Ethnography of technological competence in clinical midwifery practice

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Abstract

Background. Concept analysis has identified three domains in the competent use of birth technology – interpersonal skills, professional knowledge and clinical proficiency – and tentative criteria for birth technology competence.
Aim. Fieldwork was undertaken to observe, confirm and explore pre-defined attributes of birth technology competence.
Method. The Swartz-Barcott and Kim (2000) hybrid model of concept development was expanded to include an ethnographic observation of theory in action.
Findings. Key attributes of birth technology competence found in 'real-world' midwifery practice were skills in using the machines, decision-making and traditional midwifery skills.
Conclusions. The confusion surrounding the use of technology in midwifery practice needs to be addressed by both professionals and educationalists. Midwives should be taught to value traditional midwifery skills alongside those of machine skills. The identification of a model of appropriate technology use is needed in midwifery.

Key words: Concept development, ethnography, midwifery practice, birth technology competence

Background

This paper describes findings of an ethnographic study exploring midwifery competence in the use of birth technology. The ethnography followed a concept development study (see Table 1), which began with a concept analysis of birth technology competence in midwifery (Crozier et al, 2006). This explored professional and popular literature as well as policy documents from government, medical and healthcare regulation agencies, which enabled the illustration of the concept using exemplar and contrary cases. From these, it was possible to produce tentative attributes of birth technology competence (see Box 1).

The use of technology is a contentious issue throughout the world, but all midwives must be equipped with the skills to manage high-risk pregnancy and labour, and to make appropriate decisions about when to refer women if deviations from normal occur. In developed countries and in some developing countries, midwives have access to a wide range of medical devices that may assist them in assessment, diagnosis and treatment of women at risk. Therefore, all midwives should have competence in the appropriate use of technologies commonly used in midwifery practice, in order to meet the International Confederation of Midwives' (ICM) definition of a midwife as 'a responsible and accountable professional who works in partnership with women to give the necessary support, care and advice during pregnancy, labour and the postpartum period, to conduct births on the midwife's own responsibility and to provide care for the newborn and the infant. This care includes preventative measures, the promotion of normal birth, the detection of complications in mother and child, the accessing of medical care or other appropriate assistance and the carrying out of emergency measures' (International Confederation of Midwives, 2005).

Table 1. Phases of the hybrid model of concept development, adapted from Swartz-Barcott and Kim (2000: 131)

Phase one – theoretical	Phase two – fieldwork	Phase three – final analysis
Selecting a concept	Setting the stage	Weighing findings, synthesising data from first two phases
Searching popular, professional and government literature	Negotiating entry	Development of a model
Dealing with meanings and measurements	Selecting cases	Writing up findings
Choosing a working definition, assigning attributes	Collecting and analysing data	

Box 1. Tentative attributes of birth technology competence (Crozier et al, 2006)

Knowledge of:
- The normal mechanism of labour
- Sound evidence on which practice is based
- How drugs affect normal physiological processes.

Skills to:
- Communicate with the woman
- Use machinery safely and effectively
- Interpret readings from machinery
- Make clinical decisions based on the interpretation of findings
- Identify machine faults and take proper action
- Communicate with colleagues
- Document clearly in the relevant records.

Demonstration of:
- A caring and sensitive approach
- Respect for the privacy of the woman.

Literature review

A literature search was conducted utilising MEDLINE, CINAHL, MIDIRS, Cochrane Library and MetaLib resources for health, education and sociology. The key words used included 'birth', 'technology', 'competence', 'clinical competence', 'theory in action' and 'midwives'. Of over 2400 sources found, those written or translated into English, applicable directly to midwifery or to clinical competence were selected. Articles were also drawn from professional and regulatory bodies such as the NMC in the UK, An Bord Altranais in the Republic of Ireland, the ICM and the American College of Nurse-Midwives. The following only discusses principles of competence – other aspects of the literature review are published elsewhere (Crozier et al, 2006; Crozier and Sinclair, 2004).

Eraut (1994) argued that a definition of competence should be set against a background of lifelong learning and should be viewed as a point along a path of progress leading towards proficiency and or expertise. Phillips et al (1993) described competence as a continual process, which is being constantly reformulated through the process of developing theory and practice.

Otter (1995) asserted that there are core competencies that can be expected of all professionals. These are developed and additions made to include specific attributes required within particular disciplines. These core competencies are developed throughout primary and secondary education by means of the national curriculum, and can be transferred and developed to a greater degree in further and higher education. The core competencies are communication, application of number, information technology, personal skills – working with others and improving own learning and performance – and problem-solving.

Competency-based outcomes of educational courses focus on the particular skills, the essential knowledge to support the skills and personal development according to Carter and Neal (1995).

Both Pearson (1984) and Eraut (1994) located competence somewhere in the middle of a continuum, but Dreyfus and Dreyfus (1986) were more specific. They developed a model based on the training of airline pilots in the US that described five levels of skill acquisition or development ranging from novice at level one to expert at level five. Level three described a competent practitioner. The first level is based on adherence to rules and routine, progress through the levels is made through developing more skilled behaviour and rational decision-making. At expert level, there is an element of intuitive knowledge based on deep understanding and a forward thinking approach. This approach was adapted by Benner (1984) and used in nursing. A competent practitioner in this model is able to demonstrate deliberate planning and the ability to see their action in the context of longer-term goals and has developed a set of standardised procedures performed effectively.

Powell Kennedy (2000) carried out a Delphi study in the US to obtain consensus on a model of exemplary midwifery practice. One of the important areas of practice that emerged was judicious use of technology. The ICM competencies (Fullerton et al, 2003) describe the use of laboratory equipment but not competence in the use of appropriate technology, even though the ICM recognises that midwifery involves increasingly complex care when involved with high-risk women. Midwifery education is aimed at preparing practitioners for registration at national level, so is focused on outcomes determined by national governing bodies. The assessment of competence in technology use needs to be developed as technology in health care grows. Sandelowski (2002) criticised the lack of qualitative enquiry about the interaction between people and machines in healthcare settings. The method used in this study enabled not only theoretical understanding through concept analysis, but also practical understanding by observing people at work with machinery.

Method

Having previously identified tentative attributes of birth technology competence through the process of a structured concept analysis, it was imperative to test their existence in a 'real-world' setting. An ethnographic approach appeared most appropriate for the examination of midwifery practice in the field. In observing the behaviour of midwives in their normal work environment, it is possible to discern more about their deeper values and beliefs than in an interview situation where they are objectively examining their practice in a retrospective manner (Burns, 2000). The ethnographic approach is typically exploratory. According to Robson (1993), it is a method of discovery. Spradley (1980: 3) described ethnography as 'the work of describing culture'. This work is guided by the researchers' desire to understand or make sense of the culture. The work of midwives in a hospital setting may be regarded as part of a 'cultural scene', and it is interesting to examine this culture in depth and understand how or if it affects the work of midwives. The process of gathering and analysing data is one in which the researcher seeks to gain an insight into the common experiences that create the meaning of the

concept of birth technology competence. The use of detailed participant observation and conversations held with midwives enabled the researcher to explore in depth the use of technology in practice from the point of view of midwives in the clinical environment. It is important to observe technology and technological skills used in midwifery practice, and this was achieved through shadowing midwives in their daily work. There is an assumption by some that the use of technology may be an extended form of practice, used only by highly specialised practitioners, for example midwife sonographers. It was the intention of this study not to examine these types of roles, but rather to engage with midwives who are caring for women in pregnancy and labour and using technology as part of this everyday work.

The fieldwork took place in the delivery suites, antenatal assessment units and postnatal wards of two consultant maternity units in England that both provided a mixture of consultant-led and midwifery-led care. The two settings differed in terms of the culture within them and in their size. Ethical approval was gained from the research governance and local research ethics committees for each unit, and each head of midwifery granted access and consent for the study.

Unit One is a large regional hospital where 5000 births take place per year. The environment was predominantly high technology, with 12 delivery rooms and three large 'clinical' delivery rooms used for high-risk cases. Each delivery room was equipped with an electronic fetal monitor (EFM) and resuscitaire (infant resuscitation table and equipment). All of the delivery rooms also contained a computer terminal for recording and retrieving patient records. There was a birthing pool in one of the delivery rooms, and the obstetric theatre was attached to the delivery suite.

Unit Two facilitated approximately 2000 births per year and was perceived as a lower-technology environment by the midwives working there. It contained three designated 'low-technology' delivery rooms including a 'family room' in which there were no EFMs (these were intended as rooms for low-risk women). There were networked EFMs in the other three rooms, which could be connected to the central monitor display at the midwives' station. Computers were situated at the midwives' station for recording and retrieving patient records. The obstetric theatre was situated adjacent to the delivery suite.

The process of theoretical sampling in the field meant that observations became more focused on incidents where technology was used and observations continued until data saturation was achieved and no new categories emerged (Strauss and Corbin, 1998). According to Strauss and Corbin (1998), theoretical sampling evolves during the research process and pertains not only to the participants but also to observation episodes. It is important to be guided by concepts that emerge from data collection, therefore early transcription and initial data analysis were carried out after each observation episode in order to inform and direct the process (Silverman, 2001), and sampling decisions continued to take place over the duration of the study.

Table 2. Selection criteria for midwifery participants

Inclusion criteria	Exclusion criteria
Working at E, F or G grade with personal responsibility for caring for or managing individual women in labour	With overall responsibility for running of delivery suite during a shift (so not with responsibility for individual women)
Qualified for more than six months and having finished period of preceptorship	Qualified for less than six months or in the middle of a period of preceptorship
Having worked in the observed delivery suite or ward for more than six months (familiar with environment, including local policies and guidance)	Having worked in the observed delivery suite or ward for less than six months (still orientating to environment)
Considered by managers and peers to be technologically competent	Undergoing a period of supervised practice

Participants

A total of 16 midwives participated in the study – six in Unit One and ten in Unit Two. Their selection aimed for a sample who would be able to provide rich data. In seeking access, the researcher asked the midwifery managers in both units to identify key midwives who might demonstrate competence in technology usage in their everyday practice. Both stated that they believed strongly that all practising midwives needed to be considered competent in technology use, as it was part of their role. This supports the findings of Sinclair (2001) in an early study of technology use in midwifery. Inclusion and exclusion criteria were drawn up with agreement of the midwifery managers (see Table 2).

It was important to give midwives a true picture of the study and the reasons for conducting it so that they would feel 'safe' in volunteering. Information sessions were held for midwives, and the researcher spoke to as many as possible individually when giving them information sheets and invitations to participate. All those who took part gave their consent and their anonymity was assured. Written consent was obtained from midwives and women in their care.

Data collection

The same data collection method was used by the same observer in all settings to enable a consistent approach. The researcher made written notes during observations that included sketches of the environment, with the positioning of people and machinery within the space. Conversations among the staff, between the researcher and the midwife, and between the midwife and client were described in the field notes. Observations were made of the technologies used and decisions around care that were

informed by the outputs (readings) of the machines. Respondent validation (Silverman, 2001) ensured that points of the observation were clarified with the midwife providing the care to reflect on events and the researcher's impressions and ensure that an accurate and truthful picture was recorded.

Often, the midwives would explain their actions to the observer without having to be asked. This was possibly due to their familiarity of being observed by students. The midwives generally took only a short time to build up a relationship of trust with the researcher. This may, in part have been due to their familiarity with the researcher formed during the introductory phase where the researcher was present distributing and collecting questionnaires and inviting participants for the study. Once the midwife and the client accepted the presence of the researcher in the room, the researcher's presence no longer felt visible (Robson, 1993). The exchanges between the midwife and her client soon resumed a normal pattern of conversation, observations and questions and answers that ignored the presence of the researcher.

Field notes were transcribed as soon as possible after each observation event and an audit trail kept – extracts are presented in the findings.

Data analysis

Coding and analysis of data took place with the use of the NVivo software for qualitative analysis. Concept development is a process of building theory inductively, therefore it was important to examine instances where the concepts identified earlier may be either present or absent, and to seek to explain this (Swartz-Barcott and Kim, 2000). Work that had previously been conducted in the concept analysis became instrumental in identifying incidents of importance to the emerging theory.

Discussion of findings

Skills in using the machinery

The work of midwives constantly involved machines such as infusion pumps, monitors and computers. The most commonly used machine was the EFM, and the use of computers for patient records, ordering tests and retrieving results was frequent in every observation. Infusion pumps and syringe drivers were utilised depending on the regime used to augment or suppress labour. The researcher observed the way in which midwives handled the machinery, manoeuvring it around the space available, positioning it and connecting it to the electricity supply and to the woman and using it as part of their practice. Some have suggested that the use of machines in midwifery and nursing may reduce or even cancel out the caring factor in professionals' approach (Hawthorn and Yurkovich, 1995; McCrea et al, 1998). It was interesting to watch the interplay between midwife, woman and machine. Midwives communicated with the woman and the machines, often displaying a caring approach while using the machines. In the following episode, a midwife is caring for a woman following the birth of twins by caesarean section (CS):

'The midwife uses the datascope to check the blood pressure. The midwife explains to [the researcher] that she has taken the cuff off between readings because it was uncomfortable for the woman and she can remember to go in every hour to do the recordings. She asks the woman if she minds if she checks her blood pressure. She puts the cuff on and rests the woman's arm on a pillow at her side. She presses the button to start the machine and then asks the woman how she is feeling now. Woman says she is tired. She smiles kindly at the woman and says 'yes you must be'. The midwife then checks the reading, makes a record of it, switches off the machine, removes the cuff and pushes the machine to one side. 'Everything is fine,' she says. She then makes some recording from the patient-controlled analgesia pump. She asks the woman about her pain levels, talks to her about her babies and asks whether she would like to go to visit them on the neonatal unit' (episode 16).

Locsin (2001), who investigated the use of technology by US nurses in high dependency care, purported that it does not negate the humanity or caring aspect of the work of healthcare professionals, and in some ways can be used to enhance it. This example from the field notes illustrates the humanity in using the machinery in caring for the woman in the immediate postnatal period. This midwife was also negotiating with the doctors to change the woman's pain relief to an oral medication and to remove her catheter so that she would be mobile enough to be taken by wheelchair to visit her premature twins on the neonatal unit. This demonstrates the midwife's understanding of the woman's need to bond with her babies as well as of the technical aspects of postnatal care following CS. This is an important aspect of midwifery work, and the observer was touched by the humanity shown to this woman who had experienced a high-technology birth and postnatal period. It was interesting to see the midwife take into account the woman's worldview and balance it with a medical view of the woman's 'condition'. This mediation between two paradigms – that of medicine and the mother – was skilfully negotiated. This demonstrated a balance between purposive rationality (the need to meet the goal of ensuring the woman's physical wellbeing) and communicative rationality (the need to communicate with the woman on her level to meet her needs as a mother) (Habermas, 1984). The caring approach was evident in the midwife's ability to understand the needs of the woman to see and touch her babies, and to be able to communicate this to other healthcare professionals. The approach of the midwife was to try to normalise the woman's situation as quickly as possible so that she could experience motherhood. She balanced this against the need to carry out high-technology observations and monitor the woman's wellbeing, clearly having an understanding of the psychological and emotional as well as the physiological needs of the woman. Although she utilised the machinery, it did not undermine the humanity of her approach.

However, the machinery with which midwives work on a daily basis is varied and complex in nature. The complexities involved in using infusion pumps and syringe drivers was made clear by one midwife as she demonstrated the use of pieces of equipment during a quiet period of a shift in a delivery suite:

'Demonstrating Graseby Pumps 3300 syringe pump with perspex cover used for pethidine PCA [patient-controlled analgesia]: 'This is programmed by the midwife, 250mg [pethidine] in 50ml water. We have a policy.'

'Graseby Pumps 3100 syringe pump: 'This is used for continuous epidural infusion. Usually about 8ml to 10ml, up to 15ml per hour.' It can also be used for ritodrine [tocolytic]: 'If they are on ritodrine, we usually keep them on it long enough to have two doses of betamethasone.'

'Graseby pump MS2000 'is for diabetics' [insulin]' (episode 14).

These three types of pump were made by the same manufacturer and looked remarkably similar. The fact that midwives needed to remember which type of syringe driver was used for which intervention seemed to add to the complexity. There was a policy for the use of each piece of equipment simply because the policy applied to the intervention. The policies stated the need for a syringe pump to be used, but did not dictate which one. The use of a different type of machine for different drug regimes was a decision taken outside the realm of the midwives and would not be considered best practice. It was interesting to see the way in which the midwives accepted these policies (written and unwritten) without question. The more diverse the range of pumps in use, the greater is the potential risk of error (Medical Devices Agency, 2003). The decision over which type of pump to use was made by anaesthetists and obstetricians prescribing the regimes, therefore the midwives apparently had no control over this issue. A conversation with the medical engineering technician did not clarify why there was a need to use different syringe drivers. However, the midwife stated that it helped midwives to identify a particular machine with a particular regime and that one could identify on entering a room which regime was in progress by identifying the technology in use. There is clearly a potential for mistakes when relying on this kind of assumption.

The manoeuvring of machines around small rooms to optimise the use of equipment and space was integral to the midwifery role, demonstrating the fact that the midwife needed to control the environment.

The midwives in the study communicated not only with the human beings in the room, but also with the machines by receiving messages, inputting information and adjusting settings. This even included sometimes talking to the machines, particularly when the electronic alarms were triggered. The humour that they used in talking to the machines seemed to be a useful means of dispelling the anxiety of the women, who sometimes appeared fearful of such noises being produced by the machines, yet relaxed noticeably as the midwife gave explanations and talked to the machines.

Traditional midwifery skills

Henley-Einion (2003) claims that in adapting to the use of technology in the obstetric environment, midwives have lost touch with traditional skills that mark out their professional boundary. Symonds and Hunt (1996) regard the adaptation as re-skilling rather than de-skilling.

The element of touch seemed to play a large part in what midwives considered to be traditional skills. Kitzinger (1997) describes a process of therapeutic touch used by women to help each other in childbirth in some cultures. In palpating the abdomen to identify the lie and position of the fetus as well as palpating contractions, the midwives in this ethnographic study were demonstrating an important element of traditional midwifery skill. Midwives themselves identified this as a traditional skill that has sometimes been superseded by the reading of machines:

'When you're not using machines, you use more of your midwifery skills. You're staying with the woman, you observe her more closely, and you use your hands. When you have machines, you rely on them' (midwife 1, episode 19).

Midwives who employed the skill of abdominal palpation throughout the labour stated that women felt reassured by the touch, so as well as being able to gain the information they required they were also helping the woman to relax.

McCrea et al (1998) conducted an observational study in Ireland of midwives' approaches to pain relief in labour. Three types of midwife were identified – the cold professional, disorganised carer and warm professional. The cold professional was observed as spending a great deal of time 'checking machines and monitors' rather than holding the woman's hand or sitting with her. Elements of this type of midwifery could be observed in the course of this ethnographic study where some midwives left the room for extended periods of time and only returned to perform observations, usually by reading the machines. The researcher also observed elements of what McCrea et al (1998) termed a 'warm professional' approach. These midwives did spend time with the woman, using therapeutic touch and displaying elements of a caring approach in their relationship with the women. These midwives were more likely to palpate the abdomen during a contraction rather than relying on a machine to gauge the strength, length and frequency of contractions.

The skill of active listening with women was observed, often while the midwife sat beside the woman holding her hand. McCrea et al (1998) concluded that professional care is not only dependent on expertise, but also upon the personal qualities of midwives themselves. All midwives learn the same basic types of skills in their midwifery education, but their application of these to their personal practice depends on other values and beliefs surrounding birth.

The midwives observed in this study had an obvious pride in their ability to perform tasks that did not involve technology, and they often described technological skills as separate from midwifery skills. They demonstrated their knowledge and skills from a time when midwifery was less technologically mediated, but the move towards greater use of technology was not regarded as necessarily negative:

Table 3. Attributes of birth technology competence in the domain of clinical proficiency following the fieldwork phase

Element	Attribute
Skills in using machinery	• Ability to switch on the machine and understand that it is working correctly • Ability to identify and report faults in the machinery • Dexterity in programming the machinery and making changes to the programme during care, such as increasing dosage rate for a pump or syringe driver, changing the fluid bag in a pump, changing the syringe in a driver, changing the paper in a CTG machine, changing the date and time on a CTG machine and programming an electronic blood pressure monitor to take readings at regular intervals • Making the connection between woman and machine • Understanding where to find information concerning hazard warnings • **Appropriate use of technology*.**
Decision-making	• The ability to understand the technological products of the machines and make decisions based on these • To make appropriate referrals when deviations from the norm occur • **Ability to use evidence to inform practice in conjunction with the skill of clinical decision-making*** • **Demonstration of involvement of women in decisions surrounding technology use*.**
Traditional midwifery skills	• The ability to demonstrate traditional midwifery skills used in diagnosis, planning and implementing care, such as palpation of the abdomen, vaginal examination and auscultation of the fetal heart.

*Additional attributes that were identified in the fieldwork phase.

'I think it's used instead of being a midwife and midwifery skills. For example the odd comment 'Oh that lady is contracting one in three, it was on the monitor,' rather than actually palpating a contraction... So I feel that's changed a bit, but I feel that it is a positive side to midwifery. It's made us care for women who are... at high risk, like maybe fetal blood sampling has managed women not to have a caesarean section. So it's a positive side to it, but I feel it's abused to a certain extent. The equipment is used instead of the midwife putting a hand on the contraction and things like that, so we've become a bit deskilled, I suppose' (midwife sister B).

This midwife later admitted that she was very much a 'technology midwife'. Some midwives liked to demonstrate that they could still use traditional skills such as auscultating the fetal heart with a Pinard stethoscope:

'I like to keep my traditional skills, but of course it does take more time to listen with this [Pinard] than [an EFM]' (midwife L).

However, justification for the use of technology was never far away when the conversation turned to midwifery skills:

'It's the 21st century and people expect equipment. I think because it's there, we do use it. If we ran out of monitors, we would have to resort to our skills' (sister 2).

Midwives themselves often discussed this dichotomy of skills while the researcher was on the wards with them:

'There are two types of midwife – those who have very traditional skills and can deliver babies at home without the machines, if you put them in a hospital and make them look after high-risk women they are like a fish out of water. Likewise, if you take the high-tech midwife and put her at a home delivery she'll find it difficult' (midwife 2).

This opinion was delivered with no degree of judgement about which type of skill was of greater importance, and none of the three other midwives in the room disagreed. They realised that other women required more 'human' rather than technological support, and that some midwives had skills better suited to provide this. The difficulty arose for midwives when they were expected to work 'against type'. In particular, community midwives commented that they found it uncomfortable to come into a delivery suite and work within a high-technology environment, and some deliberately sought out women who appeared to be at 'low risk' and likely to require less intervention.

Decision-making

In observing a midwife who was conducting a waterbirth, the researcher was struck by her confident approach to conducting a birth with little technological support. She was confident in her own skills and in her ability to elicit the necessary information required to monitor the progress of labour. This confidence was clearly conveyed to the woman and her partner:

'The woman had vomited and needed to get out of the water so that the pool could be emptied, cleaned and refilled. The midwife was very reassuring and enabled the woman to return to the pool very quickly. At the end of the shift, the midwife coming on duty came in to talk to the midwife in the birthing room. She said that there were not enough midwives on shift to be able to attend to a waterbirth. She said the woman would have to come out of the pool and be attached to a cardiotocograph [CTG] monitor because she had not been 'monitored' for hours. The midwife, who was due to go off duty, elected to stay in order to deliver the woman. She felt that the woman's own confidence would be altered by being taken out of the pool at such a late stage in the labour' (episode 10).

This ethic of 'non power' is described by Ellul (1989) as the understanding by individuals of when technology should be resisted or only used appropriately. The attitude of the staff coming on duty was interesting in relation to reliance on technology and confidence in their abilities. Those coming on duty were prepared to attach a woman to a CTG machine so that the midwife could leave the woman while she also attended another woman. This use of technology, although common, is not regarded as appropriate

(National Institute for Health and Clinical Excellence, 2001) and midwives would often say that if a woman is on a monitor, then she should not be left unattended. However, in the observations it was frequently the case that midwives left women unattended while being monitored by CTG machine. Indeed, it appeared that the machine was regarded as doing the monitoring rather than the midwife. The fetal heart rate and contractions had been monitored using both palpation and EFM. Yet in the view of those taking over care, this was not seen as trustworthy. Because this particular woman was in the birthing pool it was perceived that she would require constant attendance, despite the fact that she was having a normal birth. The waterbirth involved no technological intervention, but needed the skills of a midwife who was confident in her abilities to assist a woman to give birth in the pool. This attitude to the value of the readings of machines above those of humans is interesting and relevant to the way in which delivery suites are managed and the way in which policies are developed.

Conclusion

Ethnographic fieldwork confirmed the appropriateness of attributes identified in the concept analysis. Skills in using machinery, confidence in decision-making and traditional midwifery skills were all identified under a wider domain of clinical proficiency. Additional categories emerged after empirical observation, including the importance of the 'appropriateness' of technology use, and of clinical decision-making informed by evidence and with the full involvement of women (see Table 3). The findings raise questions about how midwives view the use of technology. A judgment of competence cannot simply be made based upon whether they can switch the machine on, connect it, make adjustments to it and disconnect it. Educationalists and practice leaders need to be able to ensure that midwives can interpret machine readings for themselves, other professionals and the woman. It should also be possible to assess the midwife's ability to integrate machine use appropriately with traditional skills so that midwives are not being deskilled, but are using new skills to support practice effectively.

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