Midwives' Knowledge and Ability in Interpreting Foetal Heart Rate Patterns in Cape Town in the Western Cape Province of South Africa

by

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DECLARATION

I, **Portia Letitia Tities**, declare that this study entitled, "**Midwives' Knowledge and Ability in Interpreting Foetal Heart Rate Patterns in Cape Town in the Western Cape Province of South Africa**", is my own work, that it has not been submitted before for any degree or examination at any other university and that all sources I have used or quoted have been indicated and acknowledged by complete references.

Portia Letitia Tities   :   ....

Date Signed   :   ....

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DEDICATION

This study is dedicated to my wonderful husband, Martin, and our beautiful children, Jamie and Aydn Tities. All that I am, all that I have accomplished is because of your trust and support.

ACKNOWLEDGEMENTS

ABSTRACT

Background: Intrapartum hypoxia is a common cause of perinatal deaths in South Africa. Electronic foetal heart rate monitoring (EFHRM) is used to detect foetal hypoxia. The midwife is responsible to apply the electronic foetal monitor and it is therefore important to understand the interpretation of the cardiotocograph (CTG). Poor clinical skills and poor recording of clinical findings in EFHRM are some of the contributors to perinatal deaths and illnesses. **Aim:** The purpose of this study was to determine the midwives' knowledge and ability in interpreting foetal heart rate patterns according to their years of clinical experiences. **Objectives:** The objectives of this study were to determine midwives' knowledge in performing foetal heart rate monitoring, to assess midwives' abilities in the interpretation of foetal heart rate patterns according to their years of clinical experience as a registered midwife. **Research design:** A quantitative approach with a descriptive design and a close-ended questionnaire was used. **Participants:** The participants for this study included all the registered midwives permanently employed by the Western Cape Department of Health (n=121), in the maternity wards at Groote Schuur, Tygerberg and Karl Bremer hospitals. **Procedure:** A questionnaire was distributed to the participants by the researcher. Analysis of the data was done using the statistical package for social sciences (SPSS, Version 19). **Results:** The results of the study indicated that there is no correlation between midwives foetal monitoring knowledge and their years of clinical experience. It also proofed that there is no correlation between midwives cardiotocograph interpretation and their years of clinical experience. **Recommendations:** There is a need for further research on midwives' knowledge and ability to interpret EFHRM. It is recommended that more in-depth methodology be applied and included in open-ended questions and interviews to explore and describe the lived experiences of midwives in performing CTGs.

KEYWORDS

- Electronic foetal heart rate monitor

- Foetal heart rate

- Cardiotocograph

- Midwife

- Neonatal

- Mortality

- Morbidity

- Hypoxia

- Intrapartum

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DEFINITIONS OF CONCEPTS

Cardiotocograph

The monitoring of foetal heart rate (*cardio*) and uterine contractions (*toco*) during labour. Both measurements are recorded on a monitoring device (Freshwater & Maslin-Prothero 2005, p. 108).

Neonatal Period

The period immediately after birth continuing up to 28 days of life (Freshwater & Maslin-Prothero 2005, p. 383).

Midwife

A person qualified and competent to independently practise midwifery in the manner and to the level prescribed and who is capable of assuming responsibility and accountability for such practice (Nursing Act 2005, p.25)

Intrapartum

The period occurring during labour or delivery (Freshwater & Maslin-Prothero 2005, p. 308).
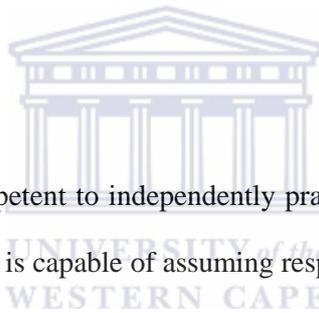
LIST OF ABBREVIATIONS

CTG   Cardiotocograph

CIST   Cardiotocograph Interpretation Skills Test

EFHRM   Electronic Foetal Heart Rate Monitoring

FHR   Foetal Heart Rate

FHRM   Foetal Heart Rate Monitoring

SANC   South African Nursing Council

MDG   Millennium Development Goals

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CHAPTER 1

OVERVIEW OF THE STUDY

1.1 Introduction

The eight millennium development goals (MDG) were adopted to alleviate poverty and improve health by the year 2015 (WHO n.d.). The focus of the fourth MDG has a direct impact on child healthcare with the focus to reduce child mortality between 1990 and 2015. It is evident that nationally, an alarming number of deaths occur among children under the age of five years, with the majority of deaths recorded during the neonatal period. The neonatal causes of deaths include infection, asphyxia, diarrhoeal diseases, preterm births, congenital anomalies, and other factors. Most of these causes of neonatal deaths are preventable if the standard of intrapartum care is improved, which includes having trained personnel available and responding to foetal distress (Pattinson 2007, p. 52).

The foetus is exposed to contractions during labour. Uterine contractions during labour are associated with periodic cord compressions or the reduction of retro-placental perfusion. This may expose the foetus to possible hypoxic injury which, in return, if not managed successfully, may lead to neonatal mortality or morbidity (Blincoe 2005, p. 108). Electronic foetal heart rate monitoring is one of the measures to determine the well-being of the foetus and to prevent foetal injury due to impaired oxygenation of the foetus (Fedorka 2010, p.15).

Foetal heart rate monitoring (FHRM) is performed on all foetuses above 28 weeks gestation. The method of FHRM is determined by risk factors from the mother and/or the pregnancy. This may include pregnancy or non-pregnancy related risk factors that will place the mother in a high risk category. Electronic FHRM is commonly used for assessing the foetal status on

all high risk pregnancies where there is a risk of perinatal death, cerebral palsy or neonatal encephalopathy (Blincoe 2005, p. 109).

Globally and nationally, midwives are responsible for monitoring the progress of pregnancy, labour and the puerperium (International Confederation of Midwives 2002). Any abnormalities, complications or illnesses such as foetal distress should be reported to a medical practitioner (Regulation 2488 1990). Foetal distress can be detected by using a hand-held Doppler or foetoscope, electronic foetal heart rate monitor (EFHRM) and a foetal scalp electrode. The EFHRM can be a fatal tool if it is used by midwives who are unable to apply it and interpret the pattern it produces. Foetal well-being plays a pivotal role in midwifery (Blincoe 2005, p. 111).

Intrapartum hypoxia is one of the primary causes of perinatal mortality in South Africa, and can be detected and prevented by applying and using an EFHRM (Buchmann & Pattinson 2005, p. 62; Wood & Dobbie 1989, p. 1). EFHRM is used globally in various obstetric units to evaluate the well-being of the foetus (Gauge & Henderson 2005, p. 3). Any abnormalities in the foetal heart rate (FHR) pattern have to be reported to the physician and noted accordingly in the patient's records. In low risk patients, intermittent auscultation is used to determine the well-being of the foetus (Gauge & Henderson 2005, p. 4). The EFHRM is widely used in high risk patients due to the high maternal morbidity and the risks posed to the foetus. Any medical conditions, pregnancy related diseases and drugs administered to the mother can place the mother and foetus in a high risk category (Gauge & Henderson 2005, p. 6). An EFHRM is commonly used in tertiary hospitals, to monitor foetal well-being and maternal labour contractions to ascertain the risks posed to the foetus.

The Confidential Enquiry into Stillbirths and Deaths in Infancy (CESDI) provides information on stillbirths, deaths in infants and ways on how it could have been prevented (Young et al 2001 p. 226). High levels of suboptimal intrapartum care were consistently

found in England, Wales and Northern Ireland in the CESDI report of 1993. This may be due to the failure in recognizing a problem or the inability to act accordingly (Young et al 2001 p. 226). Intrapartum asphyxia and birth trauma is one of the major causes of neonatal deaths. Buchmann and Pattinson (2005, p. 61) stated that foetal distress that was not detected intapartumly was one of the most avoidable factors that contributed to neonatal deaths. A retrospective analysis of case notes and regular low Apgar meetings were held in North Staffordshire Hospital. All medical staff invited and cases that had a low Apgar score were classified with regard to different gradings. According to Young et al (2001, p. 226), the CESDI grading was as follows:

1. **CESDI 0**: No suboptimal care

2. **CESDI I**: Suboptimal care, but different management would have made no difference to the outcome (defendable risk)

3. **CESDI II**: Suboptimal care where different management might have made a difference to the outcome - an avoidable factor of uncertain clarity or influence on outcome (possibly defendable risk)

4. **CESDI III**: Different management would reasonably be expected to have made a difference to the outcome. A clearly avoidable factor implying that the adverse outcome could have been prevented (undefendable risk) (Young et al 2001, p. 226)

In their study, the CESDI 11 and CESDI 111 categories were highlighted. These cases could have been avoided or the outcome could have been positive if different management was given. A cardiotocograph training course was implemented and more midwives than doctors participated. The proportion of CESDI 11/111 cases dropped significantly. This study concluded that medico-legal risks are minimized by improving standards of intrapartum care and that the cases that occur due to midwifery error were reduced because of the attendance of CTG training (Young et al 2001, p. 229).

1.2 Rationale

Foetal well-being is one of the many responsibilities of a midwife. It is expected of midwives to fulfill their roles irrespective the years of experience they have or the type of training they received.

A lack of overall description of FHRM is identified as some of the substandard practices in a study done at three maternity facilities in New Zealand (Maude & Foureur 2009, p. 29). EFHRM is only a valuable method to reduce neonatal mortality and morbidity if the CTG is interpreted correctly and appropriate actions are taken to secure neonatal and maternal well-being (Dover & Gauge 1995, p. 18). According to a confidential enquiry in South African public hospitals, the lack of identification and response to foetal distress are a contributing factor to perinatal deaths in South Africa (Buchmann & Pattinson 2005, p. 61). Foetal morbidity and mortality can be decreased if cardiotocograph patterns are interpreted correctly and the required action is taken.
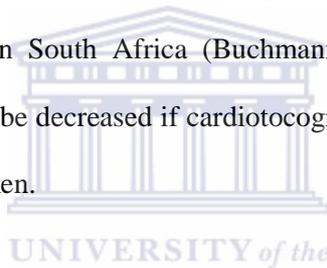
The researcher developed an interest to investigate the knowledge and ability of midwives in interpreting foetal heart rate patterns. She considered it relevant to investigate this because there is a global focus to decrease child mortality and improving healthcare by 2015 (Pattinson 2007, p.1). In order to interpret a CTG, there are specific terms that are used and specific points to look at. The researcher made the assumption that not all midwives were aware of the terminology that surrounds the interpretation and recording of a CTG.

1.3 Problem Statement

Intrapartum foetal and perinatal mortality and morbidity due to intrapartum hypoxia are a major concern for all health practitioners, including midwives. Midwives perform their duties based on their theoretical knowledge learnt through training, and exposure to practical

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experience. Intrapartum hypoxia and stillbirths can be avoided through correct interpretation and management of the FHR pattern.

Studies and confidential enquiries in South African public hospitals, the United Kingdom and New Zealand revealed substandard care of women in labour as contributors to perinatal deaths and intrapartum morbidity (Buchmann & Pattinson 2005, p. 61; Confidential enquiries into stillbirths and deaths in infancy 2001 as cited in Maude & Foureur 2009, p. 24). This includes poor intrapartum monitoring and misinterpretation of foetal distress (Farrell & Pattinson 2005, p. 13).

A study done in KwaZulu Natal in South Africa, where midwives are responsible for the maternity labour wards, identified the inconsistency of FHRM, incorrect application of the FHRM, inability to interpret FHR patterns and the recording thereof (Philpott & Voce 2005, p. 70). In Pretoria, South Africa, the relationship between the number of staff per delivery per day and the deaths due to intrapartum hypoxia were investigated. It was surprisingly significant that the availability of more staff correlated with a higher number of deaths due to intrapartum hypoxia. The possible reasons were stated as the presence of non-skilled birth attendants and the lack of training (Pattinson & Prinsloo 2005, p. 68). The inability of midwives to interpret and document foetal distress relates directly to foetal deaths and illnesses. Therefore, it has become imperative to conduct research on midwives' knowledge and ability in interpreting FHR patterns.

1.4   Aims of the Research

The aims of this study were to determine midwives' knowledge and ability in interpreting foetal heart rate patterns according to their years of clinical experience as a midwife.

1.5   Research Objectives

1.   To determine the knowledge of midwives in performing FHRM according to the years of clinical experience as a registered midwife.

2.   To assess midwives ability in interpreting of FHR patterns according to the levels of the years of clinical experience as a registered midwife.

1.6   Hypothesis

It is hypothesized that there is a positive correlation between midwives' knowledge and their years of experience as a registered midwife. It is also hypothesized that there is a positive correlation between midwives' cardiotocograph interpretation skills and their years of experience as a registered midwife.
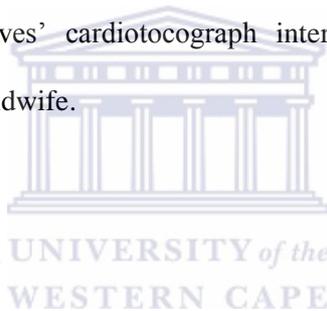
1.7   Method of Enquiry

A quantitative approach was used with a descriptive design because the researcher wanted to differentiate between the scores obtained in section B and section C of the administered questionnaire, in correlation to the years of experience. A quantitative approach was followed and this refers to the collection and analysis of numerical data (Creswell 2009, p. 17). This approach was chosen based on the research question, the objectives, the data to be collected and the analysis thereof. There was no manipulation of variables, no control over the setting and no intervention. The purpose of a descriptive design is to explore and describe the phenomena in their real life situation (Brink 2006, p. 102). An existing questionnaire used in a study by Devane and Lalor (2006, p. 300) to monitor the effectiveness of a foetal education programme was evaluated, adopted and adapted accordingly (Devane & Lalor 2006, p. 300). Permission to use the questionnaire was obtained from Declan Devane (Appendix 1). The questionnaire consisted of three sections. Section A requested demographic data of the

participants. Section B comprised knowledge-based questions which reflected the knowledge ability of the participants. Section C was an interpretation questionnaire that indicated the ability to interpret CTG tracings. All sections consisted of multiple choice questions and closed-ended questions.

1.8   Limitations of the Study

Other factors that could have interfered with the study such as shortages of staff and equipment were not taken into account. Locum midwives (not permanently employed) and community health practitioners were excluded because they were not permanently employed at any of the three participating hospitals.

The researcher was guided by the assumption that there will be a positive correlation between midwives' knowledge and interpretation skills in accordance with their years of clinical experience as a registered midwife. The researcher might have been bias due to such an assumption in the analysis of the results. However, this was largely overcome by reporting all the findings.

Another limitation of the study was that the researcher had to collect the questionnaires several days after she handed them out. Participants could have consulted with colleagues or textbooks in order to complete the questionnaire. The researcher made every attempt to overcome this by collecting the data in the shortest period of time, but this was not always feasible due to reasons beyond the control of the researcher.

1.9   Ethical Considerations

The proposal was sent to the Higher Degrees Committee of the University of the Western Cape for approval and ethical clearance (Appendix 2). Permission was granted by the Chief

Executive Officer of Mowbray Maternity Hospital to conduct the pilot study at the institution. Thereafter, permission was also obtained to conduct the main study at Karl Bremer, Groote Schuur and Tygerberg hospitals.

The researcher made use of convenience sampling and this included the whole population. Nevertheless, all the participants had the right to participate or not and no one was forced into doing so. The participants were provided with a detailed written explanation and, in some cases, verbal explanation of what the study entailed (Appendix 3). Every participant gave written consent to be part of the population (Appendix 4). All the participants were reassured of their privacy and confidentiality throughout the study. There were no risks or benefits that the participants, patients or the institution were subjected to.

1.10 Structural Overview
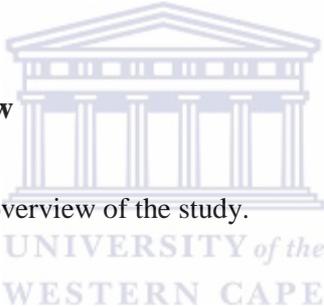
Chapter 1   Provides an overview of the study.

Chapter 2   Entails the literature review with the focus on the theoretical framework that underpins this study, training of midwives on the interpretation of CTG, neonatal mortality and morbidity related to CTG interpretation, foetal monitoring and record keeping. The findings of other studies will be discussed and compared in context.

Chapter 3   Focuses on the research methodology used in gathering and analyzing data.

Chapter 4   Summarizes the research findings.

Chapter 5   Concludes with the discussion and recommendations of the research.

1.11 Summary

Midwifery is a specialist field in nursing science and a specialist practice. Midwives are the primary healthcare providers and spokespersons for their patients. It is expected that they should be able to assess foetal heart patterns and inform the obstetrician should any abnormalities be detected. Accurate record keeping plays a pivotal role in the execution of a midwife's duties. Newly appointed midwives are expected to function independently, irrespective of their years of clinical experience as a registered midwife. This study examines midwives' knowledge and ability to interpret foetal heart rate monitoring according to their years of clinical experience as registered midwife.

CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

This chapter focuses on aspects that give clarity and understanding with regard to midwives'
knowledge of and skills in performing FHRM, and the path to becoming an expert in this
clinical field.

The literature review's outline is as follows:

1. The theoretical framework that underpins this study

2. The midwife and CTG interpretation

3. Neonatal mortality and morbidity related to CTG interpretation, and

4. Foetal monitoring and record keeping

2.2   Theoretical Framework

The research was guided by Patricia Benners' five stages of clinical competencies as adapted
from the Dreyfus model of skills acquisition (Benner 1984, p. 13). Nurses pass through five
stages of competencies before the stage of being recognized as an expert is reached. The
competency of a nurse can be determined according to the clinical exposure in a specific
field. Upon learning of a new skill or domain, nurses can rotate in the various competency
levels.

Stage 1: Novice

Novice nurses can also be referred to as beginner nurses who have no experiences or exposure to the situations in which they are expected to perform. Nurses implement rules and concepts that were theoretically given to them and they are guided and bounded by the rules (Benner 1984, p. 20). Nursing students can be classified as being novice nurses due to their limited exposure in the same situation. Novice nurses constantly change their work environment to get the clinical exposure and to grasp the link between the theoretical knowledge and the practical setting. They absorb a lot of information that apply to the setting they are exposed to with limited understanding of the correlation between the purpose of clinical findings and the actions. An expert nurse can move to the role of being a novice nurse if she is moved from her speciality field to a vastly different field (Benner 1984, p. 21; Jooste & Troskie 1995, p. 38). An example is an expert theatre professional nurse who decided to move to the maternity wards. Although she is an expert in theatre, she suddenly becomes a novice nurse when working in the maternity wards because she might have to learn new skills and she is in an area that is new to her.
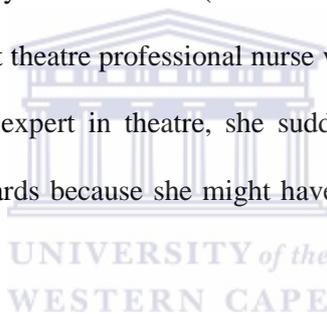
Stage 2: Advanced Beginner

The newly registered midwife can be described as an advanced beginner, who completed the minimum requirements as a registered nurse and midwife (Regulation 425 1985). Jooste and Troskie (1995, p. 38) stated that an "advanced beginner refers to the newly qualified nurse allocated to a unit". Benner (1984, p. 24) described an advanced beginner nurse as one who can gather and interpret information, but requires guidance to determine and set priorities. Advanced beginners focus on one aspect at a time and are unable to see the holistic view of a situation. They find it difficult to adapt to the changes surrounding them although they display acceptable professional attitudes. An advanced beginner nurse who just started working still requires mentoring by those who are experienced in the specific field. She has the theoretical knowledge, but lacks certain practical knowledge, interpretation and appropriate intervention

thereof (Benner 1984, p. 25). The advanced beginner's situational perception is still limited. Information is treated separately and is given equal importance. She can perform her duties, but will need mentoring in interpreting the data correctly and guidance on the management thereof (Benner 1984, p. 24). It is expected for a novice nurse to move to the level of advanced beginner within 2 years when gaining experience as midwife.

Stage 3: Competent

A competent nurse is able to manage many clinical situations, but lacks speed, flexibility and the experience to view the situation holistically (Benner 1984, p. 25). She is capable of applying the foetal heart monitor and shows improvement in her abilities in the interpretation of the foetal heart rate pattern. Her critical thinking skills regarding the management and identification of foetal distress are improving. Her focus in a situation is still limited to a specific aspect. It is expected for a nurse to move to the level of a competent nurse with 2-3 years of experience (Benner 1984, p. 25). The competent nurse executes her duties with little understanding of prioritizing. In the case where there is a lack of resources available, the competent nurse tends to focus on finishing her duties instead of setting priorities while completing her duties. Competent nurses are driven by the completion of clinical tasks rather than an integration of clinical and managerial responsibilities.

Stage 4: Proficient

The proficient nurse views a situation holistically and is capable of determining and setting of priorities. Benner (1984, p. 31) stated that " proficient performance can be found in nurses who have worked with similar patient populations for approximately 3-5 years" She perceives a situation in terms of long term goals. Through past experience, she knows what can be expected in a situation. The proficient nurse prepares herself in advance for possible outcomes that she foresees due to past experience (Benner 1984, p. 28).

Stage 5: The Expert

The expert nurse no longer relies strictly on rules and guidelines to determine the appropriate action in a situation. Due to her experience and exposure in the clinical setting, she possesses an intuitive grasp of every situation and act accordingly (Benner 1984, p. 32). She views the situation holistically. The professional nurse passes through different stages in order to acquire clinical skills. There are other factors that play a role in moving through these different stages and not all individuals are able to move through all of the stages. In order to become an expert nurse it can often takes 5 years or longer. Theoretical knowledge and practical exposure are integrated into clinical expertise (Goodlin et al 2007, p. 4). Winchcombe (2000, p. 228) describes a competent professional as a person who has acquired a set of skills with the ability to apply and measure it against performance standards. A registered midwife has to translate her knowledge and skills into practice so that quality services can be rendered.
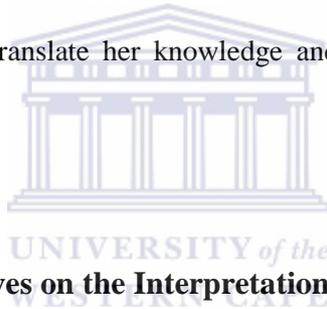
2.3   Training of Midwives on the Interpretation of CTG

A professional nurse is a person who has successfully completed formal training and who has met the minimum requirements as stipulated by Regulation 425 of 1985, the course leading to the enrolment as a registered nurse. The professional nurse has to function independently. She is expected to be competent in all her duties and has to be responsible and accountable for all her actions (Nursing Act 33 2005; Regulation 2488 1990). The scope of practice for a registered midwife entails the monitoring of the progress of the pregnancy, labour and the puerperium (Regulation 2598 1984). Upon completion and registration as a midwife, one has met the minimum requirements to qualify as a practitioner as set out by the relevant statutory body.

The European Community Midwives Directive and the Midwives' Code of Practice states that foetal monitoring is fundamental to midwifery practice and that "a midwife must care for

and assist the mother during labour, and monitor the condition of the foetus in utero by the appropriate clinical and technical means" (The European Community Midwives Directive 80/155/EEC Article 4; Midwives' Code of Practice UKCC 1994 p. 4-6, cited in Dover & Gauge 1995, p. 19).

South African midwives are expected to report to a medical doctor if any signs of foetal distress are present and ensure that clear and accurate records are kept (Regulation 2488 1990). In South Africa, student midwives receive midwifery training, most commonly in their third year of the training programme. This implies that registered midwives only practice midwifery after two years of theoretical and practical exposure in midwifery which may lead to a gap in exposure to midwifery practice and skills acquisition.

Continuous learning is an inevitable part of any healthcare worker to ensure professional and personal enrichment and development. This learning can be in the form of informal or formal training. Employers are responsible to provide informal training to their workers to ensure professional growth and to empower them with information and exposure with regard to daily tasks and responsibilities. The healthcare worker is accountable for identifying learning opportunities and undergoing and completing formal training. Williams and Arulkumaran (2004, p. 460) states that CTG misinterpretation is the most common source of alleged negligence in obstetric litigation.

To assist midwives in performing and interpreting electronic foetal heart rate patterns, informal and formal training should be available to ensure that appropriate actions can be implemented and that high risk factors can be identified. They advised that 6-monthly interval CTG study days would assist in keeping midwives and doctors up to date with CTG interpretation. All new staff should undergo induction and training programmes to ensure that trained staff assist women in labour and assess the well-being of the foetus (Williams &

Arulkumaran 2004, p. 460). This may lead to decreasing foetal and neonatal morbidity and mortality.

The fourth MDG states that child mortality (under 5 mortality rate) should be reduced by two thirds between 1990 and 2015 (WHO n.d.). The reduction of maternal morbidity and mortality will result in a significant drop in neonatal morbidity and mortality rates. By ensuring coverage, quality care, skilled staff, adequate resources, access to healthcare, rapid referral and transportation, the maternal and neonatal mortality and morbidity rates will also decrease (Farrell & Pattinson 2005, P. 1-18).

Nurses go through various phases of competencies and have to gain experience in order to function as an expert or master in a specific field (Goodlin et al. 2007, p. 4). The registered nurse progresses from being a student, as a novice nurse, to a beginner practitioner to an expert in her journey of acquiring clinical competence. On this path, theoretical and practical knowledge as well as exposure are integrated into clinical experience (Goodlin et al 2007, p. 4).
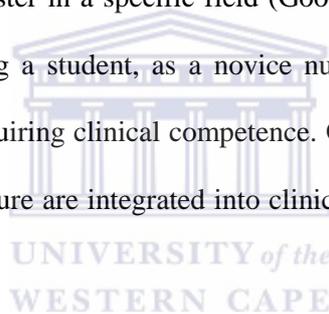
Devane and Lalor (2006, p. 302) conducted a randomized controlled trial evaluating a foetal monitoring programme. The length of experiences of midwives ranged from less than 2 years to more than 21 years, with 64% having 6 or more year's clinical experience. Most of the midwives (67%) indicated that they did not receive any training on foetal monitoring. All respondents (n=55) with clinical experiences from 2-21 years indicated that they would benefit from training on CTG interpretation (Devane & Lalor 2006, p. 303). Their research concluded that attendance at a foetal monitoring education programme increased midwives' foetal monitoring knowledge and CTG interpretation skills (Devane & Lalor 2006, p. 305). Irrespective the years of clinical experience and exposure, midwives identified the need for CTG training. The Maternal and Child Health Research Consortium (1997; 1998; 1999; 2000; 2001) stated that misinterpretation and misrecognition of abnormal FHR patterns and

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inappropriate actions are some of the problems associated with the use of intrapartum EFHRM (The Maternal and Child Health Research Consortium 1997; 1998; 1999; 2000; 2001, as cited in Devane & Lalor 2006, p. 305). Moreover, it was found that 84.1% of Swiss midwives, participating in a study in Switzerland, indicated that they were confident in interpreting CTG tracings. However, 97.4% indicated that they would want more training and care reviews on CTG. About 69.9% of the participants had 5 to 20 years of experience (Luyben & Gross 2001, p. 181).

The ability to interpret cardiotocograph tracings and initiate appropriate actions has become a fundamental skill required of midwives (Devane & Lalor 2006, p. 297). The International Federation of Gynaecology and Obstetrics (FIGO) set out guidelines to assist in the proper use of EFHRM. The importance of having trained staff in labour wards to monitor FHR during labour and to take appropriate action was one of the guidelines (Huch, Huch & Rooth 1985, p. 129). Hale (2007, p.107) concluded in her study that the interpretation of FHRM should be part of a midwife's skill set and is central to intrapartum care. She also highlighted that according to the National Institute of Clinical Excellence, staff should receive annual training and assessment to keep their skills functional and efficient.

Lack of supervision in labour ward and designated supervisors is one loophole that was identified in selected hospitals in KwaZulu Natal (Philpott & Voce 2005, p. 69). No indication was given of the length of experience of the participants. This lack of supervision as experienced personally, contributes to inadequate guiding and on the spot training of new or junior staff. This invariably leads to insufficient monitoring of junior staff members and their lack of confidence (Philpott & Voce 2005, p. 69).

Research findings regarding midwives and the interpretation of CTG do not differentiate between the knowledge according to the levels of competencies. However, it included midwives from less than 2 years of clinical experience (the beginner level) up to more than 10

years of clinical experience (the expert midwife) (Luyben & Gross 2001, p. 180; Devane & Lalor 2005, p. 137; Devane & Lalor 2006, p. 302).

2.4   Neonatal Mortality and Morbidity Related to CTG Interpretation

It is evident that errors in the interpretation of FHRM are a major contributor to infant mortality and morbidity, globally and nationally. Misinterpretations of FHRM in relation to infant mortality and morbidity, was highlighted in United Kingdom's (UK) confidential enquiry into stillbirths and deaths in infancy (Confidential enquiry into stillbirths and deaths in infancy 2001 as cited in Maude & Foureur 2009, p. 24). Electronic FHRM is only a valuable method to reduce neonatal mortality and morbidity if the CTG is interpreted correctly and appropriate actions are taken to secure neonatal and maternal well-being. EFHRM is fatal if the user is unable to interpret the findings thereof (Farell 2007, p. 14).

According to a confidential enquiry in South African public hospitals, the lack of identification and response to foetal distress are a contributing factor to perinatal deaths in South Africa (Buchmann & Pattinson 2005, p. 62). Neonatal-related causes of deaths are indicated as the highest contributor to causes of under-5 deaths globally. Birth asphyxia accounts for the third most common cause of neonatal mortality (Bradshaw 2009, p. 52). Likewise, a confidential enquiry into mature stillbirths and neonatal deaths in the West Midlands region in the UK, revealed that 78% of the deaths were due to factors that involved clinical practice of caregivers. Medical staff contributed to 39.3% of the sub-optimal care, with the highest number of junior staff who were involved, and 12.8% due to failure of interpretation and management of CTGs (Tan et al 1999, 251).

2.5   Foetal Monitoring and Record Keeping

The foetal heart rate is monitored from 28 weeks gestation when the foetus is viable. Prematurity decreases variability before 28 weeks gestation (Sweha & Hacker 1999, p. 2487). The foetal monitor has three functions, namely:

1. To monitor the foetal heart

2. To assess uterine activity, and

3. To determine the interval between contractions

The foetal heart can be monitored by using an electrode applied to the foetal scalp or externally using an ultrasound transducer applied to the maternal abdomen. The latter is commonly used because it is easy to apply. The main objective of FHRM is to reduce intrapartum asphyxia and stillbirths. FHRM prepares the midwife and obstetrician for an abnormal outcome of the neonate and enables them to intervene timely and appropriately before permanent or severe damage is suffered by the neonate (Wood & Dobbie 1989).

Twenty eight midwives of the Republic of Ireland participated in a study to determine midwives' intra- and inter-observer agreement on the visual interpretation of intrapartum cardiotocographs (Devane & Lalor 2005, p. 137). The length of experience ranged from 2 years to over 21 years. Amongst this group of expertise, inconsistencies in intra-rate agreement of CTG interpretations were observed (Devane & Lalor 2005, p. 138).

To ensure consistency in the interpretation and record keeping of foetal and maternal well-being, healthcare workers should follow a systematic approach with a full qualitative and quantitative description of the following:

- Baseline heart rate

- Baseline variability

- Presence of accelerations

- Periodic decelerations

- Changes of foetal heart rate pattern over time

- Frequency and intensity of uterine contractions, and

- Interventions done (Fedorka 2010, p. 15).

The interpretation of foetal heart rate patterns and the ability to communicate foetal well-being is very important in obstetrics. It is necessary for midwives to understand the standard terminology and method of record keeping (Wood & Dobbie 1989). The correct interpretation of the cardiotocograph contributes to early detection of an abnormal foetal heart rate pattern, allowing intervention to prevent neonatal and foetal mortality and morbidity (Devane & Lalor 2005).
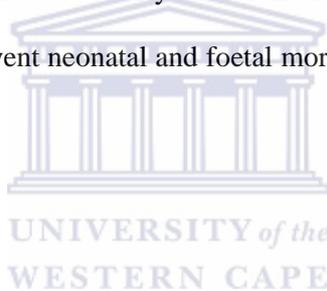
2.6   Summary

This chapter highlighted selected literature pertaining to the impact that inferior intrapartum care has on a foetus and the need for skilled trained midwives. It has substantiated that midwives of various levels of clinical experiences are in need of formal and informal training to improve their ability to interpret CTGs. The next chapter will focus on the methodological process followed to gather and analyze the data.

CHAPTER 3

RESEARCH METHODOLOGY

3.1   Introduction

The purpose of this chapter is to explain how the researcher collected and analyzed the data. Aspects that are covered in this section include the research approach, research design, the setting, the population and the sampling procedure. The validity and reliability of the instrument as well as ethical considerations are also discussed.

3.2   Research Approach

The concept refers to the approach that was adopted in order to complete the research. A quantitative approach was followed which refers to the collection of numerical data and to quantify and analyzed it. This approach was chosen based on the research question, the objectives, the data to be collected and the analysis thereof. In this study, the midwives' knowledge and interpretation of CTG, and their responses according to their years of clinical experience were compared and quantified.

3.3   Research Design

A research design is a plan for finding answers to the research question. It guides the researcher in organizing and performing research (Creswell 2009, p. 3). A descriptive design was used and a simple survey study was performed. There was no manipulation of variables, no control over the setting and no intervention. The purpose of the descriptive design was to explore and describe the phenomena as they occurred in a real life situation (Brink 2006, p.

104). Brink (2006 p. 104) states that "the researcher merely searches for accurate information about the characteristics of a single sample - subjects or groups"

3.4 Setting

The study was conducted at three tertiary institutions in the Western Cape, namely, Tygerberg, Groote Schuur and Karl Bremer hospitals. High risk patients are admitted and treated at these institutions and EFHRM is used commonly to monitor foetal and maternal well-being. All the midwives permanently employed at these institutions, who are working in the maternity wards, participated in the study. The maternity wards included the antenatal outpatient units, antenatal wards, labour wards and postnatal wards.

3.5 Population
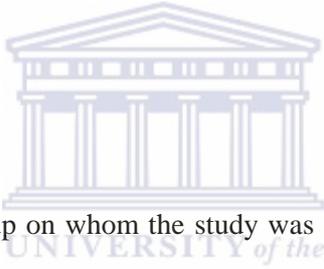
Population refers to the group on whom the study was focused. The population consisted of all permanently employed midwives at Tygerberg, Groote Schuur and Karl Bremer hospitals. The total number of midwives permanently employed in the three participating hospitals was 121. All midwives on day and night duty were targeted. The off-duty roster was used to ensure that all the midwives were included.

3.6 Criteria

The following selection criteria were used for this study:

3.6.1 Inclusion Criteria

- All permanentlyemployed midwives at the three participating hospitals.

3.6.2 Exclusion Criteria

- Community service practitioners

- Locum-registered midwives (not permanently employed)

- Other categories of nurses

3.7 Sampling and Sampling Procedure

Convenience sampling is also referred to as availability sampling because the population is readily available and accessible (Brink 2006, p. 132). All midwives were included to allow generalization of the results.

The population is summarized in Table 1.

Table 1. Summary of the sampling frame

Institution	Population
Tygerberg Hospital	62
Groote Schuur Hospital	42
Karl Bremer Hospital	17
Total number of registered midwives	**121**

All questionnaires were hand delivered. The research topic was explained and written consent was obtained from participants. A written explanation accompanied the questionnaire.

3.8 Sample Size

Polit and Hungler (1997, p. 234) suggests that in quantitative studies a large sample should be used to minimize sampling error. The population consisted of 121 registered midwives, and for the purpose of this study all the 121 midwives were included. Only 99 questionnaires were returned, therefore, the sample size consisted of 99 participants.

3.9   Data Collection Instrument

A close-ended questionnaire was used following the suggestions of Polit and Hungler ((1997, p. 256). A demographic questionnaire (Section A) was used to collect data on the country of training as a midwife, length of experience after registration as a registered midwife, experience in labour ward, the antenatal ward and performing of CTGs. The second section (Section B) is a foetal monitoring knowledge test that consists of 14 multiple choice questions (Devane & Lalor 2006, p. 300). The third section (Section C) is a structured questionnaire based on cardiotocograph interpretation skills test (Devane & Lalor 2006, p. 300; Gauge & Henderson 2005, p. 49). Certain background information of the lady and her pregnancy was given. This information includes the lady's gestational age, obstetric history of the current and previous pregnancy and whether cervical dilatation was provided. Midwives had to interpret three cardiotocograph patterns. Each tracing consisted of 7 multiple choice questions. Participants were expected to answer questions with regard to the baseline, baseline variability, periodic changes, uterine activity, possible causes of foetal heart rate abnormality and the proposed intervention required applicable to the specific pattern (Devane & Lalor 2005, p. 136; Devane & Lalor 2006, p. 300; Gauge & Henderson 2005, p. 49).

3.10 Data Collection Procedure

The researcher provided the participants with a written document outlining the details of the study. Herein, she requested written consent from them to participate in the study. The researcher administered the questionnaires to them at a time and place convenient for them. The researcher visited on various day and nights shifts, in order to make contact with all the midwives on the establishment. Data collection took place over a 4-week period.

3.11 Data Analysis

All the data were analyzed so that the relation to the study could be determined. Participants were divided into groups according to their years of clinical experience as a registered midwife.

According to Brink (2006, p. 171), statistics is the most powerful tool for analyzing quantitative data. Brink (2006, p. 171) concludes that 'descriptive statistics are used to describe and summarize data'. Data were analyzed using descriptive statistics, i.e., the mean, standard deviation and cross- tabulation. The statistical software package, SPSS 19, was used for this purpose. All completed questionnaires were marked and the data were registered on an Excel® spreadsheet. A correct answer scored 1 (one) and an incorrect answer scored 0 (zero). All questionnaires and data were registered twice to exclude possible mistakes. The data were entered into Excel® per institution and grouped according to the years of clinical experience. This data were then imported into SPSS 19 and grouped according to the years of clinical experience.
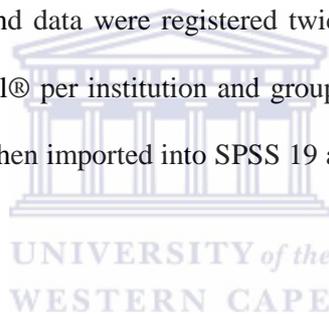
3.12 Pilot Study

A pilot study is defined by Polit and Hungler (1997, p 44) as "a small-scale version of the major study". It was carried out to detect if any loopholes existed in the questionnaires and to rectify unclear questions. A pilot study was done at Mowbray Maternity Hospital (MMH). This is a governmental hospital that admits and manages high-risk patients. The researcher selected a sample of 10 midwives. The midwives who took part in the pilot study were not included in the major study. Input with regard to the layout of the questionnaire was received and changes were made accordingly.

3.13 Validity

Validity refers to the effectiveness, comprehensiveness and quality of the measuring instrument. The focus is on the end result of the measurement and will show if the desired information was measured (Polit & Hungler 1997, p. 299; Brink 2006, p. 159). Face validity was achieved by obtaining input from experts in the field to determine whether the instrument measured what it should (Brink 2006, p. 160). The expert panel consisted of 10 midwives. The cardiotocograph interpretation skills test (CIST) was customized and adopted for this purpose. CIST was tested to determine midwives' visual interpretation CTG (Devane & Lalor 2005, p. 136).

3.14 Reliability

The reliability of an instrument refers to the consistency with which an instrument performs. A reliable instrument will produce consistent results on repeated use (Brink 2006, p. 163). An existing instrument that was piloted before was used, contextualized to the setting by adapting the literature. This instrument was used and piloted by Devane and Lalor (2005, p. 136; 2006, p. 300) on various occasions, amongst midwives with different levels of years of experience. Cronbach's Alpha reliability test was used to determine the internal consistency of the instrument with a value of 0.53 (Devane & Lalor 2006, p. 301).

3.15 Ethical Considerations

The proposal was sent to the Senate Higher Degrees Committee of the University of the Western Cape for approval. Following this, a copy of the same was sent to the Research and Ethics Committee of each of the three hospitals for approval. The researcher informed the

participants of the purpose and the aim of the study. Each participant signed a consent form prior to participating in the study. All the participants were assured of their anonymity and confidentiality. All information collected throughout this study was treated as confidential (Brink 2006, p. 35). Participants were informed that they could withdraw from the research process at any stage and that this would not disadvantage them in any way.

CHAPTER 4

RESEARCH FINDINGS

4.1   Introduction

This chapter will present the findings of the study. The findings that are presented relate to the knowledge and ability of midwives in interpreting foetal heart rate patterns according to the years of clinical experience. The population consisted of 121 registered midwives from Tygerberg, Groote Schuur and Karl Bremer hospitals. All registered midwives at the three participating hospitals, who met the inclusion criteria for this study, had equal opportunity to participate in the study. A total number of 99 (81.8%) registered midwives signed consent and completed the questionnaire.

The findings presented include the demographic data, the results of the foetal monitoring knowledge questionnaire, the results of the cardiotocograph (CTG) interpretation questionnaire and the foetal monitoring knowledge versus the CTG interpretation. These findings are discussed in relation to the overall years of clinical experience as a registered midwife and the clinical experience in performing CTGs.

4.2   Demographic Data

This section focuses on the demographic profile of the participants. The demographic profile consists of the demographic data, the country of training as a registered midwife, the years of experience as a registered midwife, the qualifications of each participant, clinical experience in labour ward, clinical experience in the antenatal ward and clinical experience in performing CTGs.

4.2.1 The Country of Training as a Registered Nurse and the Country of Training as a Registered Midwife

Eighty nine (89.9%) of participants completed their training as a registered midwife in South Africa. Ten (10.1%) of the participants did not mention their country of training. The understanding is that the majority of the participants had to meet the same requirements according to the South African Nursing Council (SANC), upon completion of their studies (Regulation 254 1975; Regulation 425 1985).

4.2.2 The Overall Years of Clinical Experience as a Registered Midwife

This section focuses on the overall years of clinical experience as a registered midwife and not the clinical years of experience in relation to conducting CTG's. The participants were divided into four groups according to their years of clinical experience as a registered midwife. This entails a registered midwife with less than two years of clinical experience, a registered midwife with two to three years of clinical experience, a registered midwife with three to five years of clinical experience and a registered midwife with more than five years of clinical experience.

Figure 1 displays the total participants according to the different clinical experience as a registered midwife. Most midwives, 74 (74.7%), have more than five years clinical experience as a registered midwife.

4.2.3 The Qualifications of the Participants

This section focuses on the qualifications of the participants. The qualifications consist of a four year nursing midwifery diploma leading to the qualification as a professional registered nurse, a four year nursing midwifery degree leading to the qualification as a professional

registered nurse, one year post basic honours degree and an advanced midwifery and neonatology diploma.

Table 2 summarizes the distribution of the years of clinical experience as a registered midwife and the qualifications of the participants. Two participants omitted to indicate their qualifications and 97 indicated their qualification. Out of the participants (n=97) who filled in their qualifications, 61 (62.9%) had a four year diploma as the highest qualification leading to a professional registered midwife. The majority of the participants with more than five years of clinical experience as a registered midwife had advanced midwifery as their highest qualification.
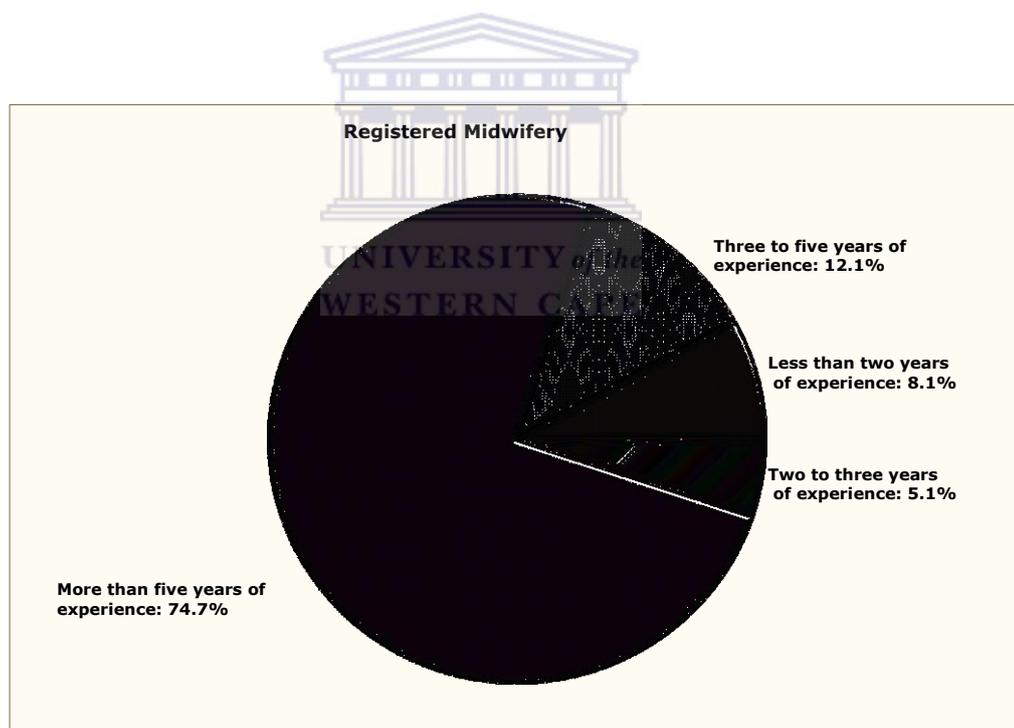
Figure 1. Clinical years of experience as a registered midwife

Table 2. Distribution of years of clinical experience as a registered midwife and qualifications

Years of clinical experience as a registered midwife	Four Year Diploma	Four Year Degree	One Year Post Basic Honours Degree	Advanced Midwifery Diploma
Less than two years of clinical experience (n=8)	5	3	0	0
% within qualification	(8.2%)	(15.0%)	(0%)	(0%)
Two to three years of clinical experience (n=5)	1	4	0	0
% within qualification	(1.6%)	(20.0%)	(0%)	(0%)
Three to five years of clinical experience (n=12)	4	7	0	1
% within qualification	(6.6%)	(35.0%)	(0%)	(6.7%)
More than five years of clinical experience (n=72)	51	6	1	14
% within qualification	(83.6%)	(30.0%)	(100.0%)	(93.3%)
Total per Qualification (n=97)	61	20	1	15

4.2.4 Clinical Experience in Labour Ward in Performing CTGs

In this section, the clinical experience of the participants in performing CTGs in labour wards is shown. The participants were divided into four categories based on their years of clinical experience as a registered midwife.

Table 3 summarizes the clinical experiences in labour ward in performing CTG's and the years of experience as registered midwife. One participant omitted to indicate the overall clinical experience and 98 indicated their overall clinical experience in labour ward in performing CTGs. Out of the participants (n=98) who filled in their overall clinical experience, 62 (63.3%) participants indicated that they were working for the past year in labour ward as opposed to 36 (36.7%) of participants who did not work for the past year in labour ward.

The core responsibility of midwives is to ensure maternal and foetal well-being. These findings show that the majority of the participants are exposed to EFHRM where the practice

of the skill is required. Expertise is developed over a number of years (Benner 1984). Expertise in midwifery is required mostly in the intrapartum clinical areas for early identification and diagnosis of foetal distress.

Table 3. Clinical experience in labour ward in performing CTG's versus years of experience as registered midwife

Years of experience as registered midwife	Clinical Experience for the Past Year in Labour Ward	
	Yes	**No**
Less than 2 years of clinical experience as a registered midwife (n=8)	3	5
% with clinical experience	(4.8%)	(13.9%)
Two to three years of clinical experience (n=5)	4	1
% with clinical experience	(6.5%)	(2.8%)
Three to five years of clinical experience (n=12)	8	4
% with clinical experience	(12.9%)	(11.1%)
More than five years of clinical experience (n=73)	47	26
% with clinical experience	(75.8)	(72.2%)
Total with clinical experience (n=98)	62	36

Participants had to indicate their clinical experience in labour ward, in months. The clinical experience in labour ward includes the clinical experience in performing CTGs. Out of the 62 (63.3%) who had clinical experience in labour ward, 32 (51.6%) participants specified the duration of clinical experience in labour ward in months. The mean of the total months of clinical experience in labour ward was 9.03 and the standard deviation 3.93 (Table 4). Participants with more than 5 years of experience as a registered midwife also had the most clinical experience in labour ward for the past year. This group had the highest mean and the lowest standard deviation.

It was noted from the data that the range were closely spread, in other words, more than one participant had the same extent of experience in months. The participants in the group with 3-5 years of clinical experience as a registered midwife had a lower mean and the highest standard deviation, suggesting that they had the lowest clinical experience and their experience in months was widely spread. The participants had different duration of experience.

Table 4. Means and standard deviations of clinical years of experience as a registered midwife in labour ward

Clinical years of experience	Mean	Standard Deviation
Less than two years of clinical experience (n=2)	8.50	4.95
Two to three years of clinical experience (n=3)	7.00	4.58
Three to five years of clinical experience (n=4)	7.50	5.26
More than five years of clinical experience (n=23)	9.61	3.69
Total (n=32)	9.03	3.93

4.2.5 Clinical Experience in Antenatal Ward in Performing CTGs

In this section, the participants' clinical experience in antenatal ward in performing CTGs and clinical experience as a registered midwife are shown (Table 5). One participant did not mention the clinical experience in antenatal ward and 98 participants indicated their clinical experience in the antenatal ward. Out of the participants (n=98), the majority 61 (62.2%) did not work for the past year in the antenatal ward compared to the 37 (37.7%) who indicated that they worked for the past year in the antenatal ward. It is noted that out of the participants (n=37) who had clinical experience in antenatal ward, most of the expert group 30 (81.1%)

had clinical experience in performing CTGs. Participants had to indicate their clinical experience in antenatal ward, in months. Out of the 37 (37.8%) who had clinical experience in the antenatal ward, 17(45.9%) specified the duration of clinical experience in the antenatal ward in months.

The clinical experience in antenatal ward includes the clinical experience in performing CTGs. The mean of the total months of clinical experience in the antenatal ward was 6.71 and the standard deviation 4.81 (Table 6). Participants within the competent group had the highest mean, but the lowest standard deviation. This suggests that for the past year most of the competent group had clinical experience in the antenatal ward in performing CTGs according to the months indicated. From the data it was noted that the range was closely spread, in other words, more than one participant had the same level of experience in months.
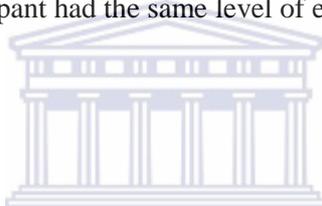
Table 5. Clinical exposure in the antenatal ward versus clinical experience as a registered midwife

Clinical experience as a registered midwife	Clinical Experience for the Past Year in the Antenatal Ward	
	Yes	No
Less than two years of clinical experience (n=8)	0	8
% with clinical exposure	(0%)	(13.1%)
Two to three years of clinical experience (n=5)	2	3
% with clinical exposure	(5.4%)	(4.9%)
Three to five years of clinical experience (n=12)	5	7
% with clinical exposure	(13.5%)	(11.5%)
More than five years of clinical experience t (n=73)	30	43
% with clinical exposure	(81.1%)	(70.5%)
Total with clinical experience (n=98)	37	61

Table 6. Means and standard deviations of clinical experience in antenatal ward

Clinical experience in antenatal ward	Mean	Standard Deviation
Less than two years of clinical experience (n=0)	*	*
Two to three years of clinical experience (n=2)	9.50	3.53
Three to five years of clinical experience (n=2)	8.00	5.65
More than five years of clinical experience (n=13)	6.08	5.02
Total (n=17)	6.71	4.81

4.2.6 Clinical Experience in Performing CTGs

In this section, the clinical experiences of the participants in doing CTGs are described. One participant omitted to include her clinical experience and 98 indicated their clinical experience in performing CTGs. Out of the participants (n=98) who indicated their clinical experience in performing CTGs, 78 (79.6%) indicated that they did CTGs for the past year in contrast to 20 (20.4%) who did not do CTGs for the past year. Table 7 summarizes the clinical experiences in doing CTGs and the clinical years of experience as a registered midwife. The group with more than 5 years of clinical experience as a registered midwife consistently had the most clinical experience in CTGs as well as expected and this should be beneficial in decreasing neonatal and foetal mortality and morbidity, thus aiding in reaching the fourth MDG.

Table 7. Clinical experience in performing CTGs versus clinical experience as a registered midwife.

Clinical experience as a registered midwife.	Clinical Experience for the Past Year in Performing CTGs	
	Yes	No
Less than two years of clinical experience (n=8) % with clinical experience in performing CTGs	4 (5.1%)	4 (20.0%)
Two to three years of clinical experience (n=5) % with clinical experience in performing CTGs	4 (5.1%)	1 (5.0%)
Three to five years of clinical experience (n=11) % with clinical experience in performing CTGs	8 (10.3%)	3 (15.0%)
More than five years of clinical experience (n=74) % with clinical experience in performing CTGs	62 (79.5%)	12 (60.0%)
Total per clinical experience in performing CTGs (n=98)	78	20
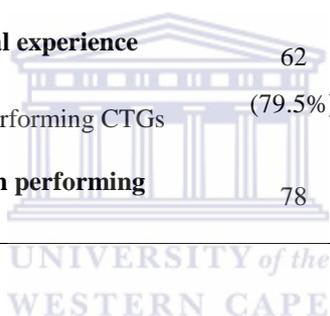
Out of the 78 (79.6%) who had clinical experience in doing CTGs, 27(34.6%) specified the duration of clinical experience in doing CTGs in months. The mean of the total months of clinical experience in doing CTGs was 10.04 and the standard deviation 3.40 (Table 8). Participants within the more than 5 years of clinical experience had the highest mean and the lowest standard deviation. This implies that for the past year most of participants with more than 5 years of clinical experience as a registered midwife had clinical experience in performing CTGs according to the months indicated.

Table 8. Means and standard deviations of clinical experience in performing CTGs

Clinical experience as a registered midwife	Mean	Standard Deviation
Less than two years of clinical experience (n=2)	8.50	4.95
*Two to three years of clinical experience (n=1)	*	*
Three to five years of clinical experience (n=4)	9.25	5.50
More than five years of clinical experience (n=20)	10.25	3.02
Total (n=27)	10.04	3.40

* There is no mean or standard deviation for a sample of 1 for the specified group.

This section concludes the demographic profile of the participants. The next section reports on knowledge and foetal monitoring.
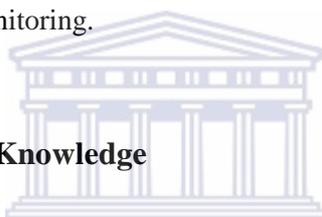
4.3 Foetal Monitoring Knowledge

This section focuses on the foetal monitoring knowledge of the participants. The participants had to complete a foetal monitoring knowledge questionnaire. The maximum score that could be obtained in the questionnaire was 14 and the minimum score 0. The findings shown include the average scores according to their years of clinical experience as a registered midwife and the interrelationship amongst the different. The average scores per group are displayed in Table 9. The overall mean was 5.41 and the standard deviation was 2.11, indicating that the average score out of 14 was 5.41, and most of the participants had the same score. This is a low average score taking into account, as shown in section 4.2.6, that 78 (79.6%) of the participants had clinical experience in performing CTGs daily. It is evident from these findings that there is a lack of foetal monitoring knowledge amongst midwives. The participants more than five years of clinical experience as a registered midwife are the only group that had a minimum score of 0 and a maximum score of 11. It was not expected

that midwives with more than five years of clinical experience would score 0 due to their clinical experience.

Table 9. Means, standard deviations, minimum and maximum scores for knowledge of foetal monitoring

Clinical years of experience as a registered midwife	Mean	Standard Deviation	Minimum	Maximum
Less than two years of clinical experience (n=8)	4.13	1.35	3	7
Two to three years of clinical experience (n=5)	3.80	0.83	3	5
Three to five years of clinical experience (n=12)	6.67	2.27	3	10
More than five years of clinical experience (n=74)	5.46	2.09	0	11
Total (n=99)	5.41	2.11	0	11

In Table 10 the interrelationships among the different groups, according to their years of clinical experience, are shown. Analysis of variance (ANOVA) was used to compare the mean scores of the different groups. The p-value amongst the different groups was calculated. The p-value is throughout more than alpha, therefore the results are not significant. The participants were also divided into groups according to their highest qualification. The years of clinical experience was not taken into account. Two participants omitted to fill in their qualifications as noted above. The groups included participants who have a four year diploma, four year degree and an advance midwifery and neonatology diploma. There was only one participant who has a one year honours degree, and the mean could not be calculated for this participant.

Table 10. Comparison of the years of clinical experience

Years of clinical experience	p-value	Alpha	Conclusion
Less than two years of clinical experience versus Two to three years of clinical experience	0.514	0.05	Not significant
Less than two years of clinical experience versus Three to five years of clinical experience	0.094	0.05	Not significant
Less than two years of clinical experience versus More than five years of clinical experience	0.181	0.05	Not significant
Two to three years of clinical experience versus Three to five years of clinical experience	0.053	0.05	Not significant
Two to three years of clinical experience versus More than five years of clinical experience	0.118	0.05	Not significant
Three to five years of clinical experience versus More than five years of clinical experience	0.568	0.05	Not significant

In Table 11, it is noted that the group who had an advanced midwifery and neonatology diploma had the lowest overall scores. They had a mean of 5.07 and a maximum score of 8. Midwives with an advanced midwifery and neonatology diploma are expected to perform their duties as clinical specialists and excel in doing so due to the postgraduate qualification they obtained (Regulation 1665 1979). It was expected that they would score higher due to their advanced training.

Table 11. Means, standard deviations, minimum and maximum knowledge score per qualification

Qualification	Mean	Standard Deviation	Minimum	Maximum
Diploma (n=61)	5.31	2.11	0	11
Degree (n=20)	6.10	2.44	3	10
Advanced Midwifery (n=15	5.07	1.71	2	8

Table 12 shows whether any relationship exists with regard to the average knowledge score amongst participants who have clinical experience in performing CTGs compared to those who do not have any clinical experience in performing CTGs. The areas that were explored included labour ward, the antenatal ward and participants who did CTGs. In all 3 of the mentioned sections, the p-value was more than alpha. It is concluded that the average knowledge score is the same for those who have clinical experience as opposed to those participants who do not have clinical experience.

Table 12. Clinical experience versus no experience

Clinical Area	p-value	Alpha	Conclusion
Labour ward	0.55	0.05	Not significant
Antenatal ward	0.66	0.05	Not significant
Performing CTGs	0.19	0.05	Not significant

4.4   Cardiotocograph Interpretation

In this section the CTG interpretation scores of the participants are discussed. The participants completed a CTG interpretation questionnaire. The maximum score that could have been obtained was 21 and a minimum score was 0. The findings include the average scores per group according to the years of clinical experience as a registered midwife, the interrelationship among the different groups according to their years of clinical experience as a registered midwife, a comparison of the average scores among the different groups based on their qualifications and the relationship among those with clinical experience versus those who do not have any clinical experience. The average score per group, according to their years of clinical experience, are shown (Table 13).

The overall mean was 12.40 and the standard deviation was 3.00. It was expected that the average score would be higher due to the experience of participants in performing CTGs. As previously shown, 78 (79.6%) participants had experience in performing CTGs. Out of the

maximum score of 21, participants had an average score of 12.40. This is low taking into account the number of participants who had experience in this field. In the advanced beginner group it was noticed that the lowest score was 0. This may be due to their lack of experience in the clinical field as shown in sections 4.2.5 and 4.2.6.

Table 13. Means, standard deviations, minimum and maximum scores of CTG interpretation

Years of clinical experience	Mean	Standard Deviation	Minimum	Maximum
Less than two years of clinical experience (n=8)	11.88	4.94	0	15
Two to three years of clinical experience (n=5)	10.60	3.84	5	15
Three to five years of clinical experience (n=12)	12.50	2.78	9	19
More than five years of clinical experience (n=74)	12.57	2.74	5	18
Total (n=99)	12.40	3.00	0	19
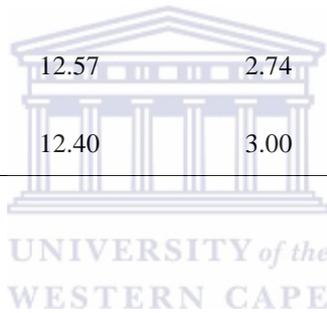
The average scores among the groups according to the years of clinical experience as a registered midwife are shown in Table 14. In order to draw a conclusion, the p-value has to be different than alpha. This would determine whether the average CTG interpretation score between the groups are statistically significant. The p-value is greater than alpha in all the groups, implying that the average CTG interpretation score of the one group is the same as the average CTG interpretation score of the other group. Therefore, the result is not significant.

The participants were divided into groups according to their highest qualification (Table 15). Two participants did not fill in their highest qualification. Ninety seven participants indicated what their highest qualification was. It was noted that the group who had advanced midwifery and neonatology had the lowest mean. There is no mean or standard deviation for a sample of 1 for the group with a one year honours degree.

Table 14. Average scores among the groups

Years of clinical experience	p-value	Alpha	Conclusion
Less than two years of clinical experience versus Two to three years of clinical experience	0.963	0.05	Not significant
Less than two years of clinical experience versus Three to five years of clinical experience	0.520	0.05	Not significant
Less than two years of clinical experience versus More than five years of clinical experience	0.296	0.05	Not significant
Two to three years of clinical experience versus Three to five years of clinical experience	0.458	0.05	Not significant
Two to three years of clinical experience versus more versus More than five years of clinical experience	0.387	0.05	Not significant
Three to five years of clinical experience versus versus More than five years of clinical experience	0.888	0.05	Not significant

Table 16 shows the relationship between the average interpretation score amongst participants who have vs those who do not have clinical experience in performing CTGs. The areas that were explored included labour ward, the antenatal ward and participants who performed CTGs. In all 3 of the mentioned categories, the p-value was more than alpha. It is concluded that the average interpretation score is the same for those who have clinical experience as opposed to those participants who do not have clinical experience.

Table 15. Means, standard deviations, minimum and maximum cardiotocograph interpretation score per qualification

Qualification	Mean	Standard Deviation	Minimum	Maximum
Four Year Diploma (n=61)	12.49	3.17	0	18
Four Year Degree (n=20)	12.65	3.10	5	19
One Year Honours Degree (n=1)	-	-	-	-
Advanced Midwifery (n=15)	11.87	2.50	8	15

Table 16. Clinical experience versus no clinical experience in performing CTGs

Clinical area	p-value	Alpha	Conclusion
Labour ward	0.980	0.05	Not significant
Antenatal ward	0.711	0.05	Not significant
Performing CTGs	0.986	0.05	Not significant

4.5   Knowledge Versus Interpretation

In this section the average knowledge and interpretation scores are noted. Correlation analysis was performed on the knowledge score versus the interpretation scores and a statistical comparison was also done on both variables.

4.5.1   Correlation Analysis

Correlation analysis was applied because the knowledge score and the interpretation score are both continuous variables. The correlation analysis revealed that the p-value = 0.05 and alpha = 0.05. This concludes that there was not enough information to draw a conclusion on

whether to accept that there is a correlation or that there is no correlation between the knowledge score and the interpretation score.

4.5.2 Comparison of the Average Knowledge Score Versus the Average Interpretation Score

The mean for the average interpretation questions were much higher than the mean for the average knowledge questions (Table 17). Statistically, the results are significant and this shows that participants had considerable difficulty in answering the foetal monitoring knowledge type questions. They scored better in answering the CTG interpretation questions.

Table 17. Comparison of the average knowledge score versus the average interpretation score.

Knowledge Versus Interpretation	Mean	Standard Deviation
Knowledge questions	5.41	2.11
Interpretation questions	12.40	3.00
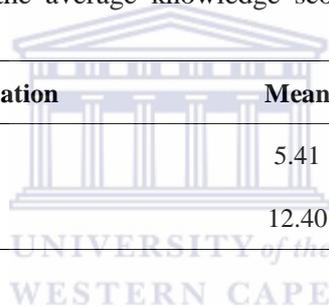
4.6 Conclusion

The findings in this chapter were summarized. There is no conclusive evidence that midwives with more years of clinical experience as a registered midwife scored higher than those with less years of experience. It is accordingly significant that there is a dire need for CTG training amongst midwives due to the low average scores on foetal monitoring knowledge questions and the CTG interpretation. The next chapter expounds the discussion and conclusion of the findings.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

5.1 Introduction

This is the final chapter of this study. In this chapter the objectives and the research findings are discussed using a literature control to interpret the results in the broader context. Conclusions as well as recommendations for further research will be drawn.

5.2 Objectives of the Study

The objectives of this study were:

1. To determine the knowledge of midwives in performing foetal heart rate monitoring (FHRM) according to the years of clinical experience as a registered midwife.

2. To assess midwives' ability in the interpretation of FHR patterns according to the years of clinical experience as a registered midwife.

5.3 Hypothesis

In the hypothesis it was assumed that there will be a positive correlation between midwives' knowledge and their years of clinical experience as a registered midwife. It was further hypothesized that there will be a positive correlation between midwives' cardiotocograph (CTG) interpretation and their years of clinical experience as a registered midwife.

5.4 Limitations

This study was conducted at three governmental hospitals in the Western Cape. Only permanent employees were included. Locum midwives and community health practitioners were excluded because they were not permanently employed at any of the three participating hospitals. Other factors that could have interfered with the study such as shortages of staff and equipment were not taken into account. The researcher had an assumption that there will be a positive correlation between midwives' knowledge and interpretation skills in accordance with their years of clinical experience as a registered nurse. The researcher might have been bias due to such an assumption in the analysis of the results. All the findings were reported to exclude the possibility that the researcher might have been bias. Another limitation was that the researcher had to collect the questionnaires several days after she handed them out. Participants could have consulted with colleagues, textbooks or other reference literature in order to complete the questionnaire. The researcher made every attempt to overcome this by setting out to collect the data in the shortest possible period of time, but this was not always feasible due to reasons beyond the control of the researcher.

5.5 Interpretation of Findings

All the stated objectives were met and the findings were discussed in relation to the demographic data, foetal monitoring knowledge and cardiotocograph interpretation.

5.5.1 Demographic Data

The demographic data focused on the country of training, the years of experience as a midwife, the qualifications of the participants, the clinical experience in labour ward, clinical experience in the antenatal ward and the clinical experience in performing CTGs. Chapter 4 explains the distribution of the participants with regard to the abovementioned focus areas. In

this section, the years of experience and the clinical experience in the different areas are elaborated.

5.5.1.1 Years of Experience

Ninety nine midwives took part in the study. The different competency levels according to Benner (Benner 1984, p. 13) were kept in mind, but as there was no formal assessment of competency levels, they were divided into different groups according to their years of clinical experience as a registered midwife. The majority of midwives, 74 (74.7%), had more than 5 years of experience. Similar findings were reported by Devane and Lalor (2006, p. 302) where participants had more than 5 years of experience.

5.5.1.2 Experience in the Clinical Setting

In this study, 62 (63.3%) of midwives indicated that they worked for the past year in labour ward, thus having the clinical experience in performing CTG's. In the study done by Devane and Lalor (2006, p. 302), the majority of participants had labour ward experience. It was noted that the majority of participants had experience in performing CTGs. In the light of these findings, it was assumed that most participants were involved, on a daily basis, in the interpretation and record keeping of CTGs. It is their primary responsibility to ensure foetal well-being by means of correct interpretation of the CTG. On the basis of the data analysis, it was evident that the participants classified into the group with more than 5 years of experience were mostly exposed to performing CTGs (n=62, 79.5%), working in labour ward (n=47, 75.8%) and working in the antenatal ward (n=30, 81.1%). The conclusion is thus that there is supposed to be a high level of clinical expertise that can contribute to the reduction of foetal and neonatal morbidity and mortality rates. This should unquestionably assist in reaching the fourth MDG (WHO n.d.). Benner (1984) stated that "expertise has been regarded

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as something that is acquired, essentially through professional experience" (Benner 1984, cited in Paley 2006, p. 88).

5.6   Foetal Monitoring Knowledge

The first objective of this study was to determine the knowledge of midwives in FHRM according to their years of clinical experience as a registered midwife. Section B of the questionnaire dealt with reaching this objective. The maximum score that could be obtained was 14. Participants who had more than five years of clinical experience as a registered midwife had the highest score of 11 (78.5%), but the lowest score of 0. The expectation was that this group would score better due to their exposure to the same clinical situations. The scores of 50% and less raise some concerns, but it can be concurred that those with less than two years of clinical experience as a midwife need guidance and mentoring in the interpretation and record keeping of CTGs.

A study was done in the Western Cape to determine the effect of a training programme on the clinical skills and decision making of midwives. Correct record keeping, effective application of knowledge and skills have been postulated to have a direct influence on neonatal well-being. The mean score for the knowledge section was 56%. The problem areas were identified as the inability to recognize foetal distress (Farrell & Pattinson 2005, p. 116). There is a minimal difference between the mean scores per group according to their years of clinical experience as a registered midwife. However, the overall mean for the foetal monitoring knowledge was 5.41. This is a low average score taking into account that 78 (79.6%) participants had clinical experience in performing CTGs.

5.7   Cardiotocograph Interpretation

The second objective of this study was to determine midwives' ability in the interpretation of FHR patterns according to their years of clinical experience as a registered midwife. Section C of the questionnaire aided in reaching this objective. The maximum score that could be obtained was 21. The expectation was that the group with more than five years of clinical experience would score better due to their clinical exposure. The scores of 50% are of particular concern and asserts the notion that those with less than two years of clinical experience need guidance and mentoring in the interpretation and record keeping of CTGs.

Participants with less than two years of clinical experience as a midwife and those with two to three years of clinical experience as a registered midwife had the lowest mean of 11.88 and 10.60, respectively. They also had a high standard deviation which indicates that the scores are spread far from the mean. This group of participants had the least years of clinical experience and still requires mentoring and exposure in the clinical field to improve their knowledge with regards to cardiotocograph interpretation. Daley (1999, p. 16) mentioned that professional and personal maturity contributes to the integration of knowledge and experience.

According to Williams and Arulkumaran (2004, p. 459), misinterpretation of CTG tracing is one of the many claims due to negligence in obstetrics litigation. In this study, the overall mean of 12.40 reflects a serious lack of knowledge and experience in the interpretation of CTGs amongst midwives. Thus, in terms of the assertions of Williams and Arulkumaran (2004, p. 459) and the findings of this study, critical ethical issues need to be addressed in midwifery education, training and care.

5.8   Knowledge Versus Interpretation

The average knowledge and interpretation scores were compared. The results revealed significance in the two scores. The mean for the interpretation score were 12.40 in comparison to the knowledge score of 5.41. Participants scored better in the CTG interpretation section than the knowledge type questions. The lack of knowledge in foetal monitoring is a major contributor to Grade III sub-optimal care which is referred to as an avoidable factor. Thus, continuing professional midwifery development with regard to CTG interpretation and foetal monitoring can ameliorate Grade III sub-optimal care and its attendant adverse outcomes such as morbidity and mortality of the foetus and neonate (Tan et al 1999, 251).

5.9   Recommendations

5.9.1 Further Research

There is a need for further research on midwives' knowledge and ability to interpret EFHM. Future studies could be done to reinforce the results reported here, and should place greater emphasis on the population who have clinical experience in performing CTGs. Factors that may prevent midwives from performing their duties effectively, for example shortage of staff and insufficient equipment, can be included. Interviews and open-ended questions should as well form part of the research methodology.

It is also recommended that the effectiveness of weekly review meetings amongst healthcare practitioners can be investigated. Williams and Arulkumaran (2004 p. 460) concluded that "competence in CTG interpretation can be achieved through a combination of strategies rather than a single approach".

It is recommended that more in-depth methodology can be applied which include open ended questions and interviews. The lived experiences of midwives in performing CTGs can then be evaluated.

5.9.2 Formal and Informal Training

Midwives and medical practitioners should have weekly case review meetings. CTG patterns and interventions can be discussed at these meetings so that their knowledge can be broadened (Williams & Arulkumaran 2004, p. 460). This will also ensure consistency and confidence amongst midwives and medical practitioners in the management of foetal distress. Foetal heart monitoring training should be available to update the knowledge and competencies of midwives and medical practitioners. It is advisable that foetal heart monitoring should form a major component of the neonatal module in undergraduate and postgraduate midwifery training to ensure maternal and foetal well-being.

5.10 Conclusion

The findings of this study revealed that there is a lack of foetal monitoring knowledge amongst midwives. It was hypothesized that there will be a positive correlation between midwives' knowledge and their years of clinical experience as a registered midwife. This hypothesis was rejected since statistical analysis of the findings could not establish a correlation between midwives' foetal monitoring knowledge and their years of clinical experience as a registered midwife. The overall mean for the foetal monitoring knowledge was low, taking into account that the majority of the participants had clinical experience in performing CTGs daily. It was also hypothesized that there will be a positive correlation between midwives CTG interpretation and their years of clinical experience as a registered midwife. This hypothesis was also rejected.
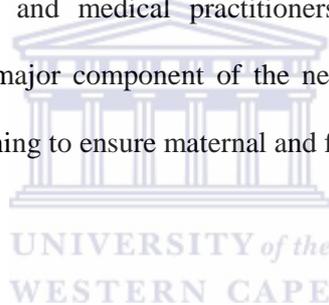
The interpretation of foetal heart rate patterns and the ability to communicate foetal well-being is very important in obstetrics. It is necessary for healthcare professionals to understand the standard terminology and method of reporting (Fedorka 2012, p. 17). The correct interpretation of the CTG contributes to early detection of an abnormal foetal heart rate pattern, allowing intervention to prevent neonatal and foetal morbidity and mortality (Gauge & Henderson 2005, p. 5). Foetal heart monitoring is one of the key responsibilities of any registered midwife. In order to become professionally matured and competent, midwives have to participate in continuous training and development programmes on the early detection of foetal distress so that potential foetal and neonatal complications due to hypoxic injuries can be prevented.

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APPENDIX 1

PERMISSION TO USE THE QUESTIONNAIRE

Gmail
by Google

Portia Tities <portiatities@gmail.com>

Fwd: RE: Research instrument

Portia Tities <Ptities@pgwc.gov.za>
To: portiatities@gmail.com

Wed, Mar 2, 2011 at 2:15 PM

>>> "Devane, Declan" <declan.devane@nuigalway.ie> 06/11/2010 19:40 >>>
Dear Portia

I attach our questionnaire

Please feel free to use so long as you acknowledge source and that
permission was given.

You will need to insert your won CTG strips into section II.

I would love to see a copy of your findings.

Best of luck

Regards

Declan

Declan Devane
Senior Lecturer
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Galway
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Fax: +353 91 494 537
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Staff web page:
http://www.nuigalway.ie/nursing-midwifery/Staff/academic_staff/declandev
ane.html
School Web: www.nuigalway.ie/nursing.midwifery
Electronic mail, whether to, from or within the University,
may be the subject of a request under the Freedom of Information
Act and consequently may be releasable.

From: PORTIA LETITIA TITIES [mailto:2930976@uwc.ac.za]
Sent: 06 November 2010 07:56
To: ddevane@tcd.ie
Subject: Research instrument
Importance: High

Good day Dr Devane
I am a Master student at The University of Western Cape in Cape Town,
South Africa. My title for my thesis is, Midwives knowledge and skills
in interpreting fetal heart rate patterns. I am looking for the
instruments that you and Joan Lalor uesd in 2 of your studies namely,
the CIST. I would really appreciate it if you can offer me some guidance
in where to find this instruments. I got a copy of the article from
M.Trepanier (1996), but to no avail. I would like to utilize the
instrument , modified to suit my participants, in my proposed research.

APPENDIX 2

APPROVALT FROM THE HIGHER DEGREES COMMITTEE OF THE UNIVERSITY OF THE WESTERN CAPE, ETHICAL CLEARANCE

OFFICE OF THE DEAN
DEPARTMENT OF RESEARCH
DEVELOPMENT

Private Bag X17, Bellville 7535
South Africa
Telegraph: UNIBELL
Telephone: +27 21 959-2948/2949
Fax: +27 21 959-3170
Website: www.uwc.ac.za

10 February 2011

To Whom It May Concern

I hereby certify that the Senate Research Committee of the University of the Western Cape has approved the methodology and the ethics of the following research project by: Mrs P. Tities (Nursing).

Research Project: Midwives knowledge and skills to interpret fetal heart rate patterns

Registration no: 11/1/27

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

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A place of quality, a place to grow, from hope to action through knowledge

APPENDIX 3

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM

TITLE OF THE RESEARCH PROJECT: *Midwives' knowledge and skills to interpret foetal heart rate patterns.*

PRINCIPAL INVESTIGATOR: Portia Tities   **CONTACT NUMBER: 079 027 8879**

What is this study about?
The purpose of the study is to determine the Midwives' knowledge and skills in interpreting foetal heart rate monitoring and to assess their level of competency in the interpretation of foetal heart rate patterns according to the levels of competency, i.e advanced beginner, competent, proficient and an expert midwife.

What will I be asked to do if I agree to participate?
You will be asked to fill in 3 questionnaires. Section A will be a demographic questionnaire, section B will be a knowledge based questionnaire and section C an interpretation skills questionnaire. Questionnaires will be handed to you while on duty and I will come and collect them once you are done.

Would my participation in this study be kept confidential?
Yes. It will not be requested from you to include your name in the questionnaires.

What are the risks of this research?
There are no known risks associated with participating in this research project.

What are the benefits of this research?
The results will not benefit you personally but it will help the researcher to identify if there are differences in the knowledge amongst midwives, on the interpretation of foetal heart rate patterns, of different competency levels. These results might lead to further research on this topic.

Do I have to be in this research and may I stop participating at any time?
Your participation is of utmost importance and voluntary. However, should you choose not to take part in this study, you will not be penalized or lose any benefits. If you decide to part take in this study, you may withdraw at any point of the process, and this will not count against you.

Is any assistance available if I am negatively affected by participating in this study?
You will not be negatively affected participating in this study.

What if I have questions?
This research is being conducted by Portia Tities, department of Nursing at the University of the Western Cape. If you have any questions about the research study itself, please contact Portia Titiesat: 079 027 8879 or e mail: 8

Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

Head of Department
Dean of the Faculty of Community and Health Sciences: University of the Western Cape
Private Bag X17
Bellville 7535

This research has been approved by the University of the Western Cape's Senate Research Committee and Ethics Committee.

Declaration by participant
By signing below, I ……………………..…………. agree to take part in a research study entitled: **Midwives' knowledge and skills to interpret foetal heart rate patterns.**

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.

- I have had a chance to ask questions and all my questions have been adequately answered.

- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.

- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.

- I may be asked to leave the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) ....…….......……………… on (*date*) …………...………... 2011.

………………………   ………………………
Signature of participant   Signature of witness
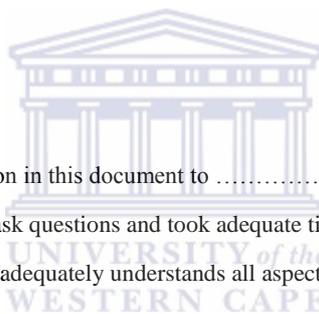
Declaration by investigator
I, Portia Tities, declare that:

- I explained the information in this document to …………………………………..

- I encouraged him/her to ask questions and took adequate time to answer them.

- I am satisfied that he/she adequately understands all aspects of the research, as discussed above

- I did/did not use an interpreter.

Signed at (*place*) ....…….......……………… on (*date*) …………...………... 2011.

………………………   ………………………
Signature of investigator   Signature of witness

APPENDIX 4

QUESTIONNAIRE

RESEARCH TITLE: Midwives' Knowledge and Skills in Interpreting Foetal Heart Rate Patterns

I am a student at The University of the Western Cape doing my MCur. The study has been approved by the Senate Ethics Committee of the university and at your institution.

This questionnaire consists of three sections:

A.   Demographic information

B.   Foetal monitoring knowledge test

C.   Cardiotocograph interpretation skill test

GUIDELINES ON COMPLETING THE QUESTIONNAIRE:

To preserve confidentiality, please do not write your name anywhere on this questionnaire.

Section A: Write or tick (√) the appropriate answer

Sections B and C: Choose the best answer for each question by placing a tick (√) in the appropriate box. Please tick one response only.
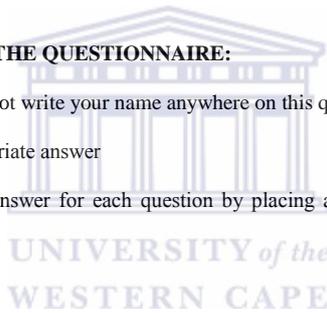
Thank you for taking the time to participate in this study and for completing this questionnaire.

………………

Mrs PL Tities

SECTION A: DEMOGRAPHIC INFORMATION

Please fill in the appropriate answer for the following questions:

1.   Where did you complete your first nursing qualification (country) ……….. …………….………….

2.   Where did you train as a midwife? (give the name of the country) ………………………………..

Please tick (√) the appropriate answer for the following questions:

3. How long have you been registered as a midwife?	1	2	3	4
	< 2 year	2-3 years	3-5 years	> 5 years

4. What is your highest training in midwifery?	1	2	3
	Degree	Diploma	Other, please specify, e.g., Advanced Midwifery, Honours/Masters Degree in Midwifery
5. Have you worked for the past year in the labour ward?	1	2	3
	No	Yes	If yes, please indicate for how long in months.
6. Have you worked for the past year in the antenatal ward?			
7. Have you been carrying out cardiotocographs for the past year?			

SECTION B: FOETAL MONITORING KNOWLEDGE TEST

This section consists of 14 multiple choice questions. Please tick the appropriate answer for each question. Please note: Only tick one answer per question.
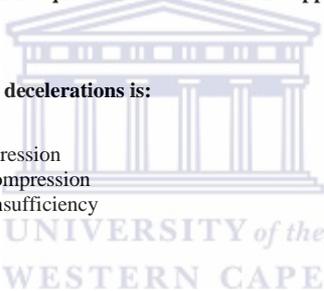
1.   **The primary cause of early decelerations is:**

    1.1   Foetal hypoxia   [   ]
    1.2   Foetal head compression   [   ]
    1.3   Umbilical cord compression   [   ]
    1.4   Utero-placental insufficiency   [   ]

2.   **Which of the following information should not be recorded on the cardiotocograph tracing?**

    2.1   Woman's identifying information   [   ]
    2.2   Woman's pulse rate   [   ]
    2.3   Your on-going interpretation of the trace   [   ]
    2.4   Administration of analgesia   [   ]

3.   **What should you include in a systematic interpretation of a cardiotocograph tracing?**

    3.1   Uterine activity, Baseline rate, Baseline variability, Decelerations   [   ]
    3.2   Baseline rate, Accelerations, Decelerations, Uterine activity   [   ]
    3.3   Baseline rate, Baseline variability, Accelerations, Decelerations   [   ]
    3.4   Uterine activity, Baseline rate, Baseline variability, Accelerations Decelerations   [   ]

4.   **When using intermittent auscultation, it is recommended that the foetal heart rate be auscultated:**

    4.1   During a contraction and for 30 seconds after   [   ]
    4.2   Before, during and for 30 seconds after a contraction   [   ]
    4.3   For one full minute immediately after a contraction   [   ]
    4.4   For 30 seconds before and 30 seconds after a contraction   [   ]

5.   **All of the following are unique characteristics of variable decelerations, except:**

    5.1   Presence of 'shouldering'   [   ]
    5.2   Vary in intensity and duration   [   ]
    5.3   Always repetitive   [   ]
    5.4   Sudden drop and rapid return to baseline   [   ]

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6. **A woman/ patient who is at 42 weeks gestation has a cardiotocograph tracing that displays a baseline FHR of 100-110 bpm with baseline variability of 10-15 bpm, reactive and with no decelerations. Which of the following represents your clinical interpretation?**

6.1   It represents a foetal bradycardia and I must intervene   [   ]
6.2   It represents early signs of increasing foetal hypoxia   [   ]
6.3   It probably reflects a healthy post-term foetus and I am reassured   [   ]
6.4   It indicates that the monitor transducer needs to be repositioned   [   ]

7. **A woman's/patient's cardiotocograph tracing displays a foetal heart baseline of 165-170 bpm. Which of the following is most likely to be the cause?**

7.1   Administration of pethidine   [   ]
7.2   Maternal pyrexia   [   ]
7.3   Prolonged head compression   [   ]
7.4   Advanced gestational age   [   ]

8. **Which of the following notations reflects appropriate documentation of the interpretation of foetal heart patterns:**

8.1   Baseline 120-150 bpm, variability 10-15 bpm, early decelerations   [   ]
8.2   Baseline 140-145 bpm, variability 5-10 bpm, no accelerations or decelerations   [   ]
8.3   Baseline 170 bpm, tachycardia, intermittent late decelerations   [   ]
8.4   Baseline 135 bpm, variability 15 bpm, accelerations & decelerations present   [   ]

9. **In the presence of uterine contractions, which one of the following foetal heart rate characteristics is considered reassuring:**

9.1   Baseline variability less than 10 bpm   [   ]
9.2   Baseline bradycardia   [   ]
9.3   Early decelerations   [   ]
9.4   Variable decelerations with 'overshoots' on recovery   [   ]

10. **Uterine contractions on the tocograph tracing are not returning to baseline. What is the best way to assess uterine resting tone:**

10.1   Adjust the toco-transducer to read between 10 and 20 mmHg   [   ]
10.2   Ask the mother if she has changed position   [   ]
10.3   Palpate the abdomen between contractions   [   ]
10.4   Re-adjust the toco-transducer on the fundus   [   ]

11. **Using the external toco-transducer, you can assess the relative:**

11.1   Duration and intensity of contractions   [   ]
11.2   Frequency and duration of contractions   [   ]
11.3   Frequency, duration and resting tone of contractions   [   ]
11.4   Frequency, duration, intensity and resting tone of contractions   [   ]

12. **The most reliable signs of foetal well-being displayed on the cardiotocograph are:**

12.1   Spontaneous accelerations and variability 15 bpm   [   ]
12.2   Normal baseline rate and absence of decelerations   [   ]
12.3   Variability 15 bpm with no accelerations or decelerations   [   ]
12.4   Presence of accelerations and absence of decelerations   [   ]

13. **Which of the following late deceleration patterns is most likely to suggest the presence of a compromised foetus:**

13.1   Accompanied by spontaneous accelerations   [   ]
13.2   Accompanied by baseline variability of less than 5 bpm   [   ]
13.3   Intermittent late deceleration pattern   [   ]
13.4   Presence of 'overshoots' on recovery   [   ]

14. **Which of the following describes the term 'reactive':**

    14.1   The presence of foetal movement recorded on the cardiotocograph   [ ]

    14.2   The recording of two or more accelerations in a 20 minute period   [ ]

    14.3   An increase in the foetal heart rate in response to uterine contractions   [ ]

    14.4   The presence of foetal movement in response to uterine contractions   [ ]

SECTION C: CARDIOTOCOGRAPH INTERPRETATION SKILL TEST

This section consists of three cardiotocograph tracings. Interpret the tracing and tick (√) the best single answer for each question.

You do not have to elaborate on your answers.

This tracing is from a 21 year old woman gravida 2, para 1. No relevant past history. Normal antenatal period, 42 weeks gestation in spontaneous labour. Cervical os 3 cm dilated.
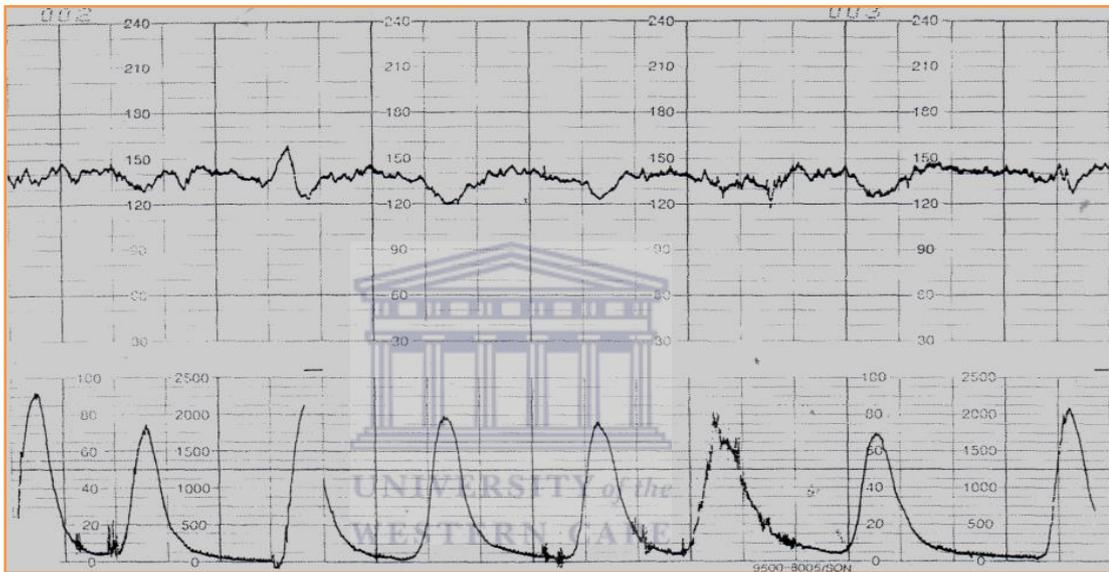
1. **What is the baseline beats per minute (bmp)?**

1.1   130 bpm

1.2   140 bpm

1.3   150 bpm

2. **What is the baseline variability beats per minute?**

2.1   5 bpm

2.2   Less than 5 bpm

2.3   10 bpm

3. **Are there any periodic changes?**

3.1   Yes

3.2   No

3.3   Unsure

4.   If any, what periodic changes are present?

4.1   Early decelerations

4.2   Variable decelerations

4.3   None

**5.   What is the possible cause of foetal heart abnormality on this trace?**

5.1   Maternal medication given

5.2   Head compression

5.3   None

6.   What uterine activity, if any, is present?

6.1   Contractions 4 in 10 minutes

6.2   Contractions 2 in 10 minutes

6.3   None

7.   What intervention would you consider necessary for this foetal heart rate pattern?

7.1   Change the maternal position

7.2   Give facial oxygen

7.3   None
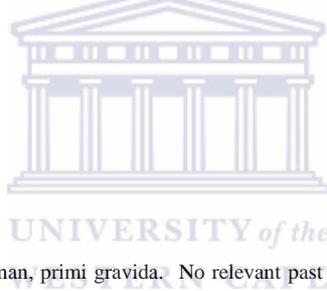
This tracing is from a 20 year old woman, primi gravida. No relevant past history. Normal antenatal period. Admitted at 40 weeks with contractions for three hours. Cervical os 5 cm dilated. Artificial rupture of membranes, clear liquor draining.
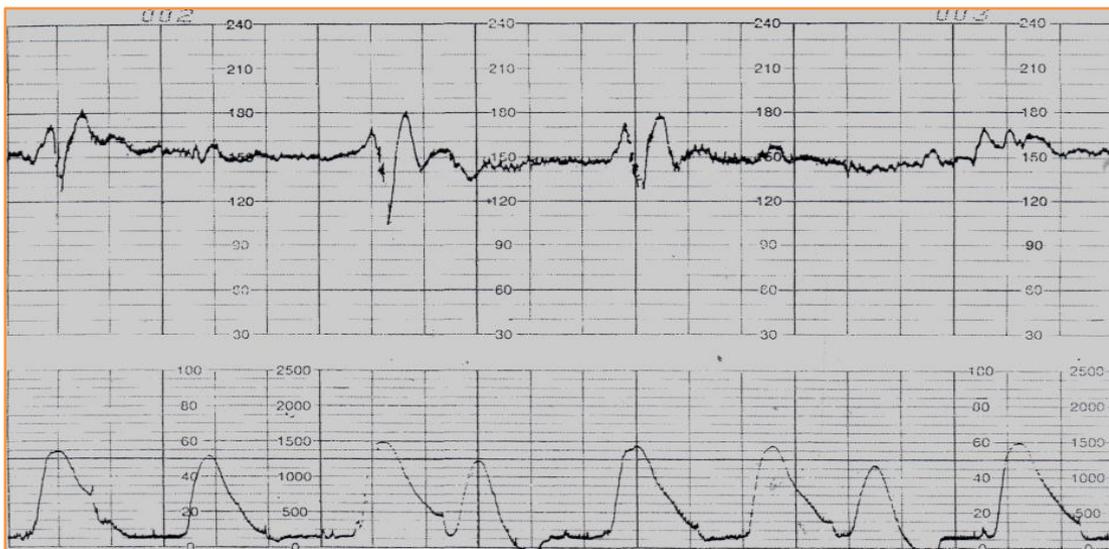

8.   What is the baseline beats per minute (bmp)?

8.1   130 bpm

8.2   140 bpm

8.3   150 bpm

9.   What is the baseline variability beats per minute?

9.1   5 bpm

9.2   Less than 5 bmp

9.3   10 bpm

10.   Are there any periodic changes?

10.1   Yes

10.2   No

10.3   Unsure

11.   If any, what periodic changes are present?

11.1   Early decelerations

11.2   Variable decelerations

11.3   None

12.   What is the possible cause of foetal heart abnormality on this trace?

12.1   Maternal medication given

12.2   Cord compression

12.3   None

13.   What uterine activity, if any, is present?

13.1   Contractions 4 in 10 min

13.2   Contractions 2 in 10 min

13.3   None

14.   What intervention would you consider necessary for this foetal heart rate pattern?

14.1   Change the maternal position

14.2   None

14.3   Start intravenous infusion

This tracing is from a 23 year old woman, gravida 2, para 1. No relevant past history. Treated for urinary tract infection at 28 weeks gestation. Admitted at 40 weeks with contractions. Cervical os 2 cm dilated. Artificial rupture of membranes, clear liquor draining.
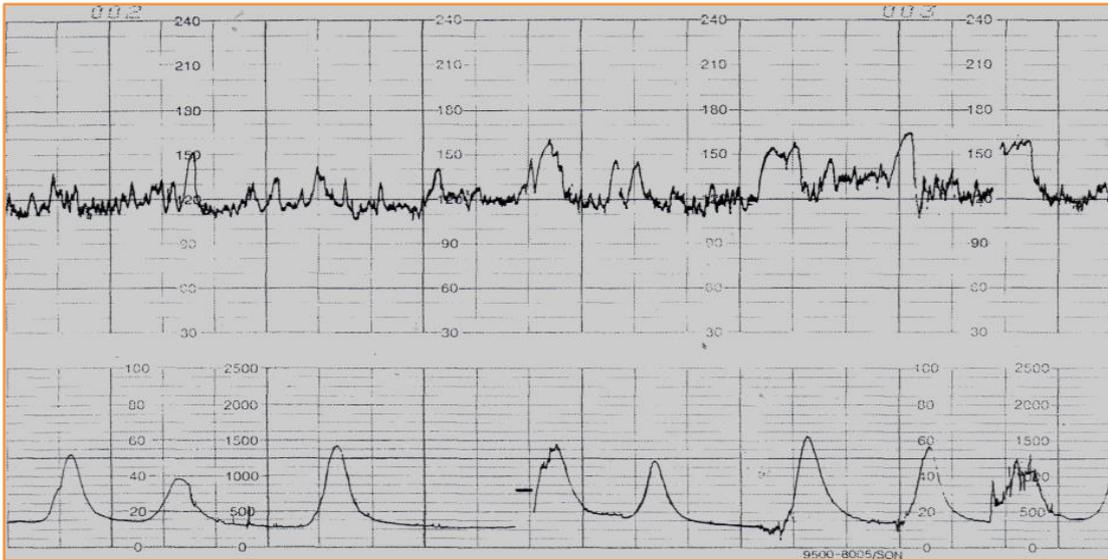
15. What is the baseline beats per minute (bmp)?

15.1   130 bpm

15.2   140 bpm

15.3   120 bpm

16. What is the baseline variability beats per minute?

16.1   10 bpm

16.2   Less than 5 bmp

16.3   More than 10 bpm

17. Are there any periodic changes?

17.1   Yes

17.2   No

17.3   Unsure

18. If any, what periodic changes are present?

18.1   None

18.2   Variable decelerations

18.3   Accelerations and contractions

19. What is the possible cause of foetal heart abnormality on this trace?

19.1   Maternal medication given

19.2   Head compression

19.3   None

20.   What uterine activity, if any, present?

20.1   Contractions 4 in 10 min

20.2   Contractions 2 in 10 min

20.3   None

21.   What intervention would you consider necessary for this foetal heart rate pattern?

21.1   Change the maternal position

21.2   Give facial oxygen

21.3   None