“I’m not doing what I should be doing as a midwife”: An ethnographic exploration of central fetal monitoring and perceptions of clinical safety.

Abstract

Background

Central fetal monitoring systems transmit cardiotocograph data to a central site in a maternity service. Despite a paucity of evidence of safety, the installation of central fetal monitoring systems is common.

Aim

This qualitative research sought to explore whether, and how, clinicians modified their clinical safety related behaviours following the introduction of a central monitoring system.

Methods

An Institutional Ethnographic enquiry was conducted at an Australian hospital where a central fetal monitoring system had been installed in 2016. Informants (n = 50) were midwifery and obstetric staff. Data collection consisted of interviews and observations that were analysed to understand whether and how clinicians modified their clinical safety related behaviours.

Findings

The introduction of the central monitoring system was associated with clinical decision making without complete clinical information. Midwives’ work was disrupted. Higher levels of anxiety were described for midwives and birthing women. Midwives reported higher rates of intervention in response to the visibility of the cardiotocograph at the central monitoring station. Midwives described a shift in focus away from the birthing woman towards documenting in the central monitoring system.

Discussion

The introduction of central fetal monitoring prompted new behaviours among midwifery and obstetric staff that may potentially undermine clinical safety.

Conclusion

This research raises concerns that central fetal monitoring systems may not promote safe intrapartum care. We argue that research examining the safety of central fetal monitoring systems is required.

Keywords: behaviour, cardiotocography, central monitoring, electronic fetal monitoring, parturition, safety

Issue

Central fetal monitoring systems are widely used and are often assumed to improve perinatal outcomes.

What is already known

Three small studies show central fetal monitoring did not improve perinatal outcomes. The effect of central fetal monitoring systems on the clinical safety behaviours of clinicians has not been studied.

What this paper adds

Following the introduction of a central fetal monitoring system clinicians modified their behaviours in ways which might potentially undermine clinical safety.

Introduction

The objective of intrapartum cardiotocograph (CTG) monitoring is the prevention of perinatal death or injury. Evidence does not demonstrate that intrapartum CTG monitoring is able to achieve these outcomes (1, 2). The use of additional technology, such as central fetal monitoring, has been proposed as a means to improve the efficacy of intrapartum CTG monitoring.

Central fetal monitoring systems transmit digitised CTG data from the birthing woman's location to a site typically located centrally within the maternity service where it is displayed (3). Central fetal monitoring systems are assumed to offer enhanced oversight, reducing the possibility that a clinician might fail to respond to a significant abnormality in the fetal heart rate pattern thus making intrapartum care safer (3). Advertising materials from providers of central monitoring systems suggest that improved outcomes can be expected when using their product (4). Central fetal monitoring technologies have been widely introduced in high-income countries, particularly in large metropolitan hospitals, and continue to be rolled out.

Research on the use of such systems is sparse. To date, there have been no randomised controlled trials investigating the impact of central fetal monitoring technologies on the safety of intrapartum care. Three non-experimental studies have been conducted, each observing the effects of removing a previously installed central monitoring system (5-7). Two of these studies were conducted in North America, one observing outcomes from 1,622 women (5) and the other 6,519 women (6). The third was an Australian study that included outcomes from 2,855 women (7). No change in perinatal outcomes were reported in any of the studies. In two of the studies, higher rates of caesarean section and instrumental birth occurred when central fetal monitoring was in use (5, 7).

Importantly, the Australian study reported a reduction in the time clinicians spent in the presence of the birthing woman when central monitoring was available (7). Irish research has reported that when the birth unit was busy, midwives perceived that the presence of

central fetal monitoring facilitated their ability to move in and out of birth rooms caring for multiple women (8). Reducing the time midwives spend with birthing women may have consequences for the safety of care provision extending beyond a focus on the fetus. Both these studies support the hypothesis that central fetal monitoring systems may enable clinicians to modify their behaviour.

Approaches to improving clinical safety typically focus on the introduction, modification, or removal of treatments or technologies (9). The social behaviours of clinicians, sometimes referred to as non-technical skills or human factors, are also critical components in ensuring a safe healthcare environment (10) yet are often overlooked. Many of the mechanisms identified as supporting safety in maternity care relate to the social behaviours of clinicians, such as respectful communication, interdependency, and collegial conduct (11). It is therefore important to question whether central fetal monitoring systems are associated with modifications in clinicians' behaviours, and whether these modified behaviours are beneficial, harmful, or neutral.

Aim

The aim of this research was to explore and describe if, and how, maternity clinicians modified their safety related behaviours in the provision of intrapartum care after the introduction of a central fetal monitoring system. This research was part of a larger doctoral project which sought to examine issues of interprofessional power in relation to the use of a central fetal monitoring system (12).

Research Design

Methodology: Institutional Ethnography

Institutional Ethnography (IE) is a qualitative critical feminist methodology that examines how peoples' everyday lives are co-ordinated by institutional processes (13). Work is a central concept in IE, and is defined generously as "anything done by people that takes time and

effort, that they mean to do, that is done under definite conditions and with whatever means and tools, and that they may have to think about" (13, p. 10). Work in maternity care is a social event, as midwives and obstetric staff work in teams to provide clinical care. This work is socially organised to enable individual people to contribute to a cohesive social process (13).

An IE seeks to understand how particular social events are socially organised, and therefore what shapes the event to occur the way it does. Using IE made it possible for us to focus on safety related behaviours and to explain how these behaviours occurred as they did. In this paper, we focus on describing clinician behaviours relating to the safety of maternity care provision. How these behaviours were socially organised will be considered in a later publication.

Setting

Data were collected in a metropolitan Australian hospital with over 5,000 births annually. The maternity and neonatal service of the hospital provided tertiary level care and was a training site for nursing, midwifery, and medical students, along with providing training for specialist obstetricians. One-on-one midwifery care was provided for each birthing woman during labour, birth, and the first few hours after birth. Two senior midwives, the team leader and the clinical midwife, oversaw the work of the midwives. Obstetric staff included a resident and registrar who were usually present, and an on-call consultant who was not always physically on-site.

In 2016, a K2 Medical Systems central fetal monitoring system was installed. Each birth room had a Phillips CTG monitor connected to a K2 portal. The CTG could be seen on the K2 portal and additional information could be entered either via touch screen or keyboard. K2 Medical Systems Guardian software generated the digital CTG, overlaid with annotations entered by clinicians, and Athena software functioned as an electronic health record for intrapartum care provision. The digital CTG and other data entered within the birth room

were projected to a central staff room where data from all birthing women were visible on a large monitor screen. Ninety percent of birthing women were monitored by CTG and their annotated CTG was displayed on the central monitor.

Informants

Fifty informants contributed to the generation of interview and clinical practice observation data. The largest group of informants were midwives (n = 34), as they were the largest professional group in the service. These informants represented midwives and final year midwifery students who interacted with the K2 system in all roles within the service. The remaining informants were doctors (n = 16), and included those yet to commence specialist training, those in training, and consultant staff of varying levels of seniority. Informants were recruited during education and shift change meetings. Some informants participated in both interviews and observations.

Data Collection

Data collection occurred from February to November 2018 and included one-to-one interviews, focus groups, and observations of clinicians as they interacted with the central fetal monitoring system (see Table for further information). Interviews were semi-structured and commenced by asking informants to describe how they worked with the central monitoring system. Interviews were digitally recorded.

Observations were conducted at the central monitoring station, in meetings where data from the K2 system was discussed or fetal monitoring education was provided, and by observing the clinical practice of seven clinicians as they worked. Field notes were recorded by hand and transcribed into a Word document as soon as possible, typically the same day. Preliminary findings from interviews were used to direct attention during observational data collection. Observations in clinical areas focused on recording clinicians' interactions with

the central fetal monitoring system, and with other clinicians in relation to information stored in and displayed by the central monitoring system.

[Table here]

Data Analysis

Analytical considerations shaped every stage of the research (14). Data storage and collation made use of NVivo software (Mac version 12). Data were indexed (15), identifying data about a particular work behaviour to gather them together. The indexed data were read repeatedly and considered in light of the research aim. “Analytical chunks” (15) were written, focusing on generating rich descriptions of particular behaviours. An iterative process of returning to the data and rewriting generated the findings reported here.

Ensuring research rigour and reflexivity

Care was taken to ensure informants’ data were captured and reported accurately. Particular aspects of working with the central monitoring system were checked with several informants, and where possible these aspects were also observed. The primary author is a specialist obstetrician with significant clinical experience of working with intrapartum fetal monitoring, but no direct experience of working with central fetal monitoring systems. This author kept a reflexive journal through the conduct of this research and met regularly with the co-authors who supervised all stages of the research. Regular meetings with a group of researchers with expertise in IE ensured methodological alignment.

Ethics

Obligations under the Australian Code for the Responsible Conduct of Research (16) were met. Both the hospital’s research ethics committee (HREC/17/XXX/313) and XXX University (2018/098) approved the research. Written consent was obtained prior to participation in interviews and clinical practice observation. When observation at the central monitoring

station was in progress, signs were placed at the entry to this area indicating that data collection was in progress and that clinicians were able to ask to suspend data collection if they wished. No one requested this. Birthing women and their support people were at times present in the field of observation. It was considered inappropriate to request written consent from birthing women and their support people as this would disrupt clinical care, and because data about or from birthing women was not sought. Verbal permission to enter the room was requested by either the researcher or the clinician being observed.

Interview recordings were transcribed, and identifying information removed prior to analysis. We identify informants by profession only, and use the singular “they” pronoun, rather than gendered pronouns, as there was a dominance of female informants and identifying an informant as male would risk their confidentiality.

Funding and conflicts of interest.

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Findings

Our analysis identified several new behaviours which commenced with the introduction of the central monitoring system. During interviews, all midwives who provided direct care to birthing women described having witnessed another midwife experience at least one of the behaviours described below or had experienced such behaviours themselves. We describe how some clinicians modified their approach to decision making, and how the heightened visibility of information at the central monitoring station drove episodes of work interruption. We also relate midwives reports that central monitoring contributed to fear and loss of confidence, led pressure to intervene, and oriented midwives focus toward the technology

rather than the birthing woman. The final section examines potentially beneficial changes to behaviours.

Decision making without all relevant information

Clinicians recognised the importance of considering all relevant information when making clinical decisions. However, those observing the CTG at the central monitor did not have access to the same information as the midwife working with the birthing woman. The following extract from one midwife, articulates this well.

> When you look at the CTG, you've got to look at every aspect of what's going on in the room. Is the woman vomiting? Has she just had an epidural? What is going on to affect everything that you're going to make a decision on? People [watching at the central monitor] have no idea that the woman is moving. They have no idea what's going on.

When making decisions, clinicians sometimes used only the information presented on the central monitoring screen rather than conversing with the birthing woman and her midwife. During a period of observation at the central monitoring station the midwifery team leader explained that their usual process was to “look at it [the CTG] here and decide what we are going to do before we go into the room”. Another midwife supported the claim about care planning happening at the central monitoring station, and went on to express concerns that such an approach negated the ability to provide woman-centred care within a partnership model:

> There's lots of conversations going on about that woman's care and plan without involving the woman and without involving the midwife. They're missing vital people in that care, because the woman's going through that experience and the midwife is caring for her. They don't seem to think it's important to involve them in that discussion.

The visibility of the CTG at the central monitoring station captured and held the attention of midwifery and medical staff, even when they were engaged with other activities. The following events unfolded during the evening shift handover and were recorded in field notes during a period of observation at the central monitoring station:

> Someone had zoomed up one of the CTGs (not the woman being discussed). Handover continued, with one of the obstetric registrars interjecting ‘that trace is looking pretty bad’. They returned to discussing another woman. A midwife walked in to have a drug chart signed and saw the CTG, saying ‘is no one stressing about that CTG?’

Obstetric staff described a sense of responsibility to act on information seen at the central monitor despite not being asked for their assistance by the midwife caring for the woman. This sometimes prompted the obstetric staff to go to the birth room, as this obstetrician related:

> If I am extremely worried [about a CTG] then I feel that you kind of need to go in there. If something is in front of you and it is extremely abnormal then you have to always act on it.

Midwives described occasions when midwifery team leaders also responded to the CTG by entering the birth room when the midwife had not previously requested their presence. Sometimes they attended the room on their own, and on other occasions they accompanied obstetric staff. During an interview, a midwife described a conversation with a colleague who was distressed after a team leader and an obstetric doctor had unexpectedly come to the birth room. The doctor and the team leader discussed the CTG without including the midwife in the conversation:

> One of my midwife colleagues from birth suite burst into tears. She went ‘the team leader and a doctor have just burst into my room. I'm the one looking after the

> woman and the doctor is speaking to the team leader about what's going on. She doesn't know what's going on. I'm the one that knows what's going on.'

Midwives also described instances when team leaders did not come to the birth room when this might be appropriate and related this to the visibility of the CTG at the central monitoring station. It was regular practice for the team leader to come to each birth room on an hourly basis to check in with the midwife, known as rounding. When the team leader was busy, rounding was sometimes replaced by reviewing the CTG at the central monitor. There was an assumption that there was no need to round when the CTG was normal. For example, one midwife explained:

> I find that you've got this over reaction in some situations, and complete under reaction in others. If I've got concerns, I would call, but then of course my fall back would be on the rounding. But because [the team leader] has rounded [at the central monitoring station] and gone, normal, normal, normal, I don't physically see her.

This practice meant that only the CTG and data available at the central monitoring station were reviewed, rather than a comprehensive review considering the birthing woman, her midwife, and others present in the room. This potentially prevented the identification of important clinical information that was not readily accessible at the central monitor. In addition, staff at the central monitor had multiple CTGs to consider simultaneously. One midwife noted this multiplicity of CTG traces created an issue with "not being able to see the wood for the trees". Another described having difficulty accessing assistance as a consequence of the visibility of more than one abnormal CTG, explaining:

> I had come out of the room and asked them to assess my trace, and they looked at it [on the central monitor]. There were four or five traces on the board**.** I was concerned about my trace, but there was someone else who had a trace that was more concerning. They looked at my trace, saying no this is fine. … They didn't consider

> the clinical context. It might be fine for a baby that is term, well grown, and got resilience, but not with a little pretermer.

The combination of multiple CTG traces and limitations on the availability of contextual information at the central monitoring station generated the opportunity for the team leader and obstetric staff to make clinical decisions without considering all relevant information.

Work interruption and disrespectful behaviour

Following the identification of an abnormal or uninterpretable CTG pattern, midwives caring for the woman worked to address the cause. If they were unable to resolve this, midwives then requested assistance from the team leader and / or obstetric staff. Midwives were sometimes interrupted while they worked to address the abnormal fetal heart rate pattern, before they had determined that assistance was appropriate or required. This unrequested arrival of clinicians in the birth room who were also concerned about the CTG trace disrupted midwives' work processes, as this midwife explained:

> Say, for instance, there was a deceleration on a trace, the midwife would generally turn her from side to side, maybe try a new position, maybe do an examination. But before you can get that examination started you've usually got six people in the room.

Midwives had to stop what they were doing in order to acknowledge and respond to the presence of these clinicians. This interview quote provides one example of the additional work midwives performed when someone came to the room:

> If there is an unprovoked doctor at the door, I will step out into the corridor with them, and go, 'what do you want, what do you need?' 'I just want to sign your trace.' 'It doesn't need to be signed, she's a normal risk.' I feel it is my job as a midwife to protect that space.

As quoted in the previous section, the entry of other clinicians into the birth room had brought a midwife to tears. Other midwives reported feeling disrespected and controlled by obstetricians, such as this midwife who commented during an interview:

> It just shows how little respect doctors have for midwives. … I mean I've been a midwife forever. The doctor that's on today, I delivered her older brother. She's been doing it for five minutes and I've been doing it for 30-odd years. But she's still going to feel that she's got to keep control of what I'm doing just in case I don't do the right thing.

Entering the birth room only when invited or after checking that it was appropriate to do so was described by obstetricians as respectful behaviour. In an interview, a senior obstetric registrar described advice they gave to junior staff:

> I always say to them don’t you ever go into a room without knocking and then standing behind the curtain and saying is it a good time to come in or not. … I think it's about being respectful. Be respectful of the space, be respectful of the professional who is in the room, and the woman.

Entering the birth room without being asked to or given permission was therefore considered a form of disrespectful behaviour. An incursion into the birth room was often described by midwives as an over-reaction to the CTG findings and not clinically appropriate given the clinical context in which the CTG pattern arose. During observation at the central monitoring station a midwife related that obstetric staff would sometimes “pile into the room, just you know, with any little wiggle”. Midwives described the uninvited entry of other staff members as disruptive, intrusive, and even chaotic:

> Often times there's already this explosion of things that need to happen and we're going, my god, my whole room just went into chaos because of that thing [the K2 portal] in the corner.

The arrival of a concerned clinician in the room inverted communication processes. The opportunity for the midwife to maintain control over the process of escalating their concerns to the midwifery team leader and/or an obstetrician was negated, and they were put in a position where they had to respond to a clinician who was sometimes argumentative. A team leader explained that sometimes obstetric doctors would "…go into the room bombarding the midwife, her not being aware that they had been questioning the CTG". Another midwife explained the experience of needing to address the forceful communication from a doctor this way:

> The doctor would see a second stage trace, and go, 'we need to get this baby out, the baby needs to come out right now!!' It's like, 'could you calm down?'

Rather than controlling the escalation process, there was a need for the midwife to de-escalate concerns. This was not an easy undertaking, as one midwife explained:

> I've often got to de-escalate which — I get concerned for our recently graduated midwives — because I have found that's a really learned skill, de-escalation. To escalate something is really quite easy, but to de-escalate is a really hard thing to do, because once people are up here [indicating with a hand high in the air], it's really hard to get them back down.

Fear and loss of confidence

For midwives, the presence of the central monitoring system created a sense of being watched by someone who might come through the door at any moment. Midwives inability to control their environment generated stress and heightened vigilance. The following quote by one midwife was typical of the description of this experience:

> It adds fear. You are fearful of anything being wrong. Not because you are worried of the outcome. But because you know that there's things that you can't control.

> Meaning you can't control who comes into the room. You can't control how they are going to talk to the woman.

When a midwife experienced the disruptive entry of a clinician into the birth room, this had the potential to challenge their confidence. During one interview a midwife reflected on a conversation with a senior midwife:

> It is my responsibility to be able to determine if there are decelerations. What that baseline is. That's my responsibility, that's not your responsibility. But you don't come in here and discuss this in that manner in front of the woman. Because you have just undermined my confidence.

Midwives clearly articulated that the disruption to the birth environment caused by the uninvited entry of staff had the potential to negatively impact the woman's labour progress, by undermining the woman's confidence in her midwife. This extract from an interview with a midwife speaks to this concept:

> When you walk past the midwife who's supporting the woman you imply to the woman that she's not competent and then that woman no longer feels safe with the person who's caring for her. We know that a woman's feeling of safety in labour has a massive impact on her. It has an impact on her well-being and her ability to labour.

In addition to disturbing the birthing woman's confidence in her midwife, midwives spoke of women becoming fearful for the wellbeing of their fetus when someone entered the birth room in an unexpected manner. One midwife related a recent experience of this, saying:

> The woman is going to be like 'what is happening? Like, is my baby ok?' ... And that woman, for the next hour and a half was freaking out thinking her baby was going to die.

Pressure to intervene

Midwives described modifying their management of women's labours in an attempt to avoid disruptive entry into the birth room. The first approach described was to limit the birthing woman's movement in order to generate an interpretable CTG. In this interview a midwife reflected on her observations of the practice of a colleague:

> They said 'we really need to get good contact. Otherwise, she can't stay in that position, because they'll be just walking into the room any minute.' Which I found - well, you're actually depriving the woman of any choices of movement, because of the CTG, because of what they're going to say outside.

The next approach described was to use directive coaching of the woman's second stage pushing to hasten the birth. The goal was to reduce the duration of time in which someone might to come to the room, as this midwife described:

> I can see decelerations. I'm not worried about them, but I know someone is going to come in, so I will say to the woman, 'come on, push, push' – because I want to get it over and done with, so that they don't come in.

When the CTG was abnormal or difficult to interpret, midwives faced pressure to place a fetal spiral electrode, and also reported seeing birthing women coerced to accept this intervention. During an observation of a midwife at work, the following events were recorded in the field notes, providing an example of the pressure exerted on the birthing woman and the midwife to use a fetal spiral electrode:

> The team leader came into the room unexpectedly, without knocking, and used directive language to tell the midwife to rupture the woman's membranes and put on a fetal spiral electrode. The team leader explained to the woman that doing this would 'make the contractions more effective', adding that 'I've been doing this for too long – I want to make sure your baby is safe'.

Midwives reported their perception that the introduction of the central monitoring system had increased the rate of obstetric intervention in birth, particularly in the second stage of labour. Midwives suggested that a lack of knowledge about the appearance of the CTG during this stage drove this. This midwife related:

> They [obstetric staff] are not used to seeing normal second stage traces. Because [prior to the adoption of central monitoring] they only got called in when it is abnormal, they are not used to now seeing normal second stage decelerations where the baby is fine. So now they are jumping into rooms and doing assisted births and doing caesarean sections on women where there was nothing wrong before.

No longer focussing on the birthing woman

Being aware of the potential for disruptive intrusions, midwives considered the information visible at the central monitor station and how specific clinicians rostered on the shift might respond to this information. In order to modify the chance that their work would be disrupted, midwives might enter additional annotations which were displayed over the CTG. These annotations assisted the viewer at the central monitor to interpret the CTG, acting as confirmation that the midwife had initiated actions when the CTG was considered abnormal. If the midwife was unable to record annotations, then it was more likely that they would be interrupted. This created a paradox for the midwife who needed to simultaneously attend to both the woman's care, and to the documentation of this care. One midwife explained it like this:

> The midwife is busy doing what she's doing, but she isn't pressing the button to say that she's done them. So outside, there's all these decelerations, and then the doctor will go 'have they done it?' You don't know, because it isn't on [K2], so better go and have a look. So of course, somebody then goes in.

The desire to maintain the birthing woman's privacy generated pressure for midwives to attend to documentation in the central monitoring system promptly. Prioritising data entry undermined midwives' sense of what it meant to be a good midwife:

> I find I'm spending a lot of my time standing at K2. I'm not talking to the woman, I'm not being with woman, and I'm not doing what I should be doing as a midwife.

In a similar way, another midwife reflected on the change in priorities that central monitoring had introduced, noting that priorities had shifted from caring for the birthing woman to serving the needs of obstetric staff and the fetal monitoring technology:

> We are looking to provide woman-centred care. We are not looking to provide doctor-centred care or CTG-centred care. Which is what's happening.

Safety enhancing behaviours?

Clinicians spoke of their belief that the central fetal monitoring system would enhance safety, for example supporting the decision to install the system because "anything that's going to benefit patient safety is worthwhile". When specific examples of safety-enhancing behaviours were sought these related to the ability to observe the CTG outside the birth room and therefore to take action when the CTG was abnormal but not recognised as such by the midwife in the room. For example, an obstetrician described how:

> I feel like anecdotally, and I don't have evidence of this, but anecdotally I feel like I've definitely picked up quite a lot of pathological CTGs that have required significant action that were just completely not picked up. They just weren't recognised as being abnormal by the midwife in the room.

Examples of situations which might lead to failure to recognise or respond to an abnormality were offered, such as this provided by a midwife:

> What if I'm out of the room having a sleep and my student is in there doing something super unprofessional?

Or this example provided by an obstetrician:

> What if everyone's fainted? What if they think that I'm meant to be coming and the phone is not working, or the buzzer is not working.

No instances of midwives sleeping, fainting, or being unable to call for assistance were observed during data collection, suggesting that the examples provided reflected theoretical rather than actual concerns.

Staff were aware that there were periods when no one was observing the CTG at the central monitoring station, and that assuming that someone would notice and respond to an abnormal CTG was problematic, as this midwife described:

> You kind of assume that somebody's watching the CTG. So that you would kind of assume that if the trace is starting to go bad then you do hope that somebody's going to come down and help. But you can't guarantee anybody's looking at your trace and you can't guarantee someone's actually going to come down and help.

Discussion

Central fetal monitoring was introduced with the aim of improving perinatal safety. However, little is known about how such technologies impact clinician's behaviour, care, and the outcomes of that care. The findings of this large qualitative research project demonstrate that clinicians did indeed modify their behaviours as a consequence of the introduction of the central fetal monitoring system. There was evidence that these behaviours may have the potential to undermine safety in clinical care provision.

Professional guidelines highlight the importance of ensuring that interpretation of the fetal heart rate pattern takes into consideration all relevant information (17, 18). Despite this, we

found clinicians sometimes generated management plans without consulting the birthing woman or her midwife. While midwives perceived that at times this led to an absence of appropriate intervention, they more commonly considered that such an omission drove unwarranted intervention. This finding mirror previous research indicating that an over-reliance on technology drives poor clinical decision making (19). The evidence from our study raises questions about the safety of decision-making processes focused primarily on information available from the central monitoring system.

Disruptive entry into the birth room interrupted midwives work, often at a time when they were focused on meeting the dynamic needs of the birthing woman. Interruptions during clinical care provision have previously been shown to threaten the safety of care provision, leading to increased medication errors among nurses (20), and unsafe decision making and longer procedural time for doctors during simulated surgery (21). Disruptive behaviours in the operating theatre have also been linked to an increase in adverse health events (22). Midwives in our research described instances of argumentative and forceful communication during these disruptions. Even mild rudeness reduces diagnostic and therapeutic performance in multi-disciplinary healthcare teams, by reducing help-seeking and information-sharing behaviours (23). Disruptive behaviours are therefore far more than simple annoyances as they have the potential to undermine clinical safety.

Midwives reported feeling fearful and less confident, relating to both the experience of being disrupted and the anticipation that it might occur. One in ten Australian midwives report high levels of fear, and a significant inverse relationship exists between fear and midwives self-reported confidence in their ability to provide intrapartum care (24). Interprofessional conflict has previously been identified as a leading contributor to the erosion of midwives' confidence (25). Professional confidence supports clinical safety as confident clinicians are more likely to challenge unsafe practice (26). Given midwives expressed need to be able to de-escalate when a clinician entered the birth room, the maintenance of professional confidence is vital in ensuring safe practice.

Rates of surgical birth are reported to be higher when central fetal monitoring is in use (5, 7). Three phenomena seen in our findings may contribute to understandings of the mechanisms for these higher rates. First, midwives in our study described that the introduction of central fetal monitoring increased the surgical birth rate, particularly during the second stage of labour. The driver for increased surgical intervention appeared to be the heightened visibility of the CTG at the central monitoring station in the absence of complete clinical information.

Second, in our study midwives perceived that labouring women experienced heightened anxiety and fear as a consequence of disruptions and disrespectful behaviour towards their midwife. Feelings of safety during birth require trust and confidence in the provider, and a sense of control over events (27). Loss of control during labour is associated with fear of birth (28). High levels of anxiety during pregnancy are associated with longer labours and an increased rate of unplanned caesarean birth (29, 30). High levels of catecholamines reduce the release of oxytocin and slow uterine activity and can lead to fetal hypoxia as a consequence of reduced utero-placental blood flow (31, 32). Thus, it is plausible that the behaviours observed in this study may play a part in women experiencing labour dystocia or abnormal fetal heart rate patterns, prompting surgical birth.

Third, it has long been recognised that intrapartum CTG monitoring can restrict women's movement during labour and birth (33). Our findings suggest that the heightened visibility of the CTG created additional pressure for midwives to generate CTG tracings that were easily interpreted by viewers outside the room. This was sometimes achieved by asking the woman to restrict her movements. It has been argued that freedom of movement facilitates progress during labour (34), and therefore restricting movement may disturb labour progress and generate an indication for surgical birth.

Some midwives in our research described that their focus shifted from clinical care provision to documentation. Similar outcomes have been reported regarding the impact of other forms of healthcare technology on nurses' work (35). This represents a shift from safeguarding to

scrutinising and has been described in previous research examining the challenge of providing midwifery care in obstetric dominated settings (36). It is possible that this shift in focus might lead to lack of attention to early and subtle clues of emerging pathology.

Clinicians in our study often described belief that the central monitoring system was enhancing safety, with some obstetricians' experiences suggesting the possibility of improved responses to abnormal CTGs. The continuous presence at the central monitoring system of a clinician able to interpret and act on an abnormal CTG did not occur at all times, however. Case reports describe adverse outcomes that arose when it was incorrectly assumed that someone would be watching at the central monitoring station (37). It is therefore important to not assume that improving the visibility of a CTG recording automatically generates improved perinatal outcomes.

Strengths and limitations

This research used a rigorous qualitative research methodology to generate findings, supported by conversations with other researchers with expertise in IE, within the context of doctoral supervision, and the use of a reflexive research journal. Data were collected using a variety of approaches, from an appropriate sample of informants, during a prolonged period of engagement. It is the first research to have explored the social effects of central fetal monitoring.

The goal in IE is not to produce generalisable knowledge, but to generate a description of the social organisation of the problematic at a specific site and point in time (13). The findings we report here were gathered from a single hospital with a specific central monitoring system and are therefore generalisation of our findings to all sites with central fetal monitoring systems is not appropriate. Given the standardised nature of commercially available central fetal monitoring systems and guidelines regarding intrapartum fetal heart rate monitoring in high-income countries, it is nonetheless our suspicion that similar behaviours are likely occurring in other health services.

While our findings regarding behaviours that related to the introduction of central fetal monitoring are sound, we did not examine quantitative measures of maternal or perinatal safety, or rates of intervention in birth. We are therefore unable to draw definitive conclusions on the impact of central fetal monitoring on either safety or intervention rates.

Recommendations

Appropriate healthcare technology improves health outcomes, provides positive experiences for healthcare providers and recipients, and reduces costs (38). There is limited evidence that central fetal monitoring satisfies these expectations. On a background of evidence indicating that intrapartum CTG monitoring offers no perinatal benefit (1, 2), central fetal monitoring was introduced without assessment of claims that it would improve perinatal outcomes. Our findings suggest the possibility that modifications in clinicians' behaviours following the introduction of central fetal monitoring potentially undermine perinatal safety and may drive inappropriate intervention. Given that the benefits of intrapartum CTG monitoring remain contested, further research is needed before implementation of central monitoring systems is continued. Where central fetal monitoring systems already exist, it is imperative that rigorous evaluation be conducted to ascertain their impact. If this evidence does not demonstrate perinatal benefit, then these systems should be removed.

Conclusion

This research highlights that the use of central fetal monitoring in one maternity service introduced behaviour changes among clinicians which may possibly undermine perinatal safety. Further research is required to examine this concern. Decisions to implement expensive central fetal monitoring technology should be carefully considered while this evidence is collected.

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