Estimated gestational age at first visit with health care professional:

Weeks

Days

170. Initial type of maternity care? (Please tick one answer only).

- Midwifery-led care
- Consultant-led care
- Shared care (between consultant and midwife)
- Private Obstetrician
- Private Midwife

Other (please specify)

171. Referral to obstetric/medical specialist?

- Yes
- No
172. If yes: (Please tick one answer only).
- Pre-existing condition
- Complication of pregnancy
- Maternal request
- Other (please specify)

173. Transfer of care during pregnancy? (e.g. from midwifery-led care to consultant-led care).
- Yes
- No

174. Booked place of birth? (Please tick one answer only).
- Tertiary hospital
- Secondary hospital
- Primary birthing unit
- Home
- Other (please specify)

175. Number of antenatal visits in 1st trimester (0-12 weeks)? (From antenatal records).
- No.

176. Number of antenatal visits in 2nd trimester (13-28 weeks)? (From antenatal records).
- No.

177. Number of antenatal visits in 3rd trimester (29-42 weeks)? (From antenatal records).
- Number

178. If no antenatal records available, please give details.

179. Ultrasound this pregnancy? (Please tick all relevant answers).
- First trimester
- Anomaly scan 18-22 weeks
- Doppler studies
- Growth scan
- None
180. Medical conditions in pregnancy? (Please tick all relevant answers).

- None
- Anaemia
- Asthma
- Cervix surgery
- Depression
- Diabetes - before pregnancy
- Epilepsy
- Essential hypertension
- Gestational diabetes - developed during pregnancy
- Heart condition - congenital
- Heart condition - rheumatic
- Hypertension / Pre-eclampsia
- Hyperthyroid
- Hypothyroid
- Inflammatory bowel
- Laparotomy
- Other autoimmune
- Renal disease
- Rheumatic heart
- Major psychiatric disorder (Other than depression)
- Sickle cell crisis
- Systemic lupus erythematosus
- Thalassaemia trait
- Urinary tract infection
- Uterine abnormality
- Venous thromboembolism

Other (please specify)

181. Blood pressure at booking?

Systolic

Diastolic

182. Last blood pressure prior to interview (controls) or when baby was last known to be alive (cases)?

Weeks

Days
<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>183. Was a customized growth chart used?</td>
<td>Yes, No, Don't know</td>
</tr>
<tr>
<td>184. Was fetal growth restriction clinically suspected?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>185. If yes, gestation first suspected?</td>
<td></td>
</tr>
<tr>
<td>Weeks</td>
<td></td>
</tr>
<tr>
<td>Days</td>
<td></td>
</tr>
<tr>
<td>186. If yes, were growth scan(s) done?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>187. Was there evidence on the growth scan of fetal growth restriction?</td>
<td>Yes AC &lt; 10%, Yes EFW &lt; 10%, No</td>
</tr>
<tr>
<td>188. If yes, what was the management? (Please tick all relevant answers).</td>
<td>No change, Increased antenatal visits, Serial cardiotocography (CTG’s), Ultrasound scan, Doppler’s, Admitted, Delivered, Other (please specify)</td>
</tr>
<tr>
<td>189. Admitted with threatened preterm labour in this pregnancy?</td>
<td>Yes, No, Don't know</td>
</tr>
</tbody>
</table>
190. Blood group?
- A Pos
- B Pos
- AB Pos
- O Pos
- A Neg
- B Neg
- AB Neg
- O Neg
- Not known

191. Hep B status?
- Positive
- Negative
- Not known

If not known

192. HIV status?
- Positive
- Negative
- Not known

If not known

193. HbA1c performed?
- Yes
- No

194. If yes:
Result
Gestation

195. GTT performed?
- Yes
- No

196. If yes:
Fasting
1 hour
2 hour
Gestation
Fasting
1 hour
2 hour
Gestation
### 197. Baby's date of birth?

<table>
<thead>
<tr>
<th>DD</th>
<th>MM</th>
<th>YYYY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 198. Place of birth?

- [ ] Tertiary/ secondary hospital
- [ ] Birthing unit
- [ ] Home
- [ ] Other (please specify)

### 199. Birth weight in grams?

Grams

### 200. Gestation at birth (for controls) or at DIAGNOSIS of stillbirth (for cases):

- [ ] Weeks
- [ ] Days

### 201. Sex of baby?

- [ ] Male
- [ ] Female

### 202. Examination of the cord? (Please tick all relevant answers).

- [ ] Normal
- [ ] Tight knot/ occluded
- [ ] Loose knot
- [ ] Cord round neck tightly
- [ ] Cord round neck loosely
- [ ] Cord round limbs/ body tightly
- [ ] Cord round limbs/ body loosely
- [ ] Torsion or spring like cord
- [ ] Marginal/ velamentous insertion
- [ ] Hypocoiled
- [ ] Thin cord
- [ ] Meconium stained
- [ ] Tear
- [ ] 2 vessels
- [ ] Other (please specify)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
203. Placenta? (Please tick all relevant answers).

- Normal
- Retroplacental clot
- Gritty/ calcified
- Vasa praevia
- Offensive odour
- Succenturiate lobe
- Extrachorial/ Circumvallate
- Bilobate/ Bilpartite placenta
- Placenta accreta
- Not examined

Other (please specify)

204. Placental weight in grams?

<table>
<thead>
<tr>
<th>Grams</th>
<th>Placenta not weighed</th>
</tr>
</thead>
</table>

205. If placenta was weighed, was it trimmed weight or full weight?

- Trimmed weight
- Full weight
- Unsure
### Details of Stillbirth (Cases only)

**206. Date of diagnosis of fetal death?**

<table>
<thead>
<tr>
<th>DD</th>
<th>MM</th>
<th>YYYY</th>
</tr>
</thead>
<tbody>
<tr>
<td>/</td>
<td>/</td>
<td></td>
</tr>
</tbody>
</table>

**207. Date of last consult prior to death where fetus confirmed alive?**

<table>
<thead>
<tr>
<th>DD</th>
<th>MM</th>
<th>YYYY</th>
</tr>
</thead>
<tbody>
<tr>
<td>/</td>
<td>/</td>
<td></td>
</tr>
</tbody>
</table>

**208. New findings at last consult prior to diagnosis of fetal death? (Please tick all relevant answers).**

- [ ] No new findings
- [ ] SGA
- [ ] LGA
- [ ] Hypertension
- [ ] Oligohydramnios
- [ ] Polyhydramnios
- [ ] APH
- [ ] Diabetes
- [ ] Decreased fetal movements
- [ ] Urinary tract infection
- [ ] Other (please specify)

**209. When did death occur?**

- [ ] Antepartum
- [ ] Intrapartum
- [ ] Unknown whether antepartum/ intrapartum

**210. Post-mortem?**

- [ ] Yes
- [ ] No

**211. If yes, where was it done? (Attach copy of results if available).**

**212. Placental pathology?**

- [ ] Yes
- [ ] No
213. If yes, where was it done? (Attach copy of results if available).
### Appendix 1 (amendment 22.07.14)

#### 214. During the night how often do you have to get up to use the toilet?

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before you were pregnant?</td>
<td></td>
</tr>
<tr>
<td>The last four weeks (before your baby died)?</td>
<td></td>
</tr>
<tr>
<td>The last week of your pregnancy?</td>
<td></td>
</tr>
<tr>
<td>Last night (the night before your baby died)?</td>
<td></td>
</tr>
</tbody>
</table>

#### 215. Since you became pregnant did your level of physical exercise:

- [ ] Stay the same
- [ ] Become less
- [ ] Become more

#### 216. How often have you engaged in vigorous exercise in the last month (the month before your baby died)? Exercise which made you breathe harder or puff or pant, such as tennis, jogging, aerobics, heavy gardening, cycling?

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td></td>
</tr>
<tr>
<td>1 time</td>
<td></td>
</tr>
<tr>
<td>2-3 times a week</td>
<td></td>
</tr>
<tr>
<td>4-6 times a week</td>
<td></td>
</tr>
<tr>
<td>Daily</td>
<td></td>
</tr>
<tr>
<td>More than once a day</td>
<td></td>
</tr>
</tbody>
</table>

#### 217. If you have engaged in vigorous exercise, on average how long did your exercise last for (in minutes)?

<table>
<thead>
<tr>
<th>Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

#### 218. What type of vigorous exercise have you done?

- [ ] Jogging
- [ ] Tennis
- [ ] Cycling
- [ ] Gym class- aerobics
- [ ] Spinning
- [ ] Weight training- gym
- [ ] Swimming

- [ ] Other (please specify)

<table>
<thead>
<tr>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
219. How often have you engaged in less vigorous exercise for recreation, sport or health fitness purposes in the last month (the month before your baby died) which did not make you breathe harder or puff or pant?

- Never
- Once a week
- 2-3 times a week
- 4-6 times a week
- Daily
- More than once a day

220. If you did engage in less vigorous exercise, what type of exercise have you done?

221. From the anomaly scan, please record placental position.

- Anterior- high
- Anterior- low
- Posterior- high
- Posterior- low
- Fundal
- Lateral
- Low lying

Other (please specify)
STROBE Statement—Checklist of items that should be included in reports of *case-control studies*

<table>
<thead>
<tr>
<th>Item No</th>
<th>Item</th>
<th>Recommendation</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Title and abstract</td>
<td>(a) Indicate the study’s design with a commonly used term in the title or the abstract</td>
<td>Page 1 Lines 1-2 + Page 2 Line 27</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Provide in the abstract an informative and balanced summary of what was done and what was found</td>
<td>Page 2-3 Lines 25-49</td>
</tr>
<tr>
<td>2</td>
<td>Introduction</td>
<td>Explain the scientific background and rationale for the investigation being reported</td>
<td>Page 4-5 Lines 72-94</td>
</tr>
<tr>
<td>3</td>
<td>Objectives</td>
<td>State specific objectives, including any prespecified hypotheses</td>
<td>Page 4-5 Lines 94-96</td>
</tr>
<tr>
<td>4</td>
<td>Methods</td>
<td>Present key elements of study design early in the paper</td>
<td>Page 4-5 Lines 93-108</td>
</tr>
<tr>
<td></td>
<td>Setting</td>
<td>Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection</td>
<td>Page 5 Lines 98-102 and Ref #13</td>
</tr>
<tr>
<td></td>
<td>Participants</td>
<td>(a) Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls</td>
<td>Page 5 Lines 102-109 and Ref #14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) For matched studies, give matching criteria and the number of controls per case</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Variables</td>
<td>Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable</td>
<td>Page 5 Lines 110-117</td>
</tr>
<tr>
<td></td>
<td>Data sources/measurement</td>
<td>For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group</td>
<td>Page 5 Lines 110-117 and Page 6 129-137 (Derivation of FM variable)</td>
</tr>
<tr>
<td>9</td>
<td>Bias</td>
<td>Describe any efforts to address potential sources of bias</td>
<td>Page 7 Lines 143-149 and Page 10-11 Lines 229-244</td>
</tr>
<tr>
<td>10</td>
<td>Study size</td>
<td>Explain how the study size was arrived at</td>
<td>In Ref #14</td>
</tr>
<tr>
<td>11</td>
<td>Quantitative variables</td>
<td>Explain how quantitative variables were handled in the analyses.</td>
<td>N/A</td>
</tr>
</tbody>
</table>
applicable, describe which groupings were chosen and why

<table>
<thead>
<tr>
<th>Statistical methods</th>
<th>12</th>
<th>(a) Describe all statistical methods, including those used to control for confounding</th>
<th>Page 6-7 Lines 120–150</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(b) Describe any methods used to examine subgroups and interactions</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) Explain how missing data were addressed</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(d) If applicable, explain how matching of cases and controls was addressed</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(e) Describe any sensitivity analyses</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Results**

<table>
<thead>
<tr>
<th>Participants</th>
<th>13*</th>
<th>(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed</th>
<th>Page 7 Lines 152-158, Figure 1 and Ref #14</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(b) Give reasons for non-participation at each stage</td>
<td>See above</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) Consider use of a flow diagram</td>
<td>Figure 1</td>
</tr>
<tr>
<td>Descriptive data</td>
<td>14*</td>
<td>(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders</td>
<td>Page 7-8 Lines -159-172 &amp; Table 1 in Ref #14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Indicate number of participants with missing data for each variable of interest</td>
<td>Table 1</td>
</tr>
<tr>
<td>Outcome data</td>
<td>15*</td>
<td>Report numbers in each exposure category, or summary measures of exposure</td>
<td>Page 7 Lines 156-157</td>
</tr>
<tr>
<td>Main results</td>
<td>16</td>
<td>(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included</td>
<td>Tables 1 and 2 Lines 8-9 Pages 174-202</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Report category boundaries when continuous variables were categorized</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period</td>
<td>N/A</td>
</tr>
<tr>
<td>Other analyses</td>
<td>17</td>
<td>Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Discussion**

<table>
<thead>
<tr>
<th>Key results</th>
<th>18</th>
<th>Summarise key results with reference to study objectives</th>
<th>Page 9 Lines 209-215</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limitations</td>
<td>19</td>
<td>Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias</td>
<td>Page 10 Lines 217-250</td>
</tr>
<tr>
<td>Interpretation</td>
<td>20</td>
<td>Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other</td>
<td>Page 11 Lines 252-</td>
</tr>
</tbody>
</table>
relevant evidence

| Generalisability | Discuss the generalisability (external validity) of the study results | Page 11-13 Lines 252-296 |

Other information

| Funding | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | Page 3 Lines 66-67 |

*Give information separately for cases and controls.

# Alterations in maternally-perceived fetal movement and their association with late stillbirth – findings from the Midland and North of England Stillbirth Case-Control Study

<table>
<thead>
<tr>
<th>Journal:</th>
<th><em>BMJ Open</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Manuscript ID</td>
<td>bmjopen-2017-020031.R3</td>
</tr>
<tr>
<td>Article Type:</td>
<td>Research</td>
</tr>
<tr>
<td>Date Submitted by the Author:</td>
<td>10-May-2018</td>
</tr>
</tbody>
</table>
| Complete List of Authors: | Heazell, Alexander; University of Manchester, Maternal and Fetal Health Research Centre  
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Li, Minglan; University of Auckland, Department of Obstetrics and Gynaecology  
Cronin, Robin; University of Auckland, Department of Obstetrics and Gynaecology  
Bradford, Billie; University of Auckland, Department of Obstetrics and Gynaecology  
McCowan, Lesley; University of Auckland  
Mitchell, Edwin; University of Auckland, Paediatrics  
Stacey, Tomasina; University of Leeds, School of Healthcare  
Martin, Bill; Birmingham Women's NHS Foundation Trust, Obstetrics  
Roberts, Devender; Liverpool Women's NHS Foundation Trust, Department of Obstetrics  
Thompron, John; University of Auckland, Paediatrics: Child and Youth Health |
| Keywords:      | Maternal Perception, Fetal movement, Reduced Fetal Movement, Exaggerated Fetal Movement, Stillbirth, Risk Factor |

*For peer review only* - [http://bmjopen.bmj.com/site/about/guidelines.xhtml](http://bmjopen.bmj.com/site/about/guidelines.xhtml)
Alterations in maternally-perceived fetal movement and their association with late stillbirth – findings from the Midland and North of England Stillbirth Case-Control Study

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4 Department of Paediatrics: Child Health and Youth Health, University of Auckland, Auckland, New Zealand
5 School of Healthcare, University of Leeds, Leeds, United Kingdom
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Telephone – 0161 701 0889 Email – alexander.heazell@manchester.ac.uk

Running Title – Fetal movements and late stillbirth
Abstract

Objective - To report perception of fetal movements in women who experienced a stillbirth compared to controls at a similar gestation with a live birth.

Design - Case-control study.

Setting – 41 maternity units in the United Kingdom.

Participants – Cases were women who had a late stillbirth ≥28 weeks’ gestation (n=291) and controls were women with an ongoing pregnancy at the time of interview (n=733). Controls were frequency matched to cases by obstetric unit and gestational age.

Methods - Data were collected using an interviewer-administered questionnaire which included questions on maternal perception of fetal movement (frequency, strength, increased and decreased movements and hiccups) in the two weeks before the interview/stillbirth. Five fetal movement patterns were identified incorporating the changes in strength and frequency in the last two weeks by combining groups of similar pattern and risk. Multivariable analysis adjusted for known confounders.

Primary outcome measure – Association of maternally-perceived fetal movements in relation to late stillbirth.

Results – In multivariable analyses women who reported increased strength of movements in the last two weeks had decreased risk of late stillbirth compared to those whose movements were unchanged (adjusted OR 0.18, 95%CI 0.13-0.26). Women with decreased frequency (without increase in strength) of fetal movements were at increased risk (aOR 4.51, 95%CI 2.38-8.55). Daily perception of fetal hiccups was protective (aOR 0.31, 95%CI 0.17-0.56).

Conclusions – Increased strength of fetal movements and fetal hiccups are associated with decreased risk of stillbirth. Alterations in frequency of fetal movements are important in identifying
pregnancies at increased risk of stillbirth, with the greatest risk in women noting a reduction in fetal activity. Clinical guidance should be updated to reflect that increase in strength and frequency of fetal movements is associated with the lowest risk of stillbirth, and that decreased fetal movements are associated with stillbirth.

**Trial Registration** – ClinicalTrials.gov registration NCT02025530

**Strengths and Limitations**
- This is the largest case-control study reporting detailed information about maternal perception of fetal movements in relation to stillbirth
- This study addressed different aspects of fetal activity including frequency and strength and hiccups
- Attempts were made to reduce recall bias including: using a structured questionnaire and no explicit hypotheses communicated to participants.
- The recruitment rate was lower than initially expected, 44.1% for cases and 25.9% for controls, which may introduce selection bias.
- The multivariate model included a prioritised variable that was partially derived from the data obtained in the study, this approach could introduce bias, thus these observations require replication in further independent data sets.

**Disclosure of Interests** - All authors declare that they have no competing interests.

**Funding** – The Midland and North of England Stillbirth Study was funded by grant GN2156 from Action Medical Research, Cure Kids and Sands.

**Keywords**
Maternal Perception; Fetal movement; Reduced Fetal Movement; Exaggerated Fetal Movement; Stillbirth; Risk Factor.
Introduction

Maternal perception of fetal activity is an accepted marker of fetal wellbeing. Conversely, maternal perception of changes in activity can indicate fetal compromise; the most commonly reported change is a reduction in fetal movement. Maternal perception of reduced fetal movements (RFM) is associated with adverse pregnancy outcomes including fetal growth restriction, oligohydramnios, and stillbirth. These conditions are associated with placental dysfunction, which is observed in women with reduced fetal movements. Despite the known association between RFM and stillbirth, two Confidential Enquiries into antepartum stillbirth in the United Kingdom (UK) conducted 15 years apart highlighted suboptimal care in terms of the information given to mothers about fetal movements and clinical management when mothers attend with RFM as factors contributing to stillbirth.

In comparison to a reduction in frequency of fetal movements little is known about other aspects of maternally-perceived fetal activity, such as: strength of movements, an episode of vigorous movement and fetal hiccups and how these relate to risk of stillbirth. Data from two case-control studies and a large international cohort study have both suggested that any significant deviation from a mother’s usual pattern of fetal movement is a risk factor for stillbirth. Importantly, existing data suggest that an increase in both strength and frequency of fetal movements in late pregnancy was reported significantly less frequently by women who had a stillbirth. Due to this paucity of data it is important to better understand maternal perception of altered fetal activity and whether these perceptions can be used to identify fetuses at high risk of antepartum stillbirth. Furthermore, women report receiving mixed messages about the importance of fetal movements and the significance of RFM, indicating the need for clear information regarding these symptoms. To address these needs, we conducted a case-control study to explore modifiable risk factors associated with late stillbirth. The objective of this manuscript is to report maternally-perceived fetal
movements in women who experienced a recent stillbirth compared to a control group of women at
similar gestation who had a live baby.

Methods

The Midlands and North of England Stillbirth Study (MiNESS) was conducted in 41 maternity units in
the UK. Ethical and research approvals were obtained (Ref 13/NW/0874). The study was registered
on www.clinicaltrials.gov (NCT02025530) and the study protocol was published. Participants were
recruited between April 2014 and March 2016. The study methodology has been described in detail
elsewhere. Cases were included if the stillbirth occurred at or after 28 weeks’ gestation and the
fetus did not have a congenital anomaly. The cause of stillbirth was assigned using the ReCoDe
classification system. Controls were women with an ongoing pregnancy. To ensure that controls
would be at a similar gestation to cases, the gestation at interview was frequency matched to the
expected distribution of stillbirths based on the prior four years of data from that unit. Potential
controls were randomly selected from the booking lists and the gestation for interview calculated
from the expected date of delivery. Women with multiple pregnancies, maternal age less than 16
years and inability to give consent were excluded from the study.

The primary outcome reported here was the association of maternal perception of fetal movements
with late stillbirth. Maternal perception of fetal movements were classified as increased, reduced or
stayed the same. Data specific to this analysis relates to questions asked about fetal movements and
more specifically about changes in strength and frequency in the last 2 weeks (before the baby died
for cases and last 2 weeks before interview for controls). Additional information was collected on
fetal hiccups. Data on uterine contractions were also collected as it has been argued elsewhere that
women may interpret uterine contractions as fetal movements. All questions as asked are reported
in Table 1 (The questionnaire is included as Supplementary file 1).
Statistical methods

Univariable analyses were carried out using logistic regression to estimate the effect of each variable. Due to likely relationships between the variables, bivariate models were fitted between each pair of movement variables to assess (by changes in effect size) which variables were able to be placed in multivariable analyses together. There was a strong association between reduced movements after 26 weeks’ gestation and the variables for strength and frequency of movements in the last 2 weeks, meaning these variables could not be included in the same multivariable model.

Additionally the question relating to reduced fetal movements since 26 weeks is complicated by the fact that the timeframe relating to this question varies by subjects, i.e. 2 weeks for a women at 28 weeks gestation and 15 weeks at 41 weeks gestation.

Although the strength and frequency variables were also associated with each other they measure different aspects of movement. However, as using 16 potential combinations (derived from 4 different levels of both strength and frequency) independently would greatly reduce the statistical power, a combined strength/frequency variable was developed to describe the relationship between the changes in strength and frequency of movements in the last two weeks before the interview/stillbirth. The variable was prioritised based upon the prevalence of the perception in controls and the magnitude of the associated risk. Groups of similar pattern and risk were then combined (see Supplementary Table 1). Thus, the prioritised strength/frequency variable used the following rule:

1. Increase in strength of movements
2. Increase in frequency but not strength of movements
3. Decrease in frequency of movements
4. Unsure of change in strength or frequency
5. No change in strength or frequency (reference category based on current guidelines)
Multivariable analyses were carried out by adding the variables identified as not showing significant co-linearity (prioritised strength/frequency variable, frequency of increased fetal movements, and frequency of feeling hiccups) to the model previously developed in relation to the risk of stillbirth in this study (maternal: age, ethnicity, parity, education, smoking in pregnancy, marital status, customised birthweight centile, sleep factors on the last night before stillbirth/interview (position went to sleep in, sleep duration, number of times got up to toilet), naps in the daytime, gestation and study centre). All analyses were carried out using the logistic procedure in SAS v9.4 (SAS Institute, Cary, N.C.).

Patient and Public Involvement

MiNESS was developed in response to research questions prioritised in the Stillbirth Priority Setting Partnership according to methodology developed by the James Lind Alliance. These included: “Do modifiable ‘lifestyle’ factors (e.g. diet, vitamin deficiency, obesity, sleep position, sleep apnoea, lifting and bending) cause or contribute to stillbirth?” and “Would empowering women to know about relevant evidence-based signs and symptoms and raise them with healthcare professionals reduce stillbirth?” Study design and participant materials were designed in conjunction with the Maternal and Fetal Health Research Centre Patient and Public Involvement Group. Participants were not involved in recruitment to or conduct of the study.

Results

In total 3490 women were identified as potentially eligible participants (660 cases and 2830 controls, Figure 1). 760 women could not be contacted (77 cases, and 683 controls) and 1700 women did not consent to participate in the study (287 cases and 1413 controls). Six cases were excluded after data collection (five stillbirths had previously unidentified congenital abnormalities detected on post-mortem and one control participant had a stillbirth). Cases were more likely to participate than
controls (p<0.0001), 291 cases (44.1%) and 733 controls (25.9%) were included in the analysis (Figure 1).

The demographic characteristics of the study population have been presented in detail previously. Briefly, the majority of participants were from white ethnic background (80.4% of cases and 81.0% of controls), with a significant proportion of participants from South Asian (13.4% of cases and 13.0% controls) and Black ethnic groups (4.1% of cases and 4.0% of controls). Participants’ ages were distributed across the reproductive lifespan, with the largest group between 30-34 years of age in both groups (29.6% cases, 36.6% controls). There was no different in mean body mass index (Cases 26.9 kg/m$^2$, Controls 26.0 kg/m$^2$). The median gestation at interview was 36 weeks 3 days for controls (Interquartile Range (IQR) 32 weeks 6 days to 38 weeks 5 days). In cases, the median gestation at diagnosis of stillbirth was 37 weeks 4 days (IQR 33 weeks 4 days to 39 weeks 5 days, p=0.003 compared to controls). The median interval between the presumed date of death in utero and diagnosis was 0 days (IQR 0-1) and the median time between the diagnosis of stillbirth and interview was 25 days (IQR 17-35). The most frequent factors associated with stillbirth were fetal growth restriction (45.2%), placental insufficiency (16.4%), placental abruption (6.5%) and acute infection (4.5%).

The prevalence of each variable relating to fetal movements and their univariable odds ratios (OR) associated with stillbirth are presented in Table 1. Women who reported RFM any time after 26 weeks’ gestation were at increased risk of having a stillbirth with the risk increasing with the number of times that they reported that decreased movements had occurred ranging from an OR of 2.36 (95% Confidence Interval (CI) 1.69-3.30) for one episode to an OR of 5.11 (95%CI 3.22-8.10) for 3 or more episodes. Similarly, women who reported a decrease in either strength (OR 1.61, 95% CI 1.05-2.42) or even more so frequency (OR 3.54, 95%CI 2.44-5.15) of fetal movements in the last 2 weeks were at increased risk of having a stillbirth compared to those who reported no change.

Conversely, increasing strength (OR 0.15, 95%CI 0.11-0.22) or frequency (OR 0.38, 95% CI 0.26-0.56) of fetal movement were associated with reduced stillbirth risk compared to those who reported no
change. There was a significantly decreased stillbirth risk in those reporting more than one episode of vigorous movement (OR 0.34, 95%CI 0.25-0.47) and a trend towards increased stillbirth risk in women who felt a single episode of vigorous movement (OR 1.47, 95%CI 0.94-2.31) compared to those who never perceived movements to be more vigorous than usual. The combined variable derived from the strength and frequency variables showed that compared to no change in frequency or strength of movement, those who reported increased strength in the last two weeks had a decreased risk of stillbirth (OR 0.18, 95%CI 0.13-0.26), which was the most commonly reported scenario in controls (62%), whilst those reporting decreased frequency of movements were at increased risk (OR 3.45, 95%CI 2.20-5.43).

Maternal perception of fetal hiccups in the last two weeks was associated with a decreased risk of stillbirth (OR 0.41, 95%CI 0.30-0.54). The magnitude of this reduced risk increased as the frequency of feeling hiccups increased, with the lowest risk for daily perception of hiccups (OR 0.32, 95%CI 0.21-0.48). There was no association between feeling contractions in the last two weeks and stillbirth (OR 0.97, 95%CI 0.72-1.29).

The multivariable model (Table 2) showed that a decrease in frequency of fetal movements remained associated with increased risk of stillbirth (aOR 4.51, 95%CI 2.38-8.55) and increasing strength of fetal movements was still associated with decreased risk of stillbirth (aOR 0.14, 95%CI 0.08-0.24) compared to no change in perception of frequency or strength of movement in the last two weeks. The decreased risk associated with feeling vigorous movements on more than one occasion in the last two weeks remained statistically significant (aOR 0.59, 95%CI 0.37-0.96), but the association between a single episode of vigorous movement in the preceding two weeks and stillbirth became statistically significant (aOR 2.10, 95%CI 1.06-4.17). Compared to not feeling hiccups in the last two weeks, feeling hiccups daily was associated with a significant reduction in risk (aOR 0.31, 95%CI 0.17-0.56).

When baby’s movements were reported as less than usual in the preceding two weeks, mothers of cases were significantly more likely to have spoken to a health professional (79% vs 70%, p=0.02)
and tended to have attended hospital due to reduced fetal movements more frequently than controls although this did not achieve statistical significance (68% vs 60%, p=0.07).

Discussion

Main Findings

This study shows that the majority of women with a live birth after 28 weeks’ gestation perceive an increase in strength of fetal movements and feel fetal hiccups in the previous two weeks; perception of these patterns of fetal movements is associated with a substantial reduction in the risk of late stillbirth (aORs 0.14 and 0.31 respectively). Conversely, a decrease in the strength or frequency of fetal movements is associated with an increased risk of late stillbirth particularly if this is a recurrent phenomenon (OR 2.36 rising to 5.11). A single episode of vigorous fetal activity is also associated with an increased risk of stillbirth.

Strengths and Limitations

This study is the largest case control study that has reported detailed information about maternal perception of fetal movements in relation to the risk of late stillbirth. A comparatively novel feature of this study is that assessment of analysis of fetal activity was not restricted to the frequency of fetal movements, but also addressed changes in strength of fetal activity as well as fetal hiccups. Apart from the Auckland Stillbirth Study (TASS) most recent publications evaluating the significance of fetal movements have comprised small cohort studies of women with reduced frequency of fetal movements in centres where intervention may be employed to prevent stillbirth. By including a broader description of fetal activity this study has been able to report the frequency and strength of fetal movements in ongoing pregnancy and describe changes that are related to late stillbirth.

A case-control design was considered the most practical means to identify late stillbirth, as a prospective cohort study is not feasible, requiring almost 108,000 women to identify 291 late stillbirths (at the current frequency of 2.9 per 1,000 births in the UK). However, it is important to
consider the potential influence of recall bias, a limitation of case-control studies. This study attempted to minimise recall bias in several ways. Firstly, all participants were asked the same series of questions about fetal movements embedded in a questionnaire about many different factors (e.g. smoking, diet, stress, social situation, sleep position and fetal movements). Secondly, women who experienced a stillbirth were interviewed within a median of 25 days, a time when events surrounding the death of a baby are likely to be clearly recalled. As women in the control group were pregnant at the time they completed the survey their experiences or concerns could not have been biased by knowledge of the outcome of their pregnancy. Finally, this study described novel findings of vigorous fetal movements and fetal hiccups, which are rarely addressed in prior studies, reducing the possibility that respondents may have read about these symptoms in advance of the questionnaire. While recall bias cannot be completely discounted, responses from participants’ who had a stillbirth do not universally show a deviation from controls e.g. there was no different in maternal perception of uterine contractions between the two groups.

The possibility of selection bias was minimised by recruiting controls who were frequency matched to cases over the duration of the study period which resulted in similar ages and ethnicities in both groups. The recruitment rate of MiNESS was lower than that of the TASS case control study (Cases 45.3% vs. 72%; Controls 26.2% vs. 72% respectively). This may have resulted in part from random selection of controls from booking lists which meant that some of these women could not be contacted and others were approached with no prior knowledge of the study, which given the sensitive subject matter, may have been reduced participation rates. A qualitative sub-study was undertaken to further understand the barriers and facilitators to participation in this study for both cases and controls, this will be reported separately.

Another potential bias in the multivariate model is the inclusion of a prioritised variable that was partially derived from the data obtained in the study. This approach was taken to reduce the number of combinations of strength and frequency by placing them in like groups (e.g. increased strength,
increased frequency) which had similar risk estimates. This approach could introduce bias and consequently requires replication in further independent data sets, which is currently underway using data from the Multi-centre Stillbirth Study from New Zealand.  

Interpretation  

Data regarding the pattern of fetal movements in late pregnancy are limited. Previous literature has suggested that the frequency of fetal movements increases until the 32nd week of pregnancy and then plateaus.  

Studies also note that the type and quality of fetal movements change with advancing gestation. In this study the majority of controls reported that the frequency of fetal movements stayed the same (54.3%) but that there was increased strength of fetal movements in most controls (62.8%) in the preceding two weeks. Interestingly, an increase in strength of fetal movements had a greater protective effect for stillbirth than increase in frequency (OR 0.15 vs. 0.38). These findings are similar to those reported in TASS. As ultrasound studies suggest that mothers are more likely to feel larger movements of trunk and limbs, an increase in strength may also be perceived as an increase in frequency. Critically, for a reduction in frequency of fetal movements can only be judged in retrospect, whereas, increased strength may be easier to judge in real time which could prompt more rapid reporting of maternal concerns. We were not able to stratify levels of fetal activity by gestation due to insufficient sample size, this will be addressed in a planned individual participant data (IPD) meta-analysis. The other studies within the IPD can also be used to determine whether the interaction between strength and frequency is similar, and has similar association with late stillbirth.  

Although regular vigorous movements are important and protective, a one-off episode of excessive fetal activity may be a warning sign of fetal compromise although the effect size in this study was less than in TASS (aOR 2.10 vs. 6.81). The repeated identification of this association here strengthens the relationship between a single episode of excessive fetal activity and stillbirth. However, practical application of this association is challenging as a woman cannot know at the time...
whether an episode of vigorous movement is isolated or will become a part of regular fetal activity.

Furthermore, the origin of the excessive movement is unclear.\textsuperscript{30} Therefore, this association requires further investigation in our planned IPD meta-analysis to establish whether it is consistently observed,\textsuperscript{29} and whether there are any clues to the aetiology of this symptom.

In agreement with many studies since the mid-1970s we have confirmed that decreased frequency of fetal movements is a major risk factor for late stillbirth.\textsuperscript{31} Furthermore, this study agrees with data from other UK units that recurrent presentation with RFM is associated with an even greater risk of adverse outcome.\textsuperscript{32, 33} This link is biologically plausible as RFM is associated with abnormal placental structure and function which may deteriorate as pregnancy progresses.\textsuperscript{5, 6} Notably, mothers with recurrent episodes of RFM have been shown to have an increased likelihood of abnormal uterine artery Doppler waveforms in the second trimester and delivery of a small for gestational age infant,\textsuperscript{32} both of which are associated with abnormal placental morphology.\textsuperscript{34, 35} This study did not have sufficient power to determine whether maternal perception of RFM was related to stillbirths associated with a specific cause (e.g. placental dysfunction) but this will be addressed in the IPD meta-analysis.

Our data regarding the protective effect of fetal hiccups are an important observation which is consistent with findings from TASS.\textsuperscript{10} This finding contrasts with a single case report which proposed that hiccups are linked to umbilical cord complications.\textsuperscript{36} Fetal hiccups appear on ultrasound to be interspersed with normal breaths and are considered physiological.\textsuperscript{37, 38} Mothers are aware of fetal hiccups throughout pregnancy, one study of 45 women suggested that they were perceived more frequently prior to 26 weeks’ gestation and remained constant after that with an average of 0.4 episodes per hour.\textsuperscript{39} Although another study found 36.6\% of women perceived hiccups in pregnancy, and this increased with gestational age.\textsuperscript{40} Fetal hiccups do not appear to relate to other aspects of fetal movement, although they are associated with active fetal behavioural states.\textsuperscript{39}
Women in this study with RFM who went on to have a stillbirth were more likely to have spoken to a healthcare professional about the symptom but only 68% attended hospital because of RFM, indicating that contacting a health professional does not appear to prevent stillbirth. This may be because a significant proportion of women do not attend hospital, management of RFM is variable, or that the baby was already dead at the time of presentation. Critically, management is presently not informed by high-quality evidence as there are insufficient data from randomised trials to guide practice. It is anticipated that the AFFIRM study, a multi-centre stepped-wedge cluster randomised trial will address whether standardised information for women and a standardised management strategy (employing antepartum cardiocotography and ultrasound for fetal biometry and liquor volume) following attendance with RFM will reduce stillbirth.

**Conclusion**

This study demonstrates that maternal perception of increased strength of fetal movements in late pregnancy is protective of late stillbirth. Decreased frequency of fetal movements is associated with risk of stillbirth as is decreased strength. Clinical guidelines and health promotion information currently suggest that fetal movements tend to increase until the 32nd week of pregnancy and then plateau. However, data from this study and TASS show that an increase in strength and frequency of fetal movements is associated with the lowest risk of stillbirth suggesting that guidance should be altered to indicate that maternal perception of fetal movement normally increases throughout pregnancy. This study adds to the evidence base that when fetal movements are reduced there is an increased risk of late stillbirth. Thus, women should contact their maternity care provider and be managed according to current clinical guidance. Importantly, development of an effective strategy for the investigation and management of RFM in late pregnancy has the potential to reduce the incidence of late stillbirth.

**Acknowledgements**
The authors thank all the participants who participated in interviews in order to help us better understand stillbirth. The authors would also like to thank the Principal Investigators, Research Midwives and Nurses at the following institutions for their hard work and dedication to this study: Airedale NHS Foundation Trust, Birmingham Women’s NHS Trust, Blackpool Teaching Hospitals NHS Foundation Trust, Bradford Teaching Hospitals NHS Foundation Trust, Buckinghamshire Healthcare NHS Trust, Burton Hospitals NHS Foundation Trust, Calderdale and Huddersfield NHS Foundation Trust, Central Manchester Hospitals NHS Foundation Trust, Countess of Chester Hospitals NHS Foundation Trust, County Durham and Darlington NHS Foundation Trust, East Lancashire Hospitals NHS Trust, Harrogate and District NHS Foundation Trust, Heart of England NHS Foundation Trust, Hull & East Yorkshire Hospitals NHS Trust, Lancashire Teaching Hospitals NHS Foundation Trust, Leeds Teaching Hospitals NHS Trust, Liverpool Women’s NHS Foundation Trust, Mid Cheshire Hospitals NHS Foundation Trust, Mid-Yorkshire Hospitals NHS Trust, Northern Lincolnshire and Goole NHS Foundation Trust, Portsmouth Hospitals NHS Trust, Royal Wolverhampton Hospitals NHS Trust, Sandwell and West Birmingham NHS Trust, Sheffield Teaching Hospitals NHS Foundation Trust, Sherwood Forest Hospitals NHS Foundation Trust, St Helens and Knowsley Teaching Hospitals NHS Trust, Stockport NHS Foundation Trust, Southport and Ormskirk Hospitals NHS Trust, South Warwickshire NHS Foundation Trust, The Dudley Group NHS Foundation Trust, University Hospitals of Coventry and Warwickshire NHS Trust, University Hospitals of North Midlands NHS Trust, University of Morecambe Bay NHS Foundation Trust, Walsall Healthcare NHS Trust, Warrington and Halton Hospitals NHS Foundation Trust, Western Sussex Hospitals NHS Foundation Trust, Wirral University Teaching Hospitals NHS Foundation Trust, York Teaching Hospitals NHS Foundation Trust.

Contribution to Authorship

AH, TS, BM, DR, EM & LM contributed to all aspects of the study design and obtained funding. AH had overall responsibility for the study. JB coordinated the running of the study. ML & JT analysed
the data with input from AH, JB, RC, BB, EM and LM. All authors were responsible for the drafting of
the manuscript. All authors gave approval for the final version of the manuscript.

Details of Ethical Approval

This study was reviewed by NRES Committee North West - Greater Manchester Central Reference
(13/NW/0874) on 24th January 2014.

Data Sharing Statement

No additional data from the MiNESS study are available from a repository. Anonymised data is
available on request to the corresponding author.


Figure Legend

**Figure 1** - Flow diagram reporting the numbers of women eligible for the study, women who did not participate and those included in the final analysis.
Table Legends

Table 1 - Univariable risks associated with perception of fetal movements and late stillbirth risk.

Table 2 - Univariable and multivariable odds of late stillbirth associated with perceptions of fetal movements.

Supplementary Table 1 - Prevalence and risk of stillbirth associated with the 16 possible combinations of change in strength and frequency of movement in the last 2 weeks.

Supplementary File 1 – Questionnaire used to obtain data from participants in the Midlands and North of England Stillbirth Study.
Table 1 - Univariable risks associated with perception of fetal movements and late stillbirth risk.

<table>
<thead>
<tr>
<th>Perception of Fetal Movements</th>
<th>Cases n (%)</th>
<th>Controls n (%)</th>
<th>Odds ratio (95% Confidence Interval) †χ², p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was there any time from 26 weeks of pregnancy that your baby’s movements were less than usual?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>112 (38.7%)</td>
<td>469 (64.2%)</td>
<td>Reference: χ²=66.69, p&lt;0.0001</td>
</tr>
<tr>
<td>Once</td>
<td>88 (30.5%)</td>
<td>156 (21.3%)</td>
<td>2.36 (1.69-3.30)</td>
</tr>
<tr>
<td>Twice</td>
<td>39 (13.5%)</td>
<td>65 (9.9%)</td>
<td>2.51 (1.61-3.93)</td>
</tr>
<tr>
<td>Three or more times</td>
<td>50 (17.3%)</td>
<td>41 (5.6%)</td>
<td>5.11 (3.22-8.10)</td>
</tr>
<tr>
<td>In the last two weeks did the strength of your baby’s movements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase</td>
<td>53 (18.3%)</td>
<td>455 (62.8%)</td>
<td>0.15 (0.11-0.22)</td>
</tr>
<tr>
<td>Decrease</td>
<td>62 (21.4%)</td>
<td>50 (6.9%)</td>
<td>1.61 (1.05-2.46)</td>
</tr>
<tr>
<td>Stay the same</td>
<td>153 (52.8%)</td>
<td>198 (27.3%)</td>
<td>Reference: χ²=169.96, p&lt;0.0001</td>
</tr>
<tr>
<td>Unsure</td>
<td>22 (7.6%)</td>
<td>22 (3.0%)</td>
<td>1.29 (0.69-2.42)</td>
</tr>
<tr>
<td>In the last two weeks did the frequency of your baby’s movements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase</td>
<td>37 (12.7%)</td>
<td>254 (34.8%)</td>
<td>0.38 (0.26-0.56)</td>
</tr>
<tr>
<td>Decrease</td>
<td>86 (29.6%)</td>
<td>63 (8.6%)</td>
<td>3.54 (2.44-5.15)</td>
</tr>
<tr>
<td>Stay the same</td>
<td>153 (52.6%)</td>
<td>397 (54.3%)</td>
<td>Reference: χ²=103.49, p&lt;0.0001</td>
</tr>
<tr>
<td>Unsure</td>
<td>15 (5.2%)</td>
<td>17 (2.3%)</td>
<td>2.29 (1.12-4.70)</td>
</tr>
<tr>
<td>During the last 2 weeks did you notice anytime that your baby was more vigourous than usual?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>182 (62.5%)</td>
<td>326 (44.7%)</td>
<td>Reference: χ²=57.39, p&lt;0.0001</td>
</tr>
<tr>
<td>Once</td>
<td>41 (14.1%)</td>
<td>50 (6.9%)</td>
<td>1.47 (0.94-2.31)</td>
</tr>
<tr>
<td>More than once</td>
<td>68 (23.4%)</td>
<td>354 (48.5%)</td>
<td>0.34 (0.25-0.47)</td>
</tr>
<tr>
<td>During the last two weeks did you feel you baby having hiccups?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>126 (43.5%)</td>
<td>460 (62.9%)</td>
<td>0.41 (0.30-0.54)</td>
</tr>
<tr>
<td>No</td>
<td>141 (48.6%)</td>
<td>209 (28.6%)</td>
<td>Reference: χ²=38.10, p&lt;0.0001</td>
</tr>
<tr>
<td>Unsure</td>
<td>23 (7.9%)</td>
<td>62 (8.5%)</td>
<td>0.55 (0.33-0.93)</td>
</tr>
<tr>
<td>How often did you feel hiccups in the last two weeks?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not felt hiccups</td>
<td>141 (48.5%)</td>
<td>209 (28.6%)</td>
<td>Reference: χ²=42.01, p&lt;0.0001</td>
</tr>
</tbody>
</table>
During the last two weeks did you feel uterine contractions (tightenings/pre-labour contractions/Braxton Hicks contractions/false labour) for longer than an hour

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Yes</th>
<th>No</th>
<th>Reference: $\chi^2$=0.12, p=0.94</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>94 (32.3%)</td>
<td>241 (33.0%)</td>
<td>0.97 (0.72-1.29)</td>
</tr>
<tr>
<td>No</td>
<td>191 (65.6%)</td>
<td>473 (64.7%)</td>
<td></td>
</tr>
<tr>
<td>Unsure</td>
<td>6 (2.1%)</td>
<td>17 (2.3%)</td>
<td>0.87 (0.34-2.25)</td>
</tr>
</tbody>
</table>

Combination of strength and frequency changes in the last 2 weeks (prioritised variable)*

<table>
<thead>
<tr>
<th>Strength/Frequency</th>
<th>Yes</th>
<th>No</th>
<th>Reference: $\chi^2$=205.34, p&lt;0.0001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased strength</td>
<td>53 (18.2%)</td>
<td>455 (62.1%)</td>
<td>0.18 (0.13-0.26)</td>
</tr>
<tr>
<td>Increased frequency but not strength</td>
<td>8 (2.8%)</td>
<td>22 (3.0%)</td>
<td>0.57 (0.25-1.32)</td>
</tr>
<tr>
<td>Decreased frequency</td>
<td>79 (27.2%)</td>
<td>36 (4.9%)</td>
<td>3.45 (2.20-5.43)</td>
</tr>
<tr>
<td>Unsure strength or frequency</td>
<td>22 (7.6%)</td>
<td>17 (2.3%)</td>
<td>2.04 (1.04-3.98)</td>
</tr>
<tr>
<td>Same</td>
<td>129 (44.3%)</td>
<td>203 (27.7%)</td>
<td></td>
</tr>
</tbody>
</table>

$\dagger$ $\chi^2$ and associated p-values are given for the overall effect of each variable

*See Supplementary table 1 for detailed description of category’s included in prioritised variable categories.
Table 2 - Univariable and multivariable odds of late stillbirth associated with perceptions of fetal movements

<table>
<thead>
<tr>
<th>Combination of strength and frequency changes in the last 2 weeks (prioritised variable)</th>
<th>Univariable Odds Ratio (95% Confidence Interval)</th>
<th>Multivariable* Odds Ratio (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased strength</td>
<td>0.18 (0.13-0.26)</td>
<td>0.14 (0.08-0.24)</td>
</tr>
<tr>
<td>Increased frequency but not strength</td>
<td>0.57 (0.25-1.32)</td>
<td>0.86 (0.30-2.52)</td>
</tr>
<tr>
<td>Decreased frequency</td>
<td>3.45 (2.20-5.43)</td>
<td>4.51 (2.38-8.55)</td>
</tr>
<tr>
<td>Unsure strength or frequency</td>
<td>2.04 (1.04-3.98)</td>
<td>2.02 (0.77-5.25)</td>
</tr>
</tbody>
</table>

*Controls for age, ethnicity, parity, education, marital status, smoking in pregnancy, customised birthweight centile, going-to-sleep position, sleep duration, got up to toilet in the night, naps in the daytime, gestation and study centre

During the last 2 weeks did you notice anytime that your baby was more vigorous than usual

<table>
<thead>
<tr>
<th></th>
<th>Univariable Odds Ratio (95% Confidence Interval)</th>
<th>Multivariable* Odds Ratio (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Reference</td>
<td>Reference: $\chi^2=104.90, p&lt;0.0001$</td>
</tr>
<tr>
<td>Once</td>
<td>1.47 (0.94-2.31)</td>
<td>2.10 (1.06-4.17)</td>
</tr>
<tr>
<td>More than once</td>
<td>0.34 (0.25-0.47)</td>
<td>0.59 (0.37-0.96)</td>
</tr>
</tbody>
</table>

How often did you feel your baby having hiccups in the last two weeks

<table>
<thead>
<tr>
<th></th>
<th>Univariable Odds Ratio (95% Confidence Interval)</th>
<th>Multivariable* Odds Ratio (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>Reference</td>
<td>Reference: $\chi^2=12.43, p=0.002$</td>
</tr>
<tr>
<td>Unsure if felt</td>
<td>0.73 (0.39-1.35)</td>
<td>0.90 (0.42-1.93)</td>
</tr>
<tr>
<td>Once</td>
<td>0.69 (0.37-1.27)</td>
<td>0.85 (0.35-2.05)</td>
</tr>
<tr>
<td>Occasionally</td>
<td>0.44 (0.32-0.62)</td>
<td>0.75 (0.45-1.26)</td>
</tr>
<tr>
<td>Daily</td>
<td>0.32 (0.21-0.48)</td>
<td>0.31 (0.17-0.56)</td>
</tr>
<tr>
<td>Unsure of frequency</td>
<td>0.37 (0.17-0.80)</td>
<td>0.50 (0.07-3.44)</td>
</tr>
</tbody>
</table>
Figure 1 - Flow diagram reporting the numbers of women eligible for the study, women who did not participate and those included in the final analysis.

254x338mm (300 x 300 DPI)
**Supplementary Table 1** - Prevalence and risk of stillbirth associated with the 16 possible combinations of change in strength and frequency of movement in the last 2 weeks

<table>
<thead>
<tr>
<th>Strength</th>
<th>Frequency</th>
<th>Stillbirths N=290 (missing=1)</th>
<th>Controls N=724 (missing=9)</th>
<th>Univariable OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase</td>
<td>Increase</td>
<td>29 (10.0%)</td>
<td>232 (32.0%)</td>
<td>0.18 (0.11, 0.28)</td>
</tr>
<tr>
<td>Increase</td>
<td>Decrease</td>
<td>7 (2.4%)</td>
<td>27 (3.7%)</td>
<td>0.37 (0.16, 0.88)</td>
</tr>
<tr>
<td>Increase</td>
<td>Same</td>
<td>16 (5.5%)</td>
<td>190 (26.2%)</td>
<td>0.12 (0.07, 0.21)</td>
</tr>
<tr>
<td>Increase</td>
<td>Unknown</td>
<td>1 (0.3%)</td>
<td>6 (0.8%)</td>
<td>0.24 (0.03, 2.01)</td>
</tr>
<tr>
<td>Decrease</td>
<td>Increase</td>
<td>1 (0.3%)</td>
<td>2 (0.3%)</td>
<td>0.72 (0.06, 7.97)</td>
</tr>
<tr>
<td>Same</td>
<td>Increase</td>
<td>5 (1.7%)</td>
<td>13 (1.8%)</td>
<td>0.55 (0.19, 1.58)</td>
</tr>
<tr>
<td>Unknown</td>
<td>Increase</td>
<td>2 (0.7%)</td>
<td>6 (0.8%)</td>
<td>0.48 (0.10, 2.40)</td>
</tr>
<tr>
<td>Decrease</td>
<td>Decrease</td>
<td>51 (17.5%)</td>
<td>23 (3.2%)</td>
<td>3.17 (1.84, 5.46)</td>
</tr>
<tr>
<td>Same</td>
<td>Decrease</td>
<td>22 (7.6%)</td>
<td>10 (1.4%)</td>
<td>3.15 (1.44, 6.88)</td>
</tr>
<tr>
<td>Unknown</td>
<td>Decrease</td>
<td>5 (1.7%)</td>
<td>3 (0.4%)</td>
<td>2.38 (0.56, 10.16)</td>
</tr>
<tr>
<td>Decrease</td>
<td>Unknown</td>
<td>2 (0.7%)</td>
<td>2 (0.3%)</td>
<td>1.43 (0.20, 10.29)</td>
</tr>
<tr>
<td>Same</td>
<td>Unknown</td>
<td>5 (1.7%)</td>
<td>2 (0.3%)</td>
<td>3.57 (0.68, 18.73)</td>
</tr>
<tr>
<td>Unknown</td>
<td>Same</td>
<td>8 (2.7%)</td>
<td>6 (0.8%)</td>
<td>1.91 (0.65, 5.63)</td>
</tr>
<tr>
<td>Unknown</td>
<td>Unknown</td>
<td>7 (2.4%)</td>
<td>7 (1.0%)</td>
<td>1.43 (0.49, 4.18)</td>
</tr>
<tr>
<td>Decrease</td>
<td>Same</td>
<td>8 (2.7%)</td>
<td>23 (3.2%)</td>
<td>0.50 (0.22,1.15)</td>
</tr>
<tr>
<td>Same</td>
<td>Same</td>
<td>121 (41.6%)</td>
<td>172 (23.5%)</td>
<td>Reference</td>
</tr>
<tr>
<td>Maternal Interview</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>---------------------</td>
<td></td>
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</tr>
<tr>
<td><strong>1. Study arm?</strong></td>
<td></td>
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</tr>
<tr>
<td>☐ Case ☐ Control</td>
<td></td>
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</tr>
<tr>
<td><strong>2. Hospital</strong></td>
<td></td>
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<td>[ ]</td>
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<tr>
<td><strong>3. Study Number:</strong></td>
<td></td>
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<td>[ ]</td>
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<tr>
<td><strong>4. Date of Interview:</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>DD/MM/YYYY [ ] / [ ] / [ ]</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>5. Interviewer</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[ ]</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>6. Who else is present during the interview?</strong></td>
<td></td>
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<tr>
<td>[ ]</td>
<td></td>
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</tr>
</tbody>
</table>
Inclusion Criteria

7. Cases: Is gestation greater than or equal to 28 weeks at the time of the stillbirth? (Not at time of birth)
   - Yes
   - No

8. Cases: Did the stillbirth occur 1-6 weeks prior to the interview? (Not eligible if more than 6 weeks previously)
   - Yes
   - No

9. Controls: Is the gestation within 2 weeks of the gestation specified at the time of interview (or at birth if already given birth)?
   - Yes
   - No

10. Gestational age?
    - Weeks
    - Days

11. Singleton pregnancy?
    - Yes
    - No

12. Major fetal abnormality?
    - Yes
    - No

13. Consent form signed?
    - Yes
    - No

14. Fluent in English?
    - Yes
    - No

If not fluent in English, was an interpreter used?
Maternal Demographics

15. What is your date of birth?

DD/MM/YYYY

16. Which country were you born in?


17. If not the United Kingdom: how many years have you lived in the UK?

Years

Months

18. If not the United Kingdom: what is your immigration status?

- UK National
- EEA National
- Discretionary leave to remain
- Indefinite leave to remain
- Study Visa
- Work Visa
- Husband/ Wife Sponsorship
- Asylum seeker awaiting decision
- Refugee
- Humanitarian Protection
- Declined to answer

19. How do you describe your ethnicity?

- White- British
- Irish
- Gypsy or Irish traveller
- Any other white background
- Black/ Black British
- African
- Caribbean
- Any other black background
- Asian/ Asian British
- Indian
- Pakistani
- Bangladeshi
- Chinese
- Any other Asian background
- Multiple ethnic group
- White & Black Caribbean
- White & Black African
- White & Asian
- Any other multiple ethnic background
- Declined to answer
20. What is the postcode of your usual residential address? (At the time of the interview).

21. Which of the following best describes the place you live in? (Lived in most of the time during your pregnancy).

- Own house
- Private rental
- Council/Housing Association rental
- Stay with family or friends
- No fixed address
- Other (please specify)

22. How many people usually live in your house? (The house you lived in during your pregnancy).

- Couples (including yourself)
- Children under 10 years
- Other adults and children over 10 years

23. How many bedrooms does your house have? (The house you lived in during your pregnancy).

- Number of bedrooms

24. Do you feel your house is large enough for your family’s needs? (The house you lived in during your pregnancy).

- Yes
- No

25. What is your highest educational qualification? (Please tick one answer only).

- None
- GCSE level (GCSE, O Level, Standards)
- A level (A, AS, S-level, Highers)
- Undergraduate (Diploma)
- Graduate (Degree, BSc, BA)
- Post-graduate (MSc, MA, PhD)
- Vocational education (NVQ, HNC, HND)
26. What was your work situation prior to this pregnancy? (Please tick one answer only).

- Full time work (over 30 hours per week)
- Part time work (includes casual work)
- Student
- Housewife
- Unemployed
- Long-term sickness benefit
- Other (please specify)

27. What was your work situation in the last month? (before your baby died). (Please tick one answer only).

- Full time work (over 30 hours per week)
- Part time work (includes casual work)
- Student
- Housewife
- Unemployed
- Long-term sickness benefit
- Off-work due to pregnancy complications
- Maternity leave
- Other (please specify)

28. If you are currently on maternity leave, how many weeks were you when you began your maternity leave?

Weeks

29. Do you or have you ever worked regular night shifts?

- Yes
- No

Please give details

30. Do you consider your work to be of a physical nature?

- Yes
- No

Please add details
31. What was your partner’s (not necessarily father of your baby) work situation in the last month? (before your baby died) (Please tick one answer only).

- Full time work (over 30 hours per week)
- Part time work (includes casual work)
- Student
- Home maker
- Unemployed
- Long term sickness benefit
- Other/unknown/no partner

32. What is your combined household income?

- <£10,000
- £10,000-£14,999
- £15,000-£19,999
- £20,000-£24,999
- £25,000-£29,999
- £30,000-£39,999
- £40,000-£49,999
- £50,000-£59,999
- £60,000-£74,999
- £75,000+
### Relationships

33. What is your marital status? (Please tick one answer only).
- [ ] Single
- [ ] Married
- [ ] Cohabiting

34. How old is the father of your baby?
- [ ] Age in years
- [ ] Don't know

35. How would he describe his ethnicity?
- [ ] Unknown
- [ ] White- British
- [ ] Irish
- [ ] Gypsy or Irish traveller
- [ ] Any other white background
- [ ] Black/ Black British
- [ ] African
- [ ] Caribbean
- [ ] Any other black background
- [ ] Asian/ Asian British
- [ ] Indian
- [ ] Pakistani
- [ ] Banladeshi
- [ ] Chinese
- [ ] Any other Asian background
- [ ] Multiple ethnic group
- [ ] White & Black Caribbean
- [ ] White & Black African
- [ ] White & Asian
- [ ] Any other multiple ethnic background
- [ ] Declined to answer

36. Is this your first pregnancy with this father?
- [ ] Yes
- [ ] No
37. How long had you had a relationship with the father of your baby when you conceived?

- Conceived on first episode of intercourse
- Less than 6 months
- 6-12 months
- More than 1 year
- Declined to answer

38. Are you related to the father of your baby? (Other than by marriage).

- Yes
- No

If yes what relation are you to each other?
### General Health and Past History

39. Did you have any medical conditions before the start of your pregnancy? (Please tick all relevant answers).

<table>
<thead>
<tr>
<th>Condition</th>
<th>Ticked</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Anaemia (prior to booking Hb&lt;10g/L)</td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td></td>
</tr>
<tr>
<td>Cervical surgery</td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td></td>
</tr>
<tr>
<td>Diabetes type 1- Insulin dependent</td>
<td></td>
</tr>
<tr>
<td>Diabetes type 2</td>
<td></td>
</tr>
<tr>
<td>Epilepsy</td>
<td></td>
</tr>
<tr>
<td>Heart condition- congenital</td>
<td></td>
</tr>
<tr>
<td>Heart condition- rheumatic</td>
<td></td>
</tr>
<tr>
<td>Hypertension- Essential</td>
<td></td>
</tr>
<tr>
<td>Hyperthyroid</td>
<td></td>
</tr>
<tr>
<td>Hypothyroid</td>
<td></td>
</tr>
<tr>
<td>Inflammatory bowel disease (Crohn's disease or ulcerative colitis)</td>
<td></td>
</tr>
<tr>
<td>Polycystic ovarian syndrome</td>
<td></td>
</tr>
<tr>
<td>Psychiatric disorder (other than depression)</td>
<td></td>
</tr>
<tr>
<td>Renal disease</td>
<td></td>
</tr>
<tr>
<td>Sickle cell disease</td>
<td></td>
</tr>
<tr>
<td>Systemic lupus erythematosus</td>
<td></td>
</tr>
<tr>
<td>Thalassaemia</td>
<td></td>
</tr>
<tr>
<td>Thrombophilia</td>
<td></td>
</tr>
<tr>
<td>Urinary tract infections (recurrent)</td>
<td></td>
</tr>
<tr>
<td>Uterine abnormality</td>
<td></td>
</tr>
<tr>
<td>Uterine surgery</td>
<td></td>
</tr>
<tr>
<td>Venous thromboembolism</td>
<td></td>
</tr>
<tr>
<td>Other medical condition</td>
<td></td>
</tr>
</tbody>
</table>

40. Did you have fertility treatment to get pregnant with your baby?

- Yes
- No
41. If yes, what was the treatment? (Please tick one answer only).

- [ ] Artificial insemination
- [ ] Ovulation induction
- [ ] IVF
- [ ] GIFT
- [ ] ICSI
- [ ] Other (please specify)

42. Have you ever been pregnant before?

- [ ] Yes
- [ ] No
## Pregnancy History

### 43. If yes how many pregnancies were:

- Miscarriages or ectopic pregnancies in the first 12 weeks of pregnancy
- Miscarriages or ectopic pregnancies between 13 and 24 weeks of pregnancy
- Surgical termination of pregnancy below 14 weeks
- Medical termination of pregnancy below 14 weeks
- Surgical termination of pregnancy between 15 and 24 weeks of pregnancy
- Medical termination of pregnancy between 15 and 24 weeks of pregnancy
- Termination of pregnancy after 24 weeks

### 44. How many other pregnancies have you had?

### 45. If yes, can you tell me about your other pregnancies and births?

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>Gestation</th>
<th>Birth weight (in grams)</th>
<th>Mode of delivery</th>
<th>Outcome (LB/SB/NND)</th>
<th>Were there any complications?</th>
</tr>
</thead>
</table>

### 46. If yes, can you tell me about your other pregnancies and births?

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>Gestation</th>
<th>Birth weight (in grams)</th>
<th>Mode of delivery</th>
<th>Outcome (LB/SB/NND)</th>
<th>Were there any complications?</th>
</tr>
</thead>
</table>
### 47. If yes, can you tell me about your other pregnancies and births?

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>Gestation</th>
<th>Birth weight (in grams)</th>
<th>Mode of delivery</th>
<th>Outcome (LB/SB/NND)</th>
<th>Were there any complications?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 48. If yes, can you tell me about your other pregnancies and births?

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>Gestation</th>
<th>Birth weight (in grams)</th>
<th>Mode of delivery</th>
<th>Outcome (LB/SB/NND)</th>
<th>Were there any complications?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 49. If yes, can you tell me about your other pregnancies and births?

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>Gestation</th>
<th>Birth weight (in grams)</th>
<th>Mode of delivery</th>
<th>Outcome (LB/SB/NND)</th>
<th>Were there any complications?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 50. If yes, can you tell me about your other pregnancies and births?

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>Gestation</th>
<th>Birth weight (in grams)</th>
<th>Mode of delivery</th>
<th>Outcome (LB/SB/NND)</th>
<th>Were there any complications?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Antenatal care in this pregnancy

51. How many weeks pregnant were you when you first saw a health professional about this pregnancy?

Weeks

52. Who did you first see? (Please tick one answer only).

- GP
- Midwife
- Infertility specialist
- Hospital obstetrician
- Family planning clinic
- Pharmacist
- Nurse
- Private obstetrician

Other (please specify)

53. Did you have morning sickness during this pregnancy?

- Yes
- No

54. If yes, were you admitted to hospital due to your vomiting?

- Yes
- No

If yes, how many times?

55. Did you have any of these common illnesses/problems during your pregnancy? (Please tick all relevant answers).

<table>
<thead>
<tr>
<th>Illness/Problem</th>
<th>Anytime during your pregnancy</th>
<th>In the last two weeks of your pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>High fever</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Runny nose/sore throat/swollen glands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cough with phlegm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diarrhoea and/or vomiting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequent urge to urinate and/or pain on urinating</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

56. Were you unwell in any other way in the last 2 weeks of your pregnancy?

- Yes
- No

If yes, please describe
57. Did you have any vaginal bleeding in your pregnancy? (Please tick one answer only).

- No bleeding
- Single episode <20 weeks gestation
- Recurrent bleeds <20 weeks gestation
- Single episode >20 weeks gestation
- Recurrent bleeds >20 weeks gestation
- Recurrent bleeds throughout
- Unsure

58. During your pregnancy, did you take any antibiotics?

- Yes
- No
- Unsure

If yes, what antibiotics and what did you have them for?

59. How many weeks pregnant were you when you took the antibiotics? (If more than one course of antibiotics, record gestation of the most recent course).

Weeks
**Personal Habits**

60. Do you currently smoke? (Please tick one answer only)

- [ ] Yes
- [ ] No, stopped in pregnancy
- [ ] No, stopped prior to pregnancy
- [ ] No, never smoked

61. If yes, what do you smoke and what is the average amount per day?

<table>
<thead>
<tr>
<th>Smoke cigarettes</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoke roll ups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoke cannabis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chew tobacco</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use shisha</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Average amount per day

62. If you smoked at any time during pregnancy, how much a day on average did you smoke?

Amount per day

63. If you stopped smoking during pregnancy, how many weeks pregnant were you when you stopped?

Weeks

64. Did you use any nicotine-replacement products during pregnancy?

- [ ] Electronic cigarettes
- [ ] Nicotine gum
- [ ] Nicotine inhalators
- [ ] Nicotine lozenges
- [ ] Nicotine microtabs
- [ ] Nicotine nasal spray
- [ ] Nicotine patches
- [ ] Other (please specify)

65. Have you changed you smoking habits during your pregnancy?

- [ ] Yes
- [ ] No

If so, what have you changed?
66. If you have stopped or reduced smoking during pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

- Midwife
- GP
- Hospital doctor
- Friend/relative
- Internet
- Magazine
- Pregnancy book
- TV

Please add details

67. Does your partner smoke?
- Yes
- No
- No partner

68. Does anyone else living in your house smoke?
- Yes
- No
- No partner

69. On average, how many standard alcoholic drinks (if any) do you have each week during your pregnancy?

<table>
<thead>
<tr>
<th></th>
<th>&lt; 1 std drink/wk</th>
<th>1-2 std drinks/wk</th>
<th>3-4 std drinks/wk</th>
<th>≥5 std drinks/wk</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the first 3 months of your pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the last month of your pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

70. What was the highest number of standard alcoholic drinks that you had on any one occasion during your pregnancy? (Please tick one answer only).

- None
- 1 to 2
- 3 to 4
- 5 to 10
- greater than 10

71. How many weeks pregnant were you when you had the most drinks?

<table>
<thead>
<tr>
<th>Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Not Known</td>
</tr>
<tr>
<td>--------</td>
</tr>
</tbody>
</table>

72. Have you changed your drinking habits during your pregnancy?

- Yes
- No

If so, what have you changed?

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
</table>
73. If you have changed your alcohol intake during pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

- Midwife
- GP
- Hospital doctor
- Friend/relative
- Internet
- Magazine
- Pregnancy book
- TV

Please add details

74. Have you taken any street drugs during pregnancy?

- Yes
- No

75. If yes, have you used any of the following, if so when?

<table>
<thead>
<tr>
<th>Drug</th>
<th>In the first 3 months of pregnancy</th>
<th>In the last month of pregnancy</th>
<th>In the last week of pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphetamine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amyl Nitrites</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cannabis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cocaine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecstasy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heroin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ketamine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magic Mushrooms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methadone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tranquillisers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (please specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

76. If yes, how often did you use these drugs?

- Daily use
- Weekly use
- Occasional use
- Once only

Other (please specify)
77. Have you changed your drug habits during your pregnancy?

☐ Yes  ☐ No

If so, what have you changed?

78. If you have changed your drug use during pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

☐ Midwife
☐ GP
☐ Hospital doctor
☐ Friend/relative
☐ Internet
☐ Magazine
☐ Pregnancy book
☐ TV

Please add details

79. Have you taken any prescribed medication during your pregnancy?

☐ Yes  ☐ No

80. If yes, please list all the prescribed medication you have taken during your pregnancy?

81. Have you taken any vitamins? If so, which ones.

<table>
<thead>
<tr>
<th></th>
<th>Prior to pregnancy</th>
<th>During the first 3 months of pregnancy</th>
<th>During the last month of pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Folic Acid 400mcg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Folic Acid 5mg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron supplement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-vitamin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-vitamin for pregnant women</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Omega-3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin D 10mcg</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comment

Comment

Comment

Comment
## Perceived Stress Scale

82. The questions in this scale ask you about your feelings and thoughts during the LAST MONTH (before your baby died).

<table>
<thead>
<tr>
<th>Question</th>
<th>Never 0</th>
<th>Almost Never 1</th>
<th>Sometimes 2</th>
<th>Fairly Often 3</th>
<th>Very Often 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How often have you been upset because of something that happened unexpectedly?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. How often have you felt that you were unable to control the important things in your life?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. How often have you felt nervous and “stressed”?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. How often have you felt confident about your ability to handle your personal problems?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. How often have you felt that things were going your way?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. How often have you found that you could not cope with all the things that you had to do?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. How often have you been able to control irritations in your life?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. How often have you felt that you were on top of things?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. How often have you been angered because of things that were outside your control?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. How often have you felt difficulties were piling up so high that you could not overcome them?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other (please specify)
### Diet

#### 83. On average, how often did you eat the following foods in the month before you were pregnant and during the last 4 weeks (before your baby died)?

<table>
<thead>
<tr>
<th>Food</th>
<th>Pre pregnancy</th>
<th>Within the last 4 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice and pasta (1 portion)</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>White bread (1 slice)</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Wholemeal bread (1 slice)</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Crisps (1 bag)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processed meat (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salad vegetables (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green vegetables (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other vegetables (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetable dishes/ foods (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soft drinks (1 glass)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diet soft drinks (1 glass)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chips (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit (1 portion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full fat spread (for 1 slice of bread)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 84. Please write how many per day.

- **Total teaspoons of sugar added each day to cereals, tea, coffee etc (tsp)**
- **Full-fat milk on average consumed per day in drinks, cereals etc (pints)**
- **Semi-skimmed milk on average consumed per day in drinks, cereals etc (pints)**
- **Skimmed milk on average consumed per day in drinks, cereals etc (pints)**
85. How many cups (190mls) of coffee/ tea do you drink per day?

<table>
<thead>
<tr>
<th>Beverage Type</th>
<th>Number of Servings/Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instant coffee</td>
<td></td>
</tr>
<tr>
<td>Brewed coffee (filter/ percolated)</td>
<td></td>
</tr>
<tr>
<td>Decaffeinated coffee (brewed/instant)</td>
<td></td>
</tr>
<tr>
<td>Tea</td>
<td></td>
</tr>
<tr>
<td>Chai tea</td>
<td></td>
</tr>
<tr>
<td>Green tea</td>
<td></td>
</tr>
<tr>
<td>Drinking chocolate</td>
<td></td>
</tr>
<tr>
<td>Energy drinks/ 250ml serving</td>
<td></td>
</tr>
<tr>
<td>Cola (regular/ diet)/ 330ml serving</td>
<td></td>
</tr>
<tr>
<td>Chocolate/ 50g bar</td>
<td></td>
</tr>
</tbody>
</table>

86. Have you changed any aspects of your diet or caffeine intake during your pregnancy?

- [ ] Yes
- [ ] No

If so, what have you changed?

87. If you have changed your diet or caffeine intake during pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

- [ ] Midwife
- [ ] GP
- [ ] Hospital doctor
- [ ] Friend/ relative
- [ ] Internet
- [ ] Magazine
- [ ] Pregnancy book
- [ ] TV

Please add details

...
Sleep Practices

If the main period of sleep is in the day (such as for shift workers) then use the day time for the following questions.

88. On average how many hours actual sleep did you usually get at night? (Hours).

- Before pregnancy
- In the last four weeks* before your baby died
- In the last week*
- Last night*

89. What size bed did you sleep in last night? (the last night before your baby died).
(Please tick one answer only).

- Small single
- Single
- Small double
- Double
- King size
- Superking
- Other - didn't sleep in bed (specify)

90. Did anyone else sleep in the same bed as you last night? (The last night before your baby died).

- Yes, partner
- No
- Yes, other
- Other (please specify)

91. What side of the bed do you usually sleep on?

- Left
- Middle
- Right
- Unsure
92. Which side of the bed did you sleep in last night? (The last night before your baby died).

- Left
- Middle
- Right
- Unsure

93. How many pillows did you usually use at night in the last few weeks? (Before your baby died).

<table>
<thead>
<tr>
<th>No. of pillows</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

94. What position did you usually fall asleep in? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Left side</th>
<th>Back</th>
<th>Right side</th>
<th>Tummy</th>
<th>Variable</th>
<th>Propped up</th>
<th>Don't remember</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the last 4 weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(before your baby</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last night (before</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

95. What position did you usually wake up in? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Left side</th>
<th>Back</th>
<th>Right side</th>
<th>Tummy</th>
<th>Variable</th>
<th>Propped up</th>
<th>Don't remember</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the last 4 weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(before your baby</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last night (before</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

96. Did you change sleep position during the night? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>Possibly once</th>
<th>Possibly twice</th>
<th>More than twice</th>
<th>Lots of times</th>
<th>Don't remember</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the last 4 weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(before your baby</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last night (before</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

97. Would you describe yourself as a restless sleeper (i.e move a lot during the night)? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>A little</th>
<th>Average</th>
<th>More than average</th>
<th>Very restless</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the last 4 weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(before your baby</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last night (before</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

98. Have you EVER been told that you snore, or are you aware that you snore?

- Yes
- No
99. If you have been told you snore, or you have woken yourself up snoring, how often has this happened? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every night</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During the last 4 weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(the 4 weeks before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
107. Were you told you coughed or choked last night? (The last night before your baby died).

Yes  ☐  No  ☐

108. Do your legs twitch or jerk often while you sleep? (Do not count the sudden jerk that sometimes occurs as you fall asleep). (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

109. Did your legs twitch or jerk often while you slept last night? (The last night before your baby died).

Yes  ☐  No  ☐  Don't know  ☐

110. Did you take medication for sleep? (Prescribed medication NOT herbal remedies). (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 weeks ago (before your baby died)</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

111. Did you take medication for sleep last night? (The night before your baby died).

Yes  ☐  No  ☐

112. How would you rate your sleep quality overall? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Very good</th>
<th>Fairly good</th>
<th>Average</th>
<th>Fairly bad</th>
<th>Very bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

113. How often do you feel tired or fatigued AFTER your night’s sleep? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

114. During your WAKE TIME do you feel tired, fatigued or not up to par? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every night</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
115. BEFORE YOUR PREGNANCY how likely were you to doze off or fall asleep in the following situations, in contrast to just feeling tired? (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Situation</th>
<th>Would never doze</th>
<th>Slight chance of dozing</th>
<th>Moderate chance of dozing</th>
<th>High chance of dozing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting and reading</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watching TV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting inactive in a public place (eg cinema, meeting)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As a passenger in a car for an hour without a break</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lying or sitting down to rest in the afternoon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting and talking to someone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting quietly after lunch without alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In a car, while stopped for a few minutes in the traffic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

116. IN THE LAST 4 WEEKS (of pregnancy) how likely were you to doze off or fall asleep in the following situations, in contrast to just feeling tired? Even if you have not done some of these things recently try and work out how they would have affected you. (Please tick one answer per line).

<table>
<thead>
<tr>
<th>Situation</th>
<th>Would never doze</th>
<th>Slight chance of dozing</th>
<th>Moderate chance of dozing</th>
<th>High chance of dozing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting and reading</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watching TV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting inactive in a public place (eg cinema, meeting)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As a passenger in a car for an hour without a break</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lying or sitting down to rest in the afternoon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting and talking to someone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitting quietly after lunch without alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In a car, while stopped for a few minutes in the traffic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

117. On average how many times would you take a nap during the day? (Please tick one answer per line).

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Occasionally</th>
<th>1-2 times/week</th>
<th>3-4 times/week</th>
<th>5-6 times/week</th>
<th>Every day</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last 4 weeks (before your baby died)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
118. Have you changed your sleeping habits during your pregnancy?

[ ] Yes  [ ] No

If so, what have you changed?

119. If you have changed your sleeping habits during your pregnancy following advice, where did you get this advice from? (Please tick all relevant answers).

[ ] Midwife
[ ] GP
[ ] Hospital doctor
[ ] Friend/relative
[ ] Internet
[ ] Magazine
[ ] Pregnancy book
[ ] TV

Please add details
### Fetal Movements

**120. Did anyone give you information about fetal movements during your pregnancy?**

- [ ] No information was given
- [ ] Verbal information
- [ ] Written information

**Other (please specify)**

---

**121. Was there anytime from 26 weeks of pregnancy that your baby's movements were less than usual?**

- [ ] Yes  
- [ ] No
122. If yes, on how many occasions?
- 1
- 2
- 3
- 4 or more

123. If yes, did you speak to a health professional for advice?
- Yes
- No

If did not speak to a health professional, why was that?

124. If yes, did you attend hospital?
- Yes
- No

If you did not attend hospital, why was that?

125. If you did attend hospital, what did they do?

126. In the last 2 weeks did the strength of your baby's movements: (The two weeks before your baby died) (Please tick one answer only).
- Increase
- Decrease
- Stay the same
- Unsure

127. In the last 2 weeks did the frequency of your baby's movements: (The two weeks before your baby died) (Please tick one answer only).
- Increase
- Decrease
- Stay the same
- Unsure

128. During the last 2 weeks, did you notice anytime that your baby was more vigorous than usual? (The two weeks before your baby died).
- Yes
- No

129. If yes, how many times?
- Once
- More than once
130. During the last 2 weeks, did you feel your baby having hiccups? (The two weeks before your baby died).
- Yes
- No
- Unsure

131. If yes, how often?
- Once
- Daily
- Occasionally
- Unsure

132. During the last 2 weeks, did you feel uterine contractions (tightly/ pre-labour contractions/ Braxton Hicks contractions/ false labour) for longer than an hour? (The two weeks before your baby died).
- Yes
- No
- Unsure
<table>
<thead>
<tr>
<th>Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>133. Did you experience any physical injury at any time during your pregnancy? (Please tick all relevent boxes).</td>
</tr>
<tr>
<td>No injury</td>
</tr>
<tr>
<td>Slips and falls</td>
</tr>
<tr>
<td>Road traffic accident</td>
</tr>
<tr>
<td>Blow to abdomen</td>
</tr>
<tr>
<td>Self- harm</td>
</tr>
<tr>
<td>Other non-accidental injury</td>
</tr>
<tr>
<td>Other accidental injury</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>134. If yes, please describe the physical injury.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

| 135. If yes, was this during the last two weeks of your pregnancy? |
| Yes | No |

| 136. Did you see a health professional about your injury? |
| Yes | No |
These questions must be asked only if the woman is on her own

Family Violence

137. Family violence questions not asked as woman was not on her own?
   ○ Yes

138. Family violence questions not asked for other reason (specify)
   

139. Woman declined to answer family violence questions?
   ○ Yes

140. In the past year have you been hurt or frightened by someone close to you?
   ○ Yes  ○ No

141. In the past year have you felt controlled or always criticized in your relationship?
   ○ Yes  ○ No

142. In the past year have you been made to do anything sexual that you did not want to do?
   ○ Yes  ○ No

143. Who in your family controls the money?
   ○ You  ○ Joint- you and your partner
   ○ Your partner  ○ Other family member

144. If disclosure of domestic abuse made, have you followed your local protocol.
   ○ Yes
Finally I would like to ask you some questions about when your baby died.

145. What was the first reason that you thought something was wrong with you pregnancy or that your baby was dying/ had died? (Please tick one answer only).

- I felt a reduction of kicks/ movements
- I felt kicks/ movements stop
- I felt abdominal pain
- I had vaginal bleeding/ haemorrhage
- I had discharge of amniotic fluid/ the membranes ruptured/ my waters had broken
- I had a "feeling that something was wrong", but cannot specify
- I had a trauma (involved in a physical accident)
- I had other symptoms (specify below if possible)
- I was told at an antenatal appointment
- I was told when I was admitted in labour
- I was told during labour
- It was not discovered before my baby was born
- I do not remember/ know

Other (please specify)

146. When do you think your baby died?

DD/MM/YYYY

I do not know when my baby died

147. What time of day do you think your baby died? (Please tick one answer only).

- During the night
- During a daytime nap
- In the morning
- In the afternoon
- In the evening
- Not sure
148. What was the reason you saw a health practitioner at the time that your baby was found to have died?
(Please tick one answer only).

- Routine scheduled pregnancy visit
- Routine scan
- Decreased baby movements
- In labour
- In hospital
- Vaginal bleeding
- Rupture of membranes
- Unwell
- Not recorded/unknown
- Other (please specify)

149. Were you asked if you would like a post-mortem for your baby?

- Yes
- No

150. If yes, did you choose to have a post-mortem?

- Yes
- No

151. If no, what was the main reason you decided against a post-mortem? (Please tick one answer only).

- We already knew why baby had died
- It would not bring baby back
- Did not want baby to be taken away
- Did not want baby to be cut
- Wanted to bury baby as quickly as possible
- Other (please specify)

152. Would you make the same decision about the post-mortem now?

- Yes
- No

153. Is there anything else that you think might be important you would like to tell us about your pregnancy?
MiNESS Feedback Form

Thank you very much for your time and thoughts.

154. How did you feel about being involved in this study?

[Blank]

155. Is there anything else that you would like to add (Anything that you feel was significant, but was not discussed)?

[Blank]
Clinical Data Collection

This data is to be collected FROM THE ANTENATAL RECORD.

Current pregnancy

156. Study Number:

---

157. Date:

DD/MM/YYYY

158. EDD by LMP:

- DD/MM/YYYY
- EDD not known

DD/MM/YYYY

159. EDD by USS:

- DD/MM/YYYY
- USS not done

DD/MM/YYYY

160. Gestation by first USS:

Weeks

Days

161. Best agreed EDD:


162. Height recorded in notes:

- Cms
- Not recorded

Cms
163. First weight in pregnancy:

- Kgs
- Not recorded

Kgs
164. Body Mass Index at booking

165. Gestation at first weight:

Weeks

166. Last weight:

☐ Kgs
☐ Not recorded

Kgs

167. Gestation at last weight:

☐ Weeks
☐ N/A

Weeks

168. Date of first visit with health care professional:

DD / MM / YYYY

169. Estimated gestational age at first visit with health care professional:

Weeks

Days

170. Initial type of maternity care? (Please tick one answer only).

☐ Midwifery-led care
☐ Consultant-led care
☐ Shared care (between consultant and midwife)
☐ Private Obstetrician
☐ Private Midwife
Other (please specify)

171. Referral to obstetric/ medical specialist?

☐ Yes
☐ No
### 172. If yes: (Please tick one answer only).
- Pre-existing condition
- Complication of pregnancy
- Maternal request
- Other (please specify)

### 173. Transfer of care during pregnancy? (e.g. from midwifery-led care to consultant-led care).
- Yes
- No

### 174. Booked place of birth? (Please tick one answer only).
- Tertiary hospital
- Secondary hospital
- Primary birthing unit
- Home
- Other (please specify)

### 175. Number of antenatal visits in 1st trimester (0-12 weeks)? (From antenatal records).
- No.

### 176. Number of antenatal visits in 2nd trimester (13-28 weeks)? (From antenatal records).
- No.

### 177. Number of antenatal visits in 3rd trimester (29-42 weeks)? (From antenatal records).
- Number

### 178. If no antenatal records available, please give details.

### 179. Ultrasound this pregnancy? (Please tick all relevant answers).
- First trimester
- Anomaly scan 18-22 weeks
- Doppler studies
- Growth scan
- None
180. Medical conditions in pregnancy? (Please tick all relevant answers).

<table>
<thead>
<tr>
<th>Condition</th>
<th>Box</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Anaemia</td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td></td>
</tr>
<tr>
<td>Cervix surgery</td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td></td>
</tr>
<tr>
<td>Diabetes - before pregnancy</td>
<td></td>
</tr>
<tr>
<td>Epilepsy</td>
<td></td>
</tr>
<tr>
<td>Essential hypertension</td>
<td></td>
</tr>
<tr>
<td>Gestational diabetes - developed during pregnancy</td>
<td></td>
</tr>
<tr>
<td>Heart condition- congenital</td>
<td></td>
</tr>
<tr>
<td>Heart condition- rheumatic</td>
<td></td>
</tr>
<tr>
<td>Hypertension / Pre-eclampsia</td>
<td></td>
</tr>
<tr>
<td>Hyperthyroid</td>
<td></td>
</tr>
<tr>
<td>Hypothyroid</td>
<td></td>
</tr>
<tr>
<td>Inflammatory bowel</td>
<td></td>
</tr>
<tr>
<td>Laparotomy</td>
<td></td>
</tr>
<tr>
<td>Other autoimmune</td>
<td></td>
</tr>
<tr>
<td>Renal disease</td>
<td></td>
</tr>
<tr>
<td>Rheumatic heart</td>
<td></td>
</tr>
<tr>
<td>Major psychiatric disorder (Other than depression)</td>
<td></td>
</tr>
<tr>
<td>Sickle cell crisis</td>
<td></td>
</tr>
<tr>
<td>Systemic lupus erythematosus</td>
<td></td>
</tr>
<tr>
<td>Thalassaemia trait</td>
<td></td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td></td>
</tr>
<tr>
<td>Uterine abnormality</td>
<td></td>
</tr>
<tr>
<td>Venous thromboembolism</td>
<td></td>
</tr>
</tbody>
</table>

Other (please specify)

---

181. Blood pressure at booking?

<table>
<thead>
<tr>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic</td>
<td></td>
</tr>
<tr>
<td>Diastolic</td>
<td></td>
</tr>
</tbody>
</table>

182. Last blood pressure prior to interview (controls) or when baby was last known to be alive (cases)?

<table>
<thead>
<tr>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weeks</td>
<td></td>
</tr>
<tr>
<td>Days</td>
<td></td>
</tr>
</tbody>
</table>
183. Was a customized growth chart used?
☐ Yes ☐ No ☐ Don't know

184. Was fetal growth restriction clinically suspected?
☐ Yes ☐ No

185. If yes, gestation first suspected?

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Days</th>
</tr>
</thead>
</table>

186. If yes, were growth scan(s) done?
☐ Yes ☐ No

187. Was there evidence on the growth scan of fetal growth restriction?
☐ Yes AC < 10%
☐ Yes EFW < 10%
☐ No

188. If yes, what was the management? (Please tick all relevant answers).
☐ No change
☐ Increased antenatal visits
☐ Serial cardiotocography (CTG's)
☐ Ultrasound scan
☐ Doppler's
☐ Admitted
☐ Delivered

Other (please specify)

189. Admitted with threatened preterm labour in this pregnancy?
☐ Yes ☐ No ☐ Don't know
190. Blood group?
- A Pos
- B Pos
- AB Pos
- O Pos
- A Neg
- B Neg
- AB Neg
- O Neg
- Not known

191. Hep B status?
- Positive
- Negative
- Not known

If not known

192. HIV status?
- Positive
- Negative
- Not known

If not known

193. HbA1c performed?
- Yes
- No

194. If yes:

Result

Gestation

195. GTT performed?
- Yes
- No

196. If yes:

Fasting

1 hour

2 hour

Gestation

Fasting

1 hour

2 hour

Gestation
197. Baby's date of birth?

DD/MM/YYYY

198. Place of birth?

- Tertiary/ secondary hospital
- Birthing unit
- Home
- Other (please specify)

199. Birth weight in grams?

Grams

200. Gestation at birth (for controls) or at DIAGNOSIS of stillbirth (for cases):

- Weeks
- Days

201. Sex of baby?

- Male
- Female

202. Examination of the cord? (Please tick all relevent answers).

- Normal
- Tight knot/ occluded
- Loose knot
- Cord round neck tightly
- Cord round neck loosely
- Cord round limbs/ body tightly
- Card round limbs/ body loosely
- Torsion or spring like cord
- Marginal/ velamentous insertion
- Hypocoiled
- Thin cord
- Meconium stained
- Tear
- 2 vessels
- Other (please specify)
203. Placenta? (Please tick all relevent answers).

☐ Normal
☐ Retroplacental clot
☐ Gritty/ calcified
☐ Vasa praevia
☐ Offensive odour
☐ Succenturate lobe
☐ Extrachorial/ Circumvallate
☐ Bilobate/ Bilpartite placenta
☐ Placenta accreta
☐ Not examined

Other (please specify)

204. Placental weight in grams?

Grams

Placenta not weighed

205. If placenta was weighed, was it trimmed weight or full weight?

☐ Trimmed weight
☐ Full weight
☐ Unsure
<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>206. Date of diagnosis of fetal death?</strong></td>
<td>DD/ MM/YYYY</td>
</tr>
<tr>
<td><strong>207. Date of last consult prior to death where fetus confirmed alive?</strong></td>
<td>DD/ MM/YYYY</td>
</tr>
<tr>
<td><strong>208. New findings at last consult prior to diagnosis of fetal death ?</strong></td>
<td>No new findings, SGA, LGA, Hypertension, Oligohydramnios, Polyhydramnios, APH, Diabetes, Decreased fetal movements, Urinary tract infection, Other (please specify)</td>
</tr>
<tr>
<td><strong>209. When did death occur?</strong></td>
<td>Antepartum, Intrapartum, Unknown whether antepartum/ intrapartum</td>
</tr>
<tr>
<td><strong>210. Post-mortem?</strong></td>
<td>Yes, No</td>
</tr>
<tr>
<td><strong>211. If yes, where was it done? (Attach copy of results if available)</strong></td>
<td>Attach copy of results if available.</td>
</tr>
<tr>
<td><strong>212. Placental pathology?</strong></td>
<td>Yes, No</td>
</tr>
<tr>
<td>213. If yes, where was it done? (Attach copy of results if available).</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 1 (amendment 22.07.14)

214. During the night how often do you have to get up to use the toilet?
Before you were pregnant?

The last four weeks (before your baby died)?

The last week of your pregnancy?

Last night (the night before your baby died)?

215. Since you became pregnant did your level of physical exercise:
- Stay the same
- Become less
- Become more

216. How often have you engaged in vigorous exercise in the last month (the month before your baby died)? Exercise which made you breathe harder or puff or pant, such as tennis, jogging, aerobics, heavy gardening, cycling?
- Never
- Once a week
- 2-3 times a week
- 4-6 times a week
- Daily
- More than once a day

217. If you have engaged in vigorous exercise, on average how long did your exercise last for (in minutes)?
Minutes

218. What type of vigorous exercise have you done?
- Jogging
- Tennis
- Cycling
- Gym class- aerobics
- Spinning
- Weight training- gym
- Swimming
- Other (please specify)
219. How often have you engaged in less vigorous exercise for recreation, sport or health fitness purposes in the last month (the month before your baby died) which did not make you breathe harder or puff or pant?

- Never
- Once a week
- 2-3 times a week
- 4-6 times a week
- Daily
- More than once a day

220. If you did engage in less vigorous exercise, what type of exercise have you done?

Other (please specify)

221. From the anomaly scan, please record placental position.

- Anterior- high
- Anterior- low
- Posterior- high
- Posterior- low
- Fundal
- Lateral
- Low lying
- Other (please specify)
<table>
<thead>
<tr>
<th>Item No</th>
<th>Item</th>
<th>Recommendation</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Title and abstract</td>
<td>(a) Indicate the study’s design with a commonly used term in the title or the abstract</td>
<td>Page 1 Lines 1-2 + Page 2 Line 27</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Provide in the abstract an informative and balanced summary of what was done and what was found</td>
<td>Page 2 Lines 25-49</td>
</tr>
<tr>
<td>2</td>
<td>Introduction</td>
<td>Explain the scientific background and rationale for the investigation being reported</td>
<td>Page 4-5 Lines 72-94</td>
</tr>
<tr>
<td>3</td>
<td>Objectives</td>
<td>State specific objectives, including any prespecified hypotheses</td>
<td>Page 4-5 Lines 94-96</td>
</tr>
<tr>
<td>4</td>
<td>Methods</td>
<td>Present key elements of study design early in the paper</td>
<td>Page 4-5 Lines 93-108</td>
</tr>
<tr>
<td>5</td>
<td>Setting</td>
<td>Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection</td>
<td>Page 5 Lines 98-102 and Ref #13</td>
</tr>
<tr>
<td>6</td>
<td>Participants</td>
<td>(a) Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls</td>
<td>Page 5 Lines 102-109 and Ref #14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) For matched studies, give matching criteria and the number of controls per case</td>
<td>N/A</td>
</tr>
<tr>
<td>7</td>
<td>Variables</td>
<td>Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable</td>
<td>Page 5 Lines 110-117</td>
</tr>
<tr>
<td>8</td>
<td>Data sources/measurement</td>
<td>For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group</td>
<td>Page 5 Lines 110-117 and Page 6 129-137 (Derivation of FM variable)</td>
</tr>
<tr>
<td>9</td>
<td>Bias</td>
<td>Describe any efforts to address potential sources of bias</td>
<td>Page 7 Lines 143-149 and Page 10-11 Lines 229-244</td>
</tr>
<tr>
<td>10</td>
<td>Study size</td>
<td>Explain how the study size was arrived at</td>
<td>In Ref #14</td>
</tr>
<tr>
<td>11</td>
<td>Quantitative variables</td>
<td>Explain how quantitative variables were handled in the analyses. If N/A</td>
<td></td>
</tr>
</tbody>
</table>
### Statistical methods

<table>
<thead>
<tr>
<th>12</th>
<th>(a) Describe all statistical methods, including those used to control for confounding</th>
<th>Page 6-7 Lines 120–150</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(b) Describe any methods used to examine subgroups and interactions</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>(c) Explain how missing data were addressed</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>(d) If applicable, explain how matching of cases and controls was addressed</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>(e) Describe any sensitivity analyses</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Results

#### Participants

<table>
<thead>
<tr>
<th>13*</th>
<th>(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed</th>
<th>Page 7 Lines 152-158, Figure 1 and Ref #14</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(b) Give reasons for non-participation at each stage</td>
<td>See above</td>
</tr>
<tr>
<td></td>
<td>(c) Consider use of a flow diagram</td>
<td>Figure 1</td>
</tr>
</tbody>
</table>

#### Descriptive data

<table>
<thead>
<tr>
<th>14*</th>
<th>(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders</th>
<th>Page 7-8 Lines 159-172 &amp; Table 1 in Ref #14</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(b) Indicate number of participants with missing data for each variable of interest</td>
<td>Table 1</td>
</tr>
</tbody>
</table>

#### Outcome data

| 15* | Report numbers in each exposure category, or summary measures of exposure                                                        | Page 7 Lines 156-157 |

#### Main results

<table>
<thead>
<tr>
<th>16</th>
<th>(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included</th>
<th>Tables 1 and 2 Pages 8-9 Lines 174-202</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(b) Report category boundaries when continuous variables were categorized</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period</td>
<td>N/A</td>
</tr>
</tbody>
</table>

#### Other analyses

| 17  | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | N/A |

### Discussion

#### Key results

| 18  | Summarise key results with reference to study objectives                                                                        | Page 9 Lines 209-215 |

#### Limitations

| 19  | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | Page 10 Lines 217-250 |

#### Interpretation

| 20  | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other | Page 11 Lines 252- |
relevant evidence

| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | Page 11-13 Lines 252-296 |

**Other information**

| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | Page 3 Lines 66-67 |

*Give information separately for cases and controls.