

THE EFFECTS OF WATER
ON BIRTH:
A RANDOMISED CONTROLLED TRIAL

by

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THESIS

**submitted in fulfilment of
the requirements for the degree**



DOCTOR CURATIONIS

in

MIDWIFERY AND NEONATOLOGY NURSING SCIENCE

in the

FACULTY OF EDUCATION AND NURSING

at the

RAND AFRIKAANS UNIVERSITY

Promoter: Prof. A.G.W. Nolte

Co-Promoter: Prof. G.J. Hofmeyr

Johannesburg: May 1999

Dedicated to my mother

DOROTHY VILJOEN (Née LEWIS)

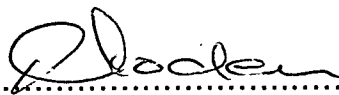
11 April 1926 - 27 August 1995

Moekie, your words came true;
"if she is born a girl with blue eyes,
she will become a nurse"



Declaration

I, VERNICÉ CHERYL NIKODEM, hereby declare that this is my own work and that I have not submitted it for a degree at any other university.


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VERNICÉ CHERYL NIKODEM

Summary

Objective

The primary objective of the study was to ascertain the effects of the use of water during birth on maternal outcomes. The main maternal outcomes evaluated were maternal experience of the second stage of labour, and trauma to the birth canal.

The second objective was to set guidelines for midwives whether or not to conduct deliveries under water.

Setting



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The study was conducted at two academic state hospitals serving the same low to middle income group urban population in the midwestern suburbs of Johannesburg, running over a period of two years, from May 1994 to May 1996. Women in active labour who met the inclusion and exclusion criteria ^(Chapter three) were asked to participate in the study.

Study design

A randomised, prospective, experimental design was used to evaluate maternal experience, trauma to the

birth canal and other additional maternal and neonatal outcomes

Main outcome measures

Primary outcomes evaluated were maternal experience of labour during the second stage of labour and trauma to the birth canal.

Results

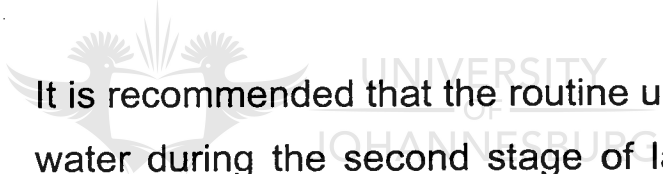
The results of this study showed that the use of water during birth significantly reduces the mothers' perception of the pain experienced compared to what they expected it to be, and enhanced their satisfaction with their ability to cope with labour. No differences were noted in trauma to the birth canal. No adverse maternal effects were noted. The primary hypotheses of this thesis did not include neonatal outcomes, but one neonatal death occurred in the water group. The most likely cause of death was pre-existing intrauterine fetal infection.

Conclusions and recommendations

The use of water during the second stage of labour may decrease the use of interventions such as episiotomies. Women who delivered in water were significantly more satisfied with their birthing

experience. Meta-analyses of this study and previous non-randomised studies showed a significant decrease in the incidence of episiotomies, second, third and fourth degree tears if women delivered in water, although more women may experience first degree tears.

Maternal and neonatal morbidity is increased when women deliver in water. The possible harmful effect of inhalation of fresh water by an infant is not resolved and a large collaborative randomised controlled trial is recommended.

The logo of Waterloo University Johannesburg is a watermark in the background. It features a stylized bird with its wings spread, perched on a globe. The text 'WATERLOO UNIVERSITY JOHANNESBURG' is written in a serif font across the middle of the logo.

It is recommended that the routine use of immersion in water during the second stage of labour should only be offered to women by competent birth attendants, who follow specific guidelines, until clear evidence is available on the possible beneficial or harmful effects of immersion in water during the second stage of labour on the mother and her infant.

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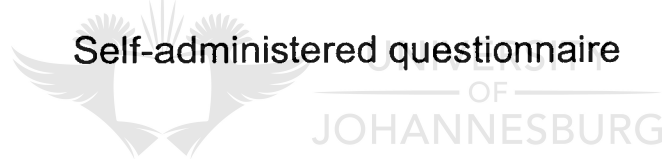
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ACKNOWLEDGEMENTS

Herewith my sincere appreciation and thanks to:

GOD

My Creator and spiritual Mentor.

TONY NIKODEM

My wonderful husband for all his patience, love, tolerance, understanding and support.

LADA NIKODEM

My loving daughter for her love, help, prayers, motivation and support.

MY FAMILY

My dearest parents who always motivate and guide me, and in a gentle way persuade me to advance my nursing career. My brothers, sister and their partners, who always showed their interest and motivated me.

JUSTUS HOFMEYR

Professor and Head of Obstetrics and Gynaecology Department Coronation Hospital / University of the Witwatersrand, my clinical supervisor, for his inspiration, clinical assistance and kind-hearted support. Also for his linguistic assistance in painstakingly reading all the drafts and providing critique.

ANNA NOLTE

Professor in Midwifery, Rand Afrikaans University, my supervisor, for her continued support, advice and help in completing this thesis.

Prof. HEILIE UYS & Dr. CHRISSIE DÖRFLING

Members of the Doctoral Committee, for their scientific input.

MARINDA DE JAGER

Research midwife, who assisted me in the clinical execution of the trial. Her long hours of hard work is appreciated.

DOROTHY STANDER AND CHRISTINA FORMAN

My sister and close friend for helping with the typing.

Dr HEATHER BROWN AND KATINKA HARROD

For commenting on the final draft and the artwork

DR METIN GÜLMEZOĞLU, CORONATION and HELEN JOSEPH HOSPITAL'S MEDICAL AND NURSING LABOUR WARD STAFF

For all their clinical assistance.

THE WOMEN WHO PARTICIPATED IN THE TRIAL

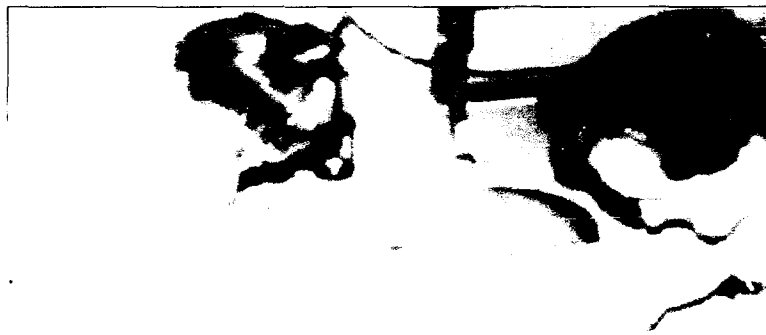
SOUTH AFRICAN MEDICAL RESEARCH COUNCIL, RAND
AFRIKAANS UNIVERSITY, HUMAN SCIENCES
RESEARCH COUNCIL AND THE NATIONAL FLORENCE
NIGHTINGALE COMMITTEE OF SOUTH AFRICA
For financial assistance.

The views expressed herein are not necessarily those of above
mentioned.





A woman sitting on a "birthing" stool during the second stage of labour. Supported by the midwife (left) and her partner.



A woman, who delivered in the squatting position on a mat, placed in the sitting position for the third stage of labour. She was assisted by the midwife, the doctor and her partner was behind her supporting her in the sitting position.



A happy mother and father posing for the photo.
This was the first woman in the trial who was allocated
to deliver her infant in water.

CHAPTER 1**INTRODUCTION AND RESEARCH CONSTRUCTION**

1.1 Introduction

Chapter one will give a short background of the study and a summary of the research construction that will be followed to conduct the trial.

1.2 Background

Birth and water is not a new association. Water has been used during pregnancy and labour since ancient times. The controversy surrounding the use of water is just as old. Cammu, Clasen, van Wetteren and Derde (1994:468) refer to Ambroise Pare who discouraged bathing during pregnancy for fear of premature onset of labour during the sixteenth century. In the mid-1800's hydrotherapy for pregnant women consisted of drinking mineral water and taking cold baths. Cold baths were believed to aid in the prevention of painful births (Schorn, Mc Allister & Blanco, 1993:336). It is noted that there are many legends and stories about giving birth in water among the Moari people, American Indians, South Pacific

Islanders and the ancient Greeks (Balaskas & Gordon, 1990:12).

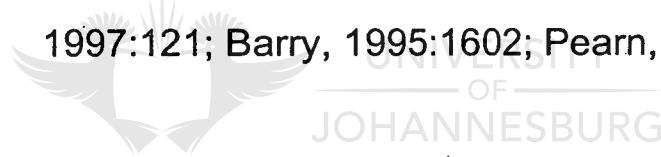
Several authors have suggested possible benefits of birth in water: labour becomes physically easier; avoidance of medical intervention; gentler, more controlled birth; enhanced emotional and spiritual aspects; increased mobility; easier coping with contractions; increased maternal relaxation; increased diuresis and relief of oedema; reduced blood pressure; decreased levels of stress related hormones; less requirement for labour augmentation; decreased length of labour; reduced perception of pain; less analgesia and anaesthesia; less perineal trauma and episiotomies (Alderdice, Renfrew, Marchant, Ashurst, Hughes, Berridge & Garcia, 1995:375; Balaskas, 1996:7; McCandlish & Renfrew, 1993:80).

The benefits to the fetus have not been clearly stated, but could derive from the fact that the baby is being born to a relaxed mother who is conscious and free of drugs. Possible advantages for the baby may be an easier adaptation to the extra uterine environment and a less traumatic birth. Babies may lose their fear of water and may be more gentle people (Alderdice,

Renfrew, Garcia & McCandlish, 1993:1563; Brown, 1990:56; Daniels, 1989:n.p.). Tjarskovsky believes that water lessens the force of gravity on the delicate brain cells at the moment of birth and thereby strengthens the baby's psychic abilities (Daniels, 1989:n.p.).

The safety of birth in water has also been questioned. Although heat may be soothing for the mother it may compromise the fetus because fetal thermoregulatory mechanisms are limited (Rosevear, Fox, Marlow & Stirrat, 1993:1048). The fetus is dependent on maternal temperature control and usually fetal core temperature is 0.5 - 1° C above the mother's amniotic fluid environment. Over or under heating by immersion of the mother's body can cause hyper- or hypothermia with consequences such as fetal tachypnoea or shivering and breathing (Johnson, 1996:204). Increased maternal temperature may lead to fetal cerebral vasodilatation with an additional increase in basal metabolic rate and need for oxygen (Rosevear, et al. 1993:1049). The risk of water inhalation by the baby has also been raised. It is claimed that the infant will not breathe under water (Odent, 1983:1476, Eldering & Selke, 1996:20), but there is little scientific evidence to support this (Barry,

1995:1602; Johnson, 1996:204). The baby who is delivered underwater has the theoretical risk of gasping before his nose and mouth are above the surface, thus inhaling bath water into his lungs. The inhalation of even a small quantity of fresh water can be quickly absorbed into the circulation causing appreciable haemodilution and fluid overload, with the risk of hyponatraemic convulsions, one of the consequences of fresh water drowning. It has been suggested that salt should be added to the water to make the solution more isotonic which presumably could reduce the risk of haemodilution effects in the event of inhalation (Hofmeyr, Nikodem & De Jager, 1997:121; Barry, 1995:1602; Pearn, 1995:1602).



Adverse effects of the use of birthing pools by women during labour and birth could include: unrealistic birthing expectations; restriction of choice of analgesia; restriction of mobility; inhibition of effective contractions; increase in perineal trauma; postpartum haemorrhage; uterine infection and other problems such as manual removal of the placenta; abruption; and puerperal psychosis (Alderdice et al. 1995:380).

The risk to the mother of entry of water into the uterus causing possible infection is always a concern when considering the safety of water immersion. Odent (1983:1476) mentioned the hypothetical danger of water embolism and advocated moving the mother out of the pool for the third stage of labour. In the literature reviewed, amniotic fluid embolism has been recorded after saline amnioinfusion, but no evidence of water embolism from immersion in water has so far been recorded (Maher, Wenstrom, Hauth & Meiss, 1994:851). Changes in maternal temperature, hydration, and blood pressure may also constitute risk factors. Circulatory redistribution may decrease placental perfusion. If warmth has a relaxing effect on the uterine muscles, this could increase bleeding after delivery of the placenta (Deans & Steer, 1995:391).

Emergency interventions could be substantially delayed if it were difficult to get the mother out of the bath or if the water did not flow out quickly. Injuries to women may occur when trying to get out of the bath as quickly as possible. Additional risks to the caregiver such as an increased risk of infection such as hepatitis or Human immunodeficiency virus (HIV) infection, or musculo-skeletal injury have also caused concern (Zimmermann, Huch & Huch, 1993:8).

Immersion in water during birth is at present a controversial issue, because there is no clear scientific evaluation of this practice available (McCandlish & Renfrew, 1993:84). The author is not aware of any published randomised systematic evaluation of water births.

1.3 Research problem

A research problem may arise from the need to evaluate interventions that may provide better or alternative ways to help parturients. The House of Commons Health Committee (UK) recommended that "all hospitals make it their policy to make full provision whenever possible for women to choose the position which they prefer for labour and birth with the option of a birthing pool where this is practicable" (McCandlish & Renfrew, 1993:79). The World Health Organisation (WHO) recommends that governments should consider developing regulations to permit the use of new birth technology only after adequate evaluation (Jenkins, 1996:54).

McCandlish and Renfrew (1993:80) conducted a review of available evidence about

immersion in water during labour and birth, and concluded that little scientific evidence is available on advantages and disadvantages of immersion in water during labour and birth. They believe that there is an urgent need for research into this practice before it becomes so widespread that proper evaluation becomes impossible. The problem is that the use of water for delivery has been introduced as a birthing method without adequate randomised evaluation of the safety, effectiveness or possible disadvantage to the mother or infant of this alternative option.

1.4

Research objectives



The study will be conducted at two academic hospitals that serve the same population of low to middle income group women in the midwestern suburbs of Johannesburg, running over a period of two years, from May 1994, through February 1996. Women in active labour who meet the inclusion and exclusion criteria ^(See chapter 3) will be asked to participate in the study.

The primary objective of the study will be to ascertain the effects of the use of water during birth on maternal

outcomes. The main maternal outcomes to be evaluated will be maternal experience of the second stage of labour, and trauma to the birth canal.

The second objective will be to set guidelines for midwives whether or not to conduct deliveries under water.

Additional outcomes will be assessed, but do not form part of the primary or secondary outcomes, because the sample size is not adjusted for significance of multiple outcomes. These additional outcomes will be assessed in the hope that the findings may stimulate further investigations. Additional maternal outcomes that will be collected are: mode of delivery, duration of second stage of labour, duration of third stage of labour, blood loss, randomisation till delivery time, presence of meconium stained liquor, and complications during second and third stage of labour. Neonatal outcomes that will be assessed are: cord around the neck at delivery of the head, Apgar scores, temperature, cord arterial blood gas pH, need for resuscitation, need for specialist paediatric care, admission to special care unit and neonatal death.

1.5 **Research model**

Research models are conceptual ideas, representing key concepts and relationships between theory, research, and practice (Burns & Grove. 1993:127). This research project is based on an adapted research model in nursing (Figure 3.1) as described by Botes (1989:245). Botes's model offers a conceptual framework that facilitates congruency in the execution of research and supports Nursing for the Whole Person Theory. Botes (1989:245) suggests that the activities of nursing be executed at three levels. These levels are the first order, which consists of the practice of nursing. The midwife aims to evaluate an intervention that has been practised for many years without scientific evaluation. She aims to assist the parturient to deliver her infant while immersed in water. The second order describes the theory and methodology of nursing. To enable the researcher to set guidelines and design a protocol to execute this project she will do a comprehensive literature search and translate the theory into practice. This will also enable her to design an effective research protocol. The third order describes the paradigmatic perspective of the researcher. These dimensions do not occur in isolation but have a reciprocal effect on each other.

The third order (paradigmatic perspective) and the first order (nursing practice) will be described in chapter one. The second order (research methodology) will be summarised in chapter one, but discussed in more detail in chapter three.

1.6 Third order

The third order is the paradigmatic perspective. All researchers have certain values and beliefs that may influence their conclusions. For this reason it is necessary for the researcher to make her assumptions clear to the reader so that any conflict of interests can be excluded. The activities of the third order are meta-methodological and are concerned with the analysis, classification, and evaluation of concepts, values, assumptions and methods that are discussed on the first and second order.

1.6.1 Paradigmatic perspective

The term paradigm in the way it is understood today, originated from the work done by Thomas Kuhn in 1962, *The structure of scientific revolutions* (Mouton & Marais, 1990:147). Paradigm refers to a generally

accepted worldview or philosophy. Thus it is a generally accepted view of the world and of man. Paradigm is a formation within which the theories of nursing are organised. It includes criteria for assigning value to the research project and the methods used of solving the research problem.

The paradigmatic perspective of this research project will be based on the Nursing of the Whole Person Theory, as it is the only accepted theory of The Rand Afrikaans University, Department of Nursing Science at present. The components of the paradigm are the meta-theoretical, theoretical and methodological assumptions (Rand Afrikaans University, 1992:2-10).

Nursing for the Whole Person Theory originated from a vision from God that Dr Tjelta experienced whilst developing a theory for the nursing curriculum of Oral Roberts University Anne Vaugh School of Nursing. Nursing for the Whole Person Theory is based on a Judeo-Christian philosophy and reflects the focus on the whole person, body (physiological and biological processes) mind (emotional, intellectual and motivational processes) and spirit (communication with God or religious activities). Beliefs about man,

health, illness, nursing and the nursing process are reflected in the theory. The theory also focuses on the parameters of nursing, which include beliefs about the individual, family, community, environment, and wholeness (Rand Afrikaans University, 1992:5,20).

1.6.2 Researcher's assumptions

The researcher's meta-theoretical assumptions refer to the researcher's belief statements concerning people and their environment. The following concepts are defined within Nursing of the Whole Person Theory.



■ Individual / person

A parturient, baby, midwife or researcher is a human being consisting of a body (physiological and biological processes), mind (emotional, intellectual and motivational processes) and spirit (communication with God or religious activities), who functions in an integrated "biophysiochemopsychosocial" manner to achieve her or his quest for wholeness. A person interacts with her internal and external environment holistically. Reference will be made only to

physiological and emotional wholeness for the purpose of this study.

■ Environment

This concept includes internal as well as external environments. The nature of the internal environment for the purpose of this study is the body. The external environment will be the labour ward or water bath specifically. The social environment will be that created by the parturient's partner and care giver. The emotional environment will be the parturient's experience of birth. Patterns of interaction with the internal and external environment determine health status.

■ Wholeness

Wholeness is a state of spiritual, mental and physical completeness. The parturient's pattern of interaction with her internal and external environment determines her state of wholeness. Wholeness can be qualitatively described on a continuum from minimum wholeness to maximum wholeness. The midwife

helps the parturient to achieve her quest for wholeness by facilitating a healthy environment.

1.6.3 Central statement

The midwife continues her quest for personal wholeness by growth in experience and thereby contributes to the wholeness of childbearing women and their neonates, through investigating the use of alternative available methods in the health care system, such as the use of a water bath. She facilitates the promotion, maintenance and restoration of the parturient's health by discovering whether she can experience a more satisfying birth with possibly less trauma to the birth canal.

1.6.4 Methodological assumptions

The assumption is that scientific practice in midwifery must arise from a functional school of thought. The aim of scientific practice in midwifery will be to give action-orientated guidelines for the improvement of midwifery practice with regard to the use of immersion in water during birth. The utilisation and value of the research findings (to improve midwifery practice) are

criteria for validity. Research does not take place in isolation, but rather in relation to midwifery practice and the philosophy of midwifery science (Botes, 1989:20).

Research methodology focuses on the research process. Research methodology encompasses the research decisions that must be taken within the framework of the determinants for research to be able to satisfy the needs of validity and reliability (Botes, 1989:131).

1.7

Second order (Theory of nursing and research methodology).

The second order is the theory and methodology of Nursing. Activities that take place in this order are research and theory development. The research methodology will be discussed in detail in chapter three, but a short description of the research methods will be mentioned in chapter one.

1.7.1 Hypotheses

It is postulated that the use of water during delivery will: enhance maternal experience of second stage of labour and decrease trauma to the birth canal.

1.7.2 Definitions

Waterbirth - The birth of a baby while the mother is immersed in water. The neonate is born fully submerged under water and is then brought to the surface.



Operational definitions of maternal experience of second stage of labour and trauma of the birth canal will be discussed in chapter three.

Maternal experience of the second stage-

The emotional, psychological and physiological sensation or feelings the mother lives through during the period or process of parturition, which commences from full cervical dilatation of the cervix to delivery of the fetus (Goldenson, 1985:275).

Trauma of the birth canal-

Any para-urethral, lateral vaginal wall and perineal lacerations or incisions. Perineal laceration will be categorised according to involvement of different anatomic structures of the birth canal. Episiotomy refers to a surgical incision in the perineum, to enlarge the vaginal opening, performed by the care giver during the second stage of labour. Intact perineum refers to no perineal lacerations. First degree laceration involves the fourchette, the perineal skin and the vaginal mucosal membrane. Second degree laceration involves the fourchette, perineal skin, vagina mucosal membrane, perineal fascia and muscle (bulbocavernosus, ischiocavernosus and transverse perineal muscle). Third degree laceration involves all the above-mentioned structures and the anal sphincter. Fourth degree laceration extends through the anal sphincter, through the rectal mucosa and exposes the lumen of the rectum (Blunt, 1995:168). Para-urethral and lateral vaginal wall lacerations refer to any tears, single or multiple, involving these anatomical structures.

1.7.3 Research purpose

The purpose of this project will be to explore the possibilities of the use of water during the second stage of labour. A description of presenting problems in the current practice will be addressed and explanations will be sought on how to overcome the present problems by setting up guidelines for the practising midwife (Burns & Grove, 1993:293). To reach the goal a specific research design (Figure 3.1) will be followed.

A randomised, controlled trial will be conducted at two academic state hospitals serving the same low to middle income group urban population in the midwestern suburbs of Johannesburg, running over a period of two years, from May 1994 to May 1996. Women in active labour who meet the inclusion and exclusion criteria ^(Chapter three) will be asked to participate in the study.

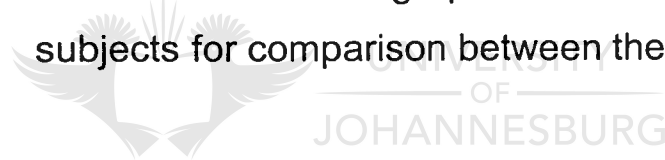
1.7.4 Trial design

A randomised, prospective, experimental design will be used to evaluate maternal experience, trauma to

the birth canal and other additional maternal and neonatal outcomes.

1.7.5 Instrument

An intrapartum data sheet will be used to collect biographical, labour, delivery and neonatal data. The subject will be asked to complete a self-administered questionnaire within 24 hours after delivery. The questions will cover maternal experience of labour and perineal pain. Biographical data will be collected to assess the demographic characteristics of the subjects for comparison between the two groups.



1.7.6 Validity and reliability

The intrapartum data collection sheet and the post partum self-answer questionnaire will be sent to specialist in the field of obstetrics and midwifery for validation. Content and face validity will be assessed. Reliability to ensure consistency of the instruments in obtaining the same results in similar situations even though the subjects and environment differ will be determined by using the test-retest method.

1.7.7 Population sampling and sample criteria

The target population will be obtained from the accessible population of women who will attend the two selected academic state hospitals, serving a low-middle-income urban population in the Midwestern Suburbs of Johannesburg. The study will be conducted over two years. Pregnant women in established labour, with a singleton pregnancy and vertex presentation, who can understand English or Afrikaans will be approached to take part in the study. A computer program, Epi Info version 6.02 will be used to determine the sample size. The sample size is estimated on the basis of a 5% level of statistical significance ($\alpha=0.05$) and a power of 80% ($\beta=0.20$). One of the primary hypotheses to be tested in the trial is whether the use of a water bath during delivery can result in a 25% reduction in birth canal trauma as defined under operational definitions. An estimated sample size of 114 subjects should be enrolled to detect a reduction in the current 40% incidence of birth canal injury to a 15% incidence. In some countries the episiotomy rate is 0.3% and perineal trauma that needs suturing is as little as 17,3% (Doherty & Cohen, 1993:532).

1.7.8 Consent

Written consent will be obtained from the subjects before enrolling. Ethical consent will be obtained from the Committee for Research on Human Subjects, University of the Witwatersrand. Consent will also be obtained from the superintendents of the hospitals involved.

1.7.9 Data gathering

The researcher will complete the intrapartum data collection sheet. Baseline data will be obtained from the subject's records or from the woman herself. Labour, delivery and neonatal data will be collected after the delivery from the case record. The subject within 24 hours post delivery will complete the post partum self-administered questionnaire.

1.7.10 Data analyses

Inferential statistics will be used to test the hypotheses to allow the researcher to make inferences about the population from which the sample will be drawn (Hicks, 1996:13).

Statistical comparisons of nominal, ordinal and non-parametric variables will be made using Epi Info version 6.02 and Revman 3.01 software (Chapter three).

1.7.11 Results

Graphic depictions and descriptive tables in chapter four will give the results. Concise summary statements of the findings will be formulated from the analysis. Discussion of findings, implications, and recommendations for further research will be discussed in chapter five.

1.8 First order (nursing practice)

Field attributes, pre-scientific and lay interpretations are determinants of the first order. The first order represents the reality or the practice. Within this project the first order will be midwifery practice (labour ward, midwife and parturient). The delivery environment will be the field of study of midwifery science. Midwifery practice holds specific attributes that guide the researcher. The activities that take place on this primary level or first order are referred to

as nursing. Nursing is the interaction between the midwife researcher, the parturient, and her partner during and after birth of the baby. Most midwifery actions are based on knowledge of midwifery, but many actions take place that are based on pre-scientific interpretations.


The actions of the parturient are mostly based on lay interpretations and on previous experiences, or beliefs. The researcher will explore, describe, analyse, test and explain the interpretations concerning delivering in water by means of a randomised controlled trial. The interpretations will be incorporated in the knowledge content of midwifery science in the form of guidelines, should it be found to be valid.

1.9 Chapter division

The following chapter divisions will be used to describe the effects of water on birth.

Chapter one will give a background to the study and a summary of the research construction that will be followed.

A literature review will be carried out to investigate the evidence and opinions regarding the effects of immersion in water during the first and second stages of labour in South Africa, and other countries in the world. A systematic review will be prepared on "Immersion in water during preagnancy, labour and birth". These results will be discussed in chapter two.

The logo of the University of Johannesburg, featuring two stylized birds facing each other with a sunburst above them, and the text "UNIVERSITY OF JOHANNESBURG" in a light grey font.

The research methodology that will be used to evaluate the effect of immersion in water during the second stage of labour will be described in chapter three.

Chapter four will present the results of the statistical analysis of the data.

Discussion of the results, implications, and recommendations for practice and research and guidelines for delivering women while immersed in

water will be presented in chapter five. This chapter will be followed with a bibliography and annexes referred to in this thesis.

1.10 Summary of chapter one

Chapter one consists of a short background and a synopsis of the research construction that will be followed to execute this research project. This study will aim to gain information as to whether the use of a water bath during the second stage of labour has positive and / or negative effects on parturients and neonates.



CHAPTER 2**LITERATURE REVIEW - WATER IMMERSION DURING LABOUR AND
BIRTH**

2.1 Introduction

A literature review has been conducted to investigate the evidence and opinions regarding the effects of immersion in water during birth. Little scientific literature has been found. A lot has been written on the subject, but most consists of personal experiences or case study reports. The search included literature regarding the effects of water immersion during the first and second stages of labour. The following search strategies were followed with help from the Cochrane Pregnancy and Childbirth Group. An electronic search of The National Library of Medicine (Medline) database has been carried out back to 1966 for any randomised or clinical trial on, water, pregnancy, birth, childbirth, labour, labor, parturient, fetus, newborn, neonate and infant. A systematic journal handsearch for perinatal trials, in general and core journals has been conducted. Obstetric, paediatric, and midwifery conference proceedings have been handsearched for the last five years. A survey to identify unpublished and ongoing trials on immersion in water has been carried out.

Additional searches were conducted using the Cochrane Central database and the Cochrane Controlled Trials Register. As only a few randomised controlled trials were identified, the researcher included comparative studies, descriptive studies, case reports and lay literature. The internet has been used to conduct a Pubmed, Medline and Medscape search and all home web pages concerning water births were visited.

2.2 Aim of the literature review

The review consists of international and national literature and enabled the researcher to gain an in depth background concerning the effects of water on birth. The information was used to support the researcher's research question to establish that the problem under investigation was real and needed to be investigated. The review examined theoretical and empirical sources up to the present date.

Literature pertaining to the primary research objectives is presented in two subsections.

- ◆ The second stage of labour:

maternal feelings and pain experience during the second stage of labour.

- ◆ Trauma to the birth canal.

Literature covering the second objective, drawing up of guidelines for the use or not of water immersion during birth, was used to help formulate the procedure and the guidelines that were used during the execution of this trial. It will also be used together with the results of this trial to set up new guidelines for midwives concerning immersion in water during birth.



The historical background, current incidence, and the rationale for immersion in water during birth have been examined and are presented in eight subsections:

- ◆ the history of immersion in water during labour and birth
- ◆ birth in water, is it an option?
- ◆ maternal benefits
- ◆ maternal disadvantages
- ◆ neonatal benefits

- ◆ neonatal disadvantages
- ◆ general benefits or disadvantages
- ◆ systematic reviews

2.3 The history of immersion in water during labour and birth

Water birth is defined as the birth of a baby while the mother is immersed in water. The infant is born fully submerged under the water and is then brought to the surface. Once the neonate has reached the cold air and inhaled the first breath it cannot be submerged again (<http://www.nutering.ca/waterbirth/> 3 May 1999). Water birth is a concept that highlights the weightlessness and changes in the effect of gravity, and the ease with which the mother gives birth in water, as well as the newborn experiencing a gentle transition from one fluid filled area to another before it is brought into the air.

The first recorded birth in water can be traced back to 1803. It took place in France when a midwife suggested a warm bath for relaxation to a woman who has been in labour for 48 hours. The baby was born soon after the women got into the bath (Church,

1989:165). Birth in the cold Black Sea by Russian women has also been recorded (Wagner, 1996:4). As far as is known, the idea of intentionally giving birth in water was pioneered by Igor Tjarkovsky during the early 1960's in Russia. He was a Soviet researcher and swimming instructor in Moscow and studied the adaptation of mammals to an aquatic environment. He recorded that a variety of mammals can give birth and nurture their young under water. Tjarkovsky believed that water made the birth easier and enhanced the development of the newborn. Tjarkovsky focuses on the baby and believes that water subdues the force on the baby's brain during birth and thereby enhances the baby's psychic abilities. He believes that water helps mature the infant's muscular co-ordination, thus increasing its intellectual, physical and psychic development (Lichy & Herzberg, 1993:18).

Michel Odent developed the Maternity Unit in a state hospital in Pithiviers, in France during the 1970's. He introduced a warm water pool primarily for comfort and pain relief during the first stage of labour. Many of the women who used the bath for pain relief were reluctant to emerge from it in spite of their impending

delivery, and ultimately gave birth in the water (Odent, 1983:1476). Odent found that there were no special risks attached either to labour or birth in water, but does not mention any advantages for the infant. He suggested that immersion during the late phase of first stage of labour is helpful to relieve pain (Odent, 1983:1477). He supports the concept that further research is needed to confirm that immersion in warm water is easier, efficient and decreases the use of analgesia (Odent, 1994:81).

The first recorded water birth in Victoria, Australia occurred during 1978. Most of the other recorded water births occurred after 1983. They reported no maternal or fetal problems except for lower Apgar scores, if the bath water was too hot (Vassie, 1996:113). The first water birth in Bensberg, Germany was unplanned. After this successful delivery in 1980 the number of woman who chose to deliver in water increased, and by 1995 more than 2,000 recorded under water births had taken place.

Van Coppenolle (personal communication) from Brasschaat in Belgium, has been helping women to deliver in water since 1983 and had recorded just

under 1000 water births by January 1995. In Ostend, Belgium they even allowed women to deliver twins or breech presentations in water (Video - Water babies- the Aquantal experience in Ostend). Hannan (1992:38) also reported on an unexpected breech delivery in water.

Professor Justus Hofmeyr assisted the first water delivery during 1985 in Johannesburg Hospital, South Africa (Personal communications). The Family Birthing Center of Upland, California opened in 1985, under the guidance of Dr. MJ Rosenthal. They offered the use of warm water baths for labour and birth. The birthing centre closed its doors in 1994. Nearly 1000 women gave birth in water during its existence. Rosenthal believes that birthing in water is a medically sound procedure that relaxes women and eases their labour and delivery. He reported that bathing during labour dilutes the concentration of bacteria in the vagina and on the perineum thereby reducing the chance of infection. Dr. Rosenthal allowed women who had had a previous caesarean section to use the water bath for labour and delivery. Many women had a VBAC (vaginal birth after caesarean section) in water at the Family Birthing Centre (Rosenthal, 1996:94). He has experienced no major neonatal

complications and women have done well with very few complications (Church, 1989:165).

In late 1985, Yehudi Gordon and Faith Haddad started to offer water births to women in the UK. They concluded that the overall birth experience of women who have had a water birth was very good, and the women were likely to have less perineal trauma. They reported that 12/358 babies suffered from some kind of a neonatal infection (Haddad, 1996:96-101).

Alderdice et al. (1995:381) reported that by 1995 labour and / or birth had occurred in most of the National Health System's hospitals in the UK. New South Wales reported a usage of water for labour and / or birth between 50-90% in their birth centres (Vassie, 1996:112). Malta's first Underwater Childbirth Clinic was established in 1988. They claim to have achieved one of the highest international rates of underwater births per capita. They also reported the use of vacuum extraction to deliver the baby under water (Muscat, 1996:77/78). Birthing pools have been used in Italy since 1990, and over 1000 deliveries were recorded by 1995. The hospitals offering water deliveries claimed a reduction in caesarean rates,


more positive birth experiences, decreased first stage of labour, less perineal trauma but slightly more blue babies at birth (Maghella, 1996:115,118).

The first obstetric unit with an official water birth programme in Denmark started in Roskilde, although the use of water has been unofficially practised for many years. Results of births in Faborg, showed a remarkable decrease in episiotomies. According to Anne Uller of the Faborg unit there were no reports of infection and water births were proven to be good and safe for both the mother and the baby in the 243 births analysed (Uller, 1996:119/120).

Odent commented that the media was intrigued by the use of birthing pools in his hospital and referred to it as "only a passing fad". Obviously, they were wrong, as today labouring and birthing pools are a reality in many birthing centres all over the world and more than 19,000 water births have been recorded (Kitzinger, 1996:vii).

2.4 Birth in water, is it an option?

Requests for the use of water during birth have been increasing and women expect labour facilities to provide a pool for an alternative method of analgesia (Gordon, 1991:245). In the United Kingdom, the House of Commons Health Committee recommended that "all hospitals make it their policy to make full provision whenever possible for women to choose the position which they prefer for labour and birth with the option of a birthing pool where this is practicable" (House of Commons Health Committee, 1992).



A survey of birthing options in England showed that although birthing pools are available, most of the pools are used only during the first stage of labour (Alderdice et al. 1995:379). Women have laboured and delivered in many other places than a birthing bath. Normal bath tubs, large birthing pools, small swimming pools, water filled plexiglass tanks, hot springs, cattle troughs, garden ponds and personally constructed tubs. Walker (1994:467) indicated that newspaper reports that over 20 000 deliveries occurred under water during 1993 in the UK were inaccurate. He said that most of the women only labour in water but deliver out of the bath. He

estimated that less than 30% of women actually delivered in the bath. The Royal College of Obstetricians and Gynaecologists (1993) emphasised the fact that only about 1 in 10, 000 women deliver in a pool, although many do use immersion in water for pain relief during the first stage of labour. Waterbirth website (<http://www.nuturing.ca/waterbirth/3> May 1999) claimed that water birth is extremely safe and so far more than 45,000 water births have been documented.

Recently there has been an increase in the demand by pregnant women for the use of water during labour and delivery in South Africa. In major cities, Government Hospitals and Private Health Care Clinics have started to introduce water tubs in their labour wards.

The literature has shown that not everybody supports the option of immersion in water during birth. James Drife (1994:339) has gone so far to say, "There are still conservative obstetricians who say underwater caesarean sections (UWS) is just plain daft but to them I say this: UWS is no sillier than a normal delivery under water". The East Hertfordshire NHS

Trust has disciplined two midwives who helped a woman birthing in water at home, as water births have been banned in their area until the safety of delivering in water has been established (Reid, 1994:26). The Swedish Health Department recommended that only labour should be allowed in water as it is felt that giving birth in water may carry an unacceptable risk for the infant (Robinson, 1993:8).

2.5 Maternal benefits

The following factors have been mentioned in the literature as beneficial effects for women who have used immersion in water during their labour or birth and will be discussed in the following paragraphs.

- ◆ gentler, more controlled birth
- ◆ empowers the woman
- ◆ coping better
- ◆ increased maternal relaxation
- ◆ stress related hormones
- ◆ increased mobility
- ◆ increased diuresis and relief of oedema
- ◆ reduced blood pressure

- ◆ improved uterine perfusion and amniotic fluid volume
- ◆ less labour augmentation required and shorter duration of labour
- ◆ enhanced fetal rotation and decrease need for interventions
- ◆ reduced pain and physically easier labour
- ◆ less perineal trauma and episiotomies.

2.5.1 Gentler, more controlled birth

Water birth is not only claimed to be the gentlest of gentle births, but also to be a safe and a gentle form of childbirth that results in a more controlled delivery with no immediate crying of the newborn. The newborn's transition from an intrauterine environment to an extrauterine environment is soft, gentle and non-threatening. It was noticed that the midwives usually spoke in quite tones and moved more gently around the room (Alderdice et al. 1995:375; Blair-Myers, 1989:73; Burns & Greenish, 1993:315; Daniels, 1989:198 & Harper, 1994:17).

2.5.2 Empowers the woman

Women who deliver in water experience a sense of privacy in their own small space where they seek control of their birthing process (Rosenthal, 1991:34). Their own female power is enhanced; they feel in control and experience a feeling of satisfaction, with a lasting memory of a pleasant birth experience. Being fully awake, aware and in control enhances their physical, emotional and spiritual needs which gives personal strength and power that enriches their lives (Daniels, 1989:198; Reid 1994; 28). Women felt warm, secure and not in danger when in water and experienced satisfaction and empowerment when they were given the opportunity to utilise water during birth (Daniels, 1989:199).

2.5.3 Coping better

The use of water during the first stage of labour brought back a sense of control, which enabled women to cope better with their labour. Women felt more in control of their pain if they did not receive pharmacological analgesia and felt that they could cope better with their contractions once they had entered a birth pool (Cammu et.al. 1994:470; Ford &

Garland, 1989:234). The humid atmosphere also helps asthma sufferers to cope better with their breathing during labour (Balaskas, 1996:10). Some may not cope with their breathing techniques as inhalation may be impeded since the abdominal organs are shifted upwards against the thorax as a result of the hydrostatic pressure.

2.5.4 Increased maternal relaxation

Burns and Greenish (1993:315) asked women how they felt when they used the birthing pool. The majority of woman who used the pool commented that they felt relaxed on entering the water. In a randomised controlled trial on the use of water during the first stage of labour, 80% of women who used the water found it very soothing and all except one claimed that water relaxed their body (Cammu et al. 1994:470).

It is theorised that the comfort and warmth of the water acts as a relaxant to the muscles. This deep physical relaxation has been verbalised by many women on entering the water. A concomitant effect of mental relaxation usually follows the physical relaxation. In


the relaxed state women become less tense and anxious, some women even fell asleep between their contractions. The warmth of the water decreases tension in the abdominal muscles and allows the body to stretch slowly and gently, in order to accommodate the emergence of the foetus. Relaxation also helps to conserve energy and strength, enhancing the woman's reserves for the duration of labour (Balaskas, 1996:11; Cammu et al. 1994:470; Church, 1989: 165; Harper, 1994:17; Schorn et al. 1993:338 & Taylor, 1987:49).

2.5.5 Stress related hormones

Cammu et.al. (1994:470) theorised that the natural stress hormones secreted during labour may adversely affect the uterine contractions and prolong the duration labour. Harper (1994:17) claimed that stress hormones increased blood pressure and inhibited the progress of labour. Warm water may reduce the secretion of stress related hormones allowing the natural flow of these hormones and therefore facilitate labour progress (Odent, 1983:1476).

2.5.6 Increased mobility

Buoyancy in water enables women to change their labouring position frequently and with ease and floating is a position commonly used during first stage of labour (Footner, 1992:273). It provides a feeling of physical liberation with freedom to move around (Balaskas, 1996:10). Midwives who supported the use of water claimed that water created support and equal pressure on all the parts of the body. It increased the buoyancy and improved body gravity, weightlessness and flexibility.



The bioengineering principles underlying hydrotherapy such as buoyancy, made women feel lighter when they sat in a tub filled with water. Muscles may be less tense as they do not need to support the woman's entire weight. Water has been a great help for obese women, as buoyancy is increased making the body feel weightless and thus enabling the women to change their position with ease (Church, 1989:165; Edlich, Towler, Goitz, Wilder, Buschbacher, Morgan & Thacker, 1987:581; Footner, 1992:273; Waldenström & Nilsson, 1992:57).

2.5.7 Increased diuresis and relief of oedema

Women who used immersion in water during their pregnancy have reported increased diuresis after immersion and significantly less pedal and hand oedema (Doniec-Ulman, Wambach & Drab, 1987:55; Goodlin, Hoffmann, Williams, & Buchan, 1984:175; Jackson, Corsaro, Niles, Stange & Haber 1989:193; Rosenthal, 1991:33; Weston, O'hare, Evans & Corral, 1987: 613).

2.5.8 Reduced blood pressure

Hydrotherapy has marked physiological effects on the cardiovascular system. Shoulder deep warm water immersion, reduces blood pressure due to vasodilatation of the peripheral vessels and redistribution of blood flow. A significant change in blood pressure has been observed within two minutes of entering shoulder deep water (Church, 1989:165; Doniec-Ulman et al. 1987: 51 & Rosenthal, 1991:39; 1999:<http://www.gentlebirth.org/archives/wterbrth.htm>. 3 May 1999).

2.5.9 Improved uterine perfusion and amniotic fluid volume

Water allows abdominal relaxation with possible dilatation of uterine vessels, which may cause an increase in uterine perfusion. There have been publications showing an increase in amniotic fluid volume after shoulder deep warm water immersion (1999:<http://www.gentlebirth.org/archives/waterbrth.htm>. 3 May 1999).

2.5.10 Less labour augmentation required and shorter duration of labour

It is reported that the use of water during labour decreases the duration of labour (Alderdice et al. 1993:342). Women experienced quicker and shorter labours and their cervixes appeared to dilate more quickly when they were immersed in water during labour (Lenstrup, Schantz, Berget, Feder, Roseno & Hertel, 1987:709; Footner, 1992:273). Less oxytocin for augmentation of labour has been reported when women used water during the active phase of labour (Alderdice et al. 1995:375; Burke & Kilfoyle n.j.:3; Cammu et al. 1994:471; Daniels, 1989:n.p. Schorn et al. 1993:337). Warm water during

the first stage of labour has also been used to correct dysfunctional labour (Rosenthal, 1991:44). Contradictory statements exist, and Cammu et al. (1994:468) claimed that there is no evidence that the use of water immersion facilitates labour or corrects cervical dystocia.

2.5.11 Enhanced fetal rotation and decreased need for interventions

Women whose fetuses had occipito posterior positions adopted different positions while immersed in water. This facilitated rotation of the fetal head and decreased the need for interventions (Milner, 1988:40). The use of water has been associated with fewer forceps deliveries, vacuum extractions (9%) and fewer caesarean sections (1.4%) (Kitzinger, 1996:vii; Muscat, 1996:80). The incidence of shoulder dystocia was much less when women delivered in water (w1vs c9) (Rosenthal, 1996:94).

Several countries in Europe with low perinatal mortality rates use midwives as the principal birth attendant for at least 70% of all the births. Medicalisation of childbirth allowed obstetricians to

replace midwives as the primary caregiver to women in labour. This change did not decrease infant mortality rates, yet it increased puerperal fever and maternal deaths and it was said that "perhaps the greatest coup of scientific medicine ... was its finding a solution to a problem it had created" (Hafner-Eaton & Pearce, 1994:815/816).

Most obstetricians consider birth to be a pathological event and make use of interventions (induction of labour, rupture of membranes, epidurals, forceps, vacuums, episiotomies), that they claim are of benefit for the women. A few interventions are undoubtedly beneficial, do save lives in a small proportion of births, and therefore do have a marginal influence on the morbidity and mortality rates. It is true though that many interventions cause positive harm to the mother or her infant and cause a ripple effect of more interventions (induction → epidural → failure to progress → augmentation → fetal distress → caesarean section → separation from the infant → breast engorgement → mastitis etc.) (Hafner-Eaton & Pearce, 1994:817).

Very few obstetricians support the concept of offering women the option of immersion in water during labour or birth and thus indirectly increase the incidence of the use of interventions.

2.5.12 Reduced pain and physically easier labour

Increasingly more women request labour wards to provide them with the facility of the use of a water tub during labour as they feel that water is a safe and cheap analgesic (Gordon, 1991:245). It is said that water has the power to alter women's perceptions of the pain they may experience during labour (Balaskas, 1996:10). Relaxation in water reduces pain and relaxes the body, providing an alternative for the need of pharmacological analgesia. Some women refer to the use of a water tub during labour to "taking an aquadural" ([http:// www. well. com/user/karil/benefits.html](http://www.well.com/user/karil/benefits.html). 3 May 1999).

Odent (1991:133) described the effect of "lumbar reflexotherapy", by referring to Melzack and Wall's "gate control theory of pain", where painful stimulation of the area of the skin served by the posterior branch of the 12th dorsal nerve can compete at the level of the

spinal posterior horn with painful messages coming from the uterus. The use of immersion in warm water may reduce pain through the "gate control theory", as water stimulates various nerve fibres (heat, touch, and temperature).

Milner (1988:39) advocated that the use of water baths is a very effective form of pain relief in labour as fewer women made use of pharmacological analgesia when they used a water tub during labour (Alderdice et.al. 1995:375; Eldering & Selke, 1996:26; Burke & Kilfoyle, n.j.:3; Cammu et al. 1994:470; Footner, 1992:274).



Immersion in water is said to have fewer complications than epidural or spinal anaesthesia (<http://www.well.com/user/karil/benefits.html>. 3 May 1999). The use of warm water as pain relief may be viewed as radical but no other intervention for pain relief has been said to be so free of risks. Immersion in water may not decrease the use of analgesia, but appeared to decrease the perception of pain by relieving anxiety or by providing a temporary pain stabilising effect (Cammu et.al. 1994:470; Rosenthal, 1991:77).

2.5.13 Less perineal trauma and episiotomies

Midwives practising water deliveries claimed a lower rate of perineal trauma when compared to other births (Alderdice et.al. 1995:375, Burke & Kilfoyle, n.j.:3). Water softens the perineal muscles allowing more stretch by increasing the elasticity to the perineum. It reduces the incidence (27.7%) and severity of tearing, the need for episiotomies (2.3%), forceps, vacuum deliveries (9%), and caesarean sections (1.4%) (Adam, 1996:87; Garland & Jones, 1994:114; McCandlish & Renfrew, 1993:80; Muscat, 1996:81; Rosenthal, 1991:43).



2.6 Maternal disadvantages

Up till now we have found no clear objective evidence to support or contraindicate the use of water during labour or birth. It is worrying to read some of the publications as early as 1988 where midwives claimed that the use of warm water for birth has been clearly shown to be a safe and positive intervention and that it facilitates rather than interferes with normal labour. They go further and state that women have the right to choose water for labour and birth and caregivers have the responsibility to inform women of their possible

choices, including the use of water. Even now there is little evidence about the possible benefits or disadvantages for the mother, or the infant, and thus it is very difficult to help the mother make an informed choice (McNeese, 1988:11). The following have been suggested as potential disadvantages of birth in water:

- ◆ unmet expectations
- ◆ temperature changes, dehydration and low blood pressure
- ◆ slow labour progress
- ◆ stress related hormone level changes
- ◆ no pharmacological analgesia given
- ◆ increased perineal tears
- ◆ uterine and other maternal infections
- ◆ puerperal psychosis
- ◆ water embolus
- ◆ slow response if complications arise.

2.6.1 Unmet expectations

Some women may have raised expectations due to journalistic descriptions of water births as safe, pain free, gentle, and easy. These women can suffer from severe post partum depression if their expectations

were not met. It has been suggested that their birthing experience may be more difficult due additional pressure of the water that they must push against (Walker, 1994:468; Zimmermann et al. 1993:7).

2.6.2 Temperature changes, dehydration, and low blood pressure

Immersion in warm water brings about physiological changes in the cardiovascular system (Weston, Evans & Corral, 1987:613). Vessels in the limbs and the skin become dilated and circulatory redistribution of blood occurs. The theoretical possibility of insufficient placental perfusion due to lowering of blood pressure or dehydration should not be excluded (Waldenström & Nilsson, 1992:62).

A study done on healthy men to compare two different bath tub temperatures (40.0°C vs 41.5°C) found that thermoregulatory and cardiovascular responses correlated to water temperature if the men were immersed for 21 minutes in circulating water. There was a significant rise in all body temperatures (rectal, oesophageal and non-immersed skin), sweat

rate and heart rate. Postural hypotension when standing up was a complication in both trials, which could be a potential hazard when using warm water immersion during labour (Allison & Reger, 1998:846). Dissipation of the body's heat can no longer take place if the temperature of the water exceeds the labouring woman's body temperature. Perspiring, which is commonly noticed when women are immersed in water, may lead to dehydration. Decreased blood pressure may result in decreased perfusion of the muscles and the women may experience severe fatigue with inhibition of effective uterine contractions (Church, 1989:165; McCandlish & Renfrew, 1993:80; Waldenström & Nilsson, 1992:57 & Zimmermann et al. 1993:7).

2.6.3 Slow labour progress

Information available concerning the relationship between duration of labour and the use of immersion in water is contradictory (Burke & Kilfoye, n.j.:6). Garland & Jones (1994:2) documented shorter labours in the water birth women and on the other hand Reid (1994:26) reported shorter labours in women who

delivered in the bed, but ascribe the difference to the higher incidence of artificial rupture of membranes in the women who do not deliver in water.

2.6.4 Stress related hormone level changes

It is said that the use of water decreases stress related hormones. This may not be to the benefit of the mother and the infant. Catecholamines are usually increased during labour and very high levels have been found in cord arterial blood (Mohamed Gülmezôglu, Nikodem, Wolman, Chalmers & Hofmeyr, 1995:181). A benefit of these high levels may be that the infant is more alert at birth. The supposed lowering of the stress hormone levels during water relaxation may also be the reason why infants who are born in water usually appear calm and do not cry immediately. β -endorphins are also increased during stress-inducing situations such as labour (Hofmeyr, Gülmezôglu, Nikodem, Van der Spuy, Hendriks, 1995:299). These hormones in circulating blood produce pain sedation as they inhibit spinal neurons that are usually stimulated by noxious receptors. They also play a fundamental role in construction of memories, emotions, and feelings (Dalayeun, Norès & Bergal, 1993:315-318).

hormones selectively cause leucocytosis in the neonate of cells that are mediators of nonspecific immunity (Marx, 1995:1948).

2.6.5 No pharmacological analgesia given

The use of analgesia differs between hospitals. Some do not allow women who want to deliver in the tub to use pharmacological drugs other than Nitrous oxide (Hurley, n.j.:112). Other hospitals allow women to have pharmacological analgesia or epidural anaesthesia and still to use the bath (Burns & Greenish, 1993:314; Burns, 1992:6, Cammu *et al.* 1994:469). At Rochford maternity unit women who request analgesia must leave the pool for at least two to three hours before returning (Harmsworth, 1994; 32). Drowning due to over sedation or loss of consciousness may be a potential risk.

2.6.6 Increased perineal tears

Burns and Greenish (1993:315) observed more perineal tears when women delivered in the water, however they noticed a decrease in episiotomies. Although the episiotomy rate was low (1.2%) when

women delivered in water, perineal injury still occurred in 54% of the women (Nightingale, 1996:68).

2.6.7 Postpartum haemorrhage and retained placenta

Warm water induces hyperaemia and relaxation of smooth muscles. This may result in uterine atony during the third stage of labour, resulting in an increase in post partum haemorrhage. Women delivering in water may thus be at an increased risk of post partum haemorrhage (Alderdice et al. 1995: 380; Reid, 1994:28; Zimmermann et al. 1993:8). There is a fear that uterine atony may also cause the placenta not to be expelled. Studies have not supported this fear. Eldering and Selke (1996:28) reported a 4% incidence of retained placenta when women used water during labour and or birth. This was similar in the conventional birthing group. Rosenthal (1996:95) experienced a small incidence of overall retained placentas (0.6%) with only a 0.2% incidence when women delivered in water.

2.6.8 Uterine and other maternal infections

The possible risk of an increase in maternal infections is of concern if women use a bath tub to deliver in (Alderdice et.al. 1995:375). Post partum fever and maternal infections have been reported after women used water during labour or birth (Church, 1989:165; Lenstrup et.al. 1987:709.) No evidence of amnionitis or endometritis was found when women used water during the first stage of labour if they had less than 24 hours of ruptured membranes, even if they had scalp electrodes applied (Cammu et.al. 1994:471).

Whether there is an increased risk of water entering the vagina, is disputable. — Siegel (1960:660) found that none of the tampons were contaminated, when dry tampons were placed into the vagina of women, who were encouraged to move around freely in a tub filled with water containing potassium iodide. It is known that migration of micro-organisms from the vagina to the uterine cavity does take place. Theoretically this migration may be enhanced by water entering the vagina. The natural antibacterial barriers in cervical mucus gradually lessen with cervical dilatation and effacement. There is a further decrease in the natural barrier if the membranes are ruptured. This may lead to an increase in endometritis

barriers in cervical mucus gradually lessen with cervical dilatation and effacement. There is a further decrease in the natural barrier if the membranes are ruptured. This may lead to an increase in endometritis or chorio-amnionitis (Schorn et al. 1993:340; Waldenström & Nilsson, 1992:59).

2.6.9 Puerperal psychosis

A survey carried out in England and Wales reported that puerperal psychosis had occurred in women who used water immersion during labour and / or birth (Alderdice et al. 1995:380).

2.6.10 Water embolus

The potential danger of water embolism after delivery is a hypothetical issue raised by Odent, but has so far never been recorded (Burns & Greenish, 1993:315). Water embolism should still be acknowledged as a risk because amniotic fluid embolism after saline amnioinfusion has been reported (Maher, Wenstrom, Hauth & Meiss, 1994:851). Air embolism has also been reported in women who engaged in intercourse soon after delivery (Sunday Times, 1999).

2.6.11 Slow response if complications arise

The problem arises as to how quickly a bath can be emptied or a woman removed from the bath if unexpected complications arise, needing urgent intervention. Delay in delivery of the fetus or the risk of accidents to the mother and the caregiver may be increased whilst trying to get the woman out of the bath quickly. (Hurley, 1994:113; Zimmermann et al. 1993:8).

2.7 Neonatal benefits

These may include the following and will be discussed in the next paragraphs:

- ◆ reduced exposure to pain-relief drugs
- ◆ calmer, gentler, easier transition

2.7.1 Reduced exposure to pain-relief drugs

The infant may benefit from reduced exposure to pharmacological pain relief drugs taken by the mother (Alderdice et al. 1993:1563). The baby's transition from intra uterine to extra uterine existence is more gradual, as it descends from the birth canal into warm

water. Only when it is brought up onto the mother's chest is it exposed to environmental changes that stimulate the breathing reflex (Daniels, 1989:n.p.; Gordon, 1991:245; Jackson, Corsaro, Niles, Stange & Haber, 1989:196).

2.7.2 Calmer, gentler, easier transition

Infants born in water usually do not cry when they are brought to the surface and mothers and midwives claim that this may be due to the less traumatic birth experienced (Blair-Myers, 1989:73). Theoretically the reason is unknown at this stage and hypothetically it could be due to a suppressed central nervous system due to hyperthermia. Studies have shown that the fetus is able to perceive music and to respond to the sound of it (Woodward, 1992:204). Evidence for fetal or neonatal pain experience is scarce and is mostly expressed in changes in hormonal or metabolic functions. Increased levels of cortisol and β -endorphins, correlating with the duration of the procedure, have been recorded in fetuses who underwent intra-abdominal versus umbilical fetal blood sampling (Giannakoupoulos, Sepulveda & Kourtis, 1994:77). Evidence has shown a mean increase of 90% in fetal activity during ultrasound exposure, it is

not reported whether this increase is due to the "noise" of ultrasound exposure or due to the possible pain the fetus may experience due to the ultra sound (Mander, 1998:198). It is difficult to assess what the baby experiences when delivered and freed from the constraints of the mother's body, but still kept submerged for a while (Anderson, 1992:110).

2.8 Neonatal disadvantages

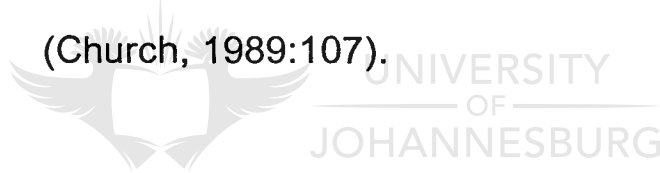
Some authors have expressed their concerns about the possible disadvantages of water births to the neonate. These may include the following factors and will be described in the following paragraphs.

- ◆ decreased fetal surveillance
- ◆ cord around the neck
- ◆ low Apgar scores
- ◆ water inhalation
- ◆ respiratory problems / hypoxia
- ◆ circulatory problems / tachycardia
- ◆ hypo/hyper thermia
- ◆ infection
- ◆ hypoglycaemia
- ◆ polycythaemia
- ◆ neurological problems

- ◆ still births and neonatal deaths

2.8.1 Decreased fetal surveillance

Non-accessibility to monitor the fetal heart whilst under water may be a problem when women are immersed in water (Royal College of Obstetricians & Gynaecologists, 1993). It may also be difficult to suction the oropharynx if meconium stained liquor is present, although some units requested the woman to stand up out of the water directly after delivery of the head to enable them to suction the infant's oropharynx (Church, 1989:107).



2.8.2 Cord around the neck

When the umbilical cord is tightly around the fetus's neck it may be very difficult to clamp and cut the umbilical cord under the water. Most midwives recommend that the woman should stand up out of the water if the cord cannot be slipped over the head (Harmsworth, 1994:31, Hurley, 1994:112). If the umbilical cord is cut under the water the fetus may gasp due to carbon dioxide build-up (Footner, 1992:272). Rosenthal (1991:43) manages the

umbilical cord by slipping it over the fetal head if loose, or by clamping and cutting it while the woman is still immersed in the water.

2.8.3 Water inhalation

Proponents of water birth claim there is no risk of water inhalation (Odent, 1983:1476) or that the newborn will attempt to breathe under water. The reason given for this is the "diving reflex", an apnoea in expiratory position with closure of the larynx. This reflex is stimulated when the facial skin comes into contact with water (Eldering & Selke, 1996:20). They claim that the diving reflex is functional if an infant is born under water and that no reflex bradycardia will occur while the umbilical cord is pulsating.

This statement is questionable because firstly, all normal reflexes can be depressed when asphyxia is present, which could lead to premature lung fluid absorption and increased breathing activity, with possible inhalation or aspiration of water during birth (Eldering & Selke, 1996:23).

Secondly, if one observes video recordings or actual births taking place in water one can see the baby gasping for air or making an attempt to cry. Low-grade hypoxia inhibits fetal breathing, but severe asphyxia is associated with gasping and could result in the inhalation of water at delivery (Johnson, 1996:32). Harmsworth (1994:32) claims that babies born too rapidly are distressed or compromised babies and babies whose umbilical cords are clamped before delivery of the body may gasp under the water. It is a known fact that many babies born in the conventional way do attempt to cry even if the chest is still undelivered and compressed in the birth canal (Barry, 1995:1602). It has also been recorded that a midwife observed a baby spitting out a long string of mucus and meconium before its face was brought to the surface (Lemay, 1991:95).

Many important features of fetal physiology, particularly those relating to breathing and temperature regulation, have not been adequately assessed in units where underwater deliveries are offered. The risk of drowning or potential inhalation of water is one of the major concerns of the use of water during birth. It is claimed that evolution and natural selection have produced humans that are

physiological designed to encounter air immediately after birth.

Fetal breathing in the near term fetus occurs mainly during active sleep and is normally intermittent, occurring for approximately 40% of the time (Johnson, 1996:202). Studies have shown that lung fluid is rich in chloride (greater than 150meq/l), almost free of protein (Bland 1983:12) and this increases exponentially towards term. In physiological studies, the lungs of sheep fetuses were expanded with 15 - 40 ml of saline during their first inspiration breath. The results show that fluid secretion only changes to fluid absorption after 50% expansion of the lungs has occurred. Therefore small fetal breathing movements in a liquid environment do not result in entry of liquid into the fetal lungs, but larger expansion changes such as the first breath would produce rapid changes.

The inhalation of meconium before birth is very unusual and this could be due to the fact that in utero breathing movements do not expand the lungs sufficiently and only allow for minimal intake of amniotic fluid (Johnson, 1996:202). However, it is possible that abnormally strong gasping efforts may

result in inhalation of liquid (such as water during the time of submersion) (Perks & Cassin, 1985:149). Acute hypoxia in utero usually will inhibit breathing, unless it is severe and prolonged at which point the fetus may start gasping and inhale amniotic fluid or water (Johnson, 1996:203).

It is further reported that the volume of liquid in the lungs starts to decrease about two - three days before the onset of labour and decreases further during labour, with the final completion of reabsorption within six hours after birth (Eldering & Selke, 1996:22). Lambs born with a reduced volume of liquid in their lungs improved their arterial acid base status more quickly than those who had an increased volume of liquid in their lungs. Postnatal gas exchange is thus enhanced if there is a reduced volume of fluid in the lungs at the onset of breathing (Berger, Smolich, Ramsden & Walker, 1996:905). During delivery, the lungs are compressed and about 35 - 40 ml (35% of the fluid contained in the lungs) is expelled, optimally preparing the infant for extra uterine breathing (Robertson, 1986:50). Keeping the baby submerged for a longer time may slow the transition from fetal circulation to neonatal circulation and may influence the neonate's health. Slow absorption of the lung

liquid gives rise to transient respiratory distress and is commonly reported following caesarean sections (Roberton, 1986:264). Reports of "wet lungs" in babies born in water, similar to those encountered when women are delivered by elective caesarean section, have been associated with an increase in admission to special neonatal units.

Inhalation of fresh water causing haemodilution and hyponatremia resulting in convulsions are well documented when people try to "drownproof" infants under the age of one year when teaching them to swim (Pearn, 1995:1602). It is suggested that the expansion of the lungs activates a Na^+/K^+ ATPase pump that helps with the reabsorption of salt and water (Perks & Cassin, 1985:149). The inhalation of even a small quantity of fresh water can be quickly absorbed into the circulation causing appreciable haemodilution and fluid overload, one of the consequences of fresh water drowning.

Certain physiological fluids (physiological saline, amniotic fluid, lung fluid, gastric fluid, urine, blood, meconium and breastmilk) at body temperature elicit very little sensory impulses from the superior laryngeal

nerve and the cardiorespiratory receptors when instilled into the larynx. On the other hand the full diving response (apnoea, swallowing, arousal, bradycardia, hypertension) is stimulated even at body temperature when the larynx comes into contact with fresh water, isotonic alkalis, ammonia and nonspecies specific milks (Johnson, 1996:205).

The death of a neonate after a water delivery in Sweden raised further concerns about the safety of immersion in water during the second stage of labour. The fetal heart was monitored frequently and there were no signs of fetal distress. The baby was born in the water and lifted out of the water directly after birth. Two midwives attended the birth, one of whom has reported that breathing efforts were noticed, but the infant had no heartbeat. The midwives resuscitated the newborn and paramedical help arrived within ten minutes. The newborn was taken to hospital where it suffered from fits and respiratory problems and later died. The post-mortem result showed the presence of a meconium like substance in the lungs. The fetus did not pass meconium, but the mother had defecated in the water. It is speculated that the combination of an asphyxiated infant without the normal laryngeal protection and the contaminated water caused the infant to inhale the substance (Robinson, 1993:8).

Based on theoretical considerations as no clinical evidence is available yet, it has been suggested that salt should be added to the water to make the solution more isotonic, which presumably could reduce the risk of stimulation of the diving response as well as haemodilution and possible hyponatremic convulsions (Hofmeyr, Nikodem & De Jager, 1997:121; Barry, 1995:1602). Pearn (1995:1602), disagrees and does not encourage the use of salt until evidence for its use is available.

Neuroendocrine hormones such as serotonin and epinephrine have also been shown to play an important role in clearing fluid from the fetal lungs at the time of birth in guinea pigs (Chua & Perks, 1999:374; Woods, Doe & Perks, 1997: 772). Neuroendocrine hormones may be influenced by the different thermoregulatory and cardiovascular changes the newborn experiences when born submerged in water. Prostaglandin E₂ (PGE₂) is a powerful inhibitor of fetal breathing and during labour there is an increase of PGE₂ resulting in the inhibition of fetal breathing movements (Johnson, 1996:203).

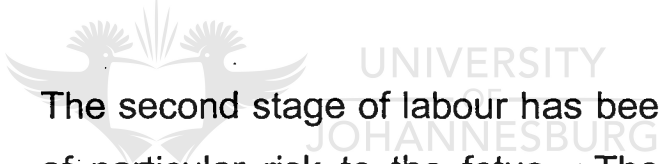
Ambient temperature plays a crucial role in both the stimulation and inhibition of breathing. A warm fetal environment inhibits fetal breathing, causing "panting", while cooler fetal environments are associated with stimulation of breathing patterns and shivering (Johnson, 1996:31). Environmental temperature is the major determinant of the effectiveness of breathing after umbilical cord occlusion (Johnson, 1996:204). Studies have shown that a reduction of 2°C in room temperature stops liquid secretion in the lungs. Decreased temperatures did not influence reabsorption of fetal lung liquid. Thus any increase in temperature such as maternal fever or immersion in warm water during second stage may affect lung development adversely as lung fluid may continue to be secreted. The fall in temperature directly after birth is an important factor in the early absorption of lung liquid (Garrad & Perks, 1990: 109).

Barry (1995:310) reported on an infant who was born in water who experienced difficulty in breathing after birth. The infant suffered from convulsions and was found to have a low plasma sodium concentration, possibly due to haemodilution after inhaling a small quantity of fresh water. The infant recovered and the

diagnosis on discharge was recorded as fresh water drowning.

In general it could be accepted that breathing or gasping should not occur in a nonasphyxiated newborn, with its umbilical cord intact (not stretched or occluded), who is delivered into a physiological liquid with a normal fetal environmental temperature. In practice this is not always possible.

2.8.4 Apgar scores



The second stage of labour has been considered to be of particular risk to the fetus. The Apgar score was devised by Virginia Apgar to identify the at risk newborn in need of resuscitation, but it has been commonly used as an indicator of hypoxemia, even though it does not reflect the fetal acid-base state (Blackstone & Young, 1993: 35; Jepson, Talashek & Tichy, 1991:83). The most frequently used criteria to diagnose the presence of asphyxia in the newborn are Apgar scores and cord arterial blood gas analysis, despite evidence that there is a poor relationship between Apgar scores and cord blood gas values (Behnke, Eyler, Conlon, Woods & Thomas, 1993:73). The value of the Apgar score as a

way of identifying newborns at risk of developing cerebral complications has also been questioned as only about 15% of infants suffering from cerebral palsy had low 5 minute Apgar scores (Blackstone & Young, 1993: 33).

Hull & Dodd (1991) reported on a study by Nelson and Ellenberg on 40 000 children. They found that 75% of subjects who developed cerebral palsy, had Apgar scores greater than seven at five minutes. There was no tendency for the Apgar score to decrease as the duration of the second stage increased. No association was observed between length of second stage and the Apgar score, whether cardiocograph patterns were normal or pathological (Alexander, Cantraine & Schwes, 1986: 61-62)

The Apgar score is still an integral part of the neonate's risk assessment at birth and has a high specificity in that only very few healthy newborns will have a low Apgar score. It lacks sensitivity because there is not good correlation between Apgar scores and the risk for mortality, neurologic outcome, or metabolic acidaemia (Jepson et.al. 1991:91). The five minute Apgar score is a useful guide for the clinical

assessment and immediate care of the newborn (Manganaro, Mami & Gemelli, 1994:102). Portman, Carter, Gaylord, Murphy, Thieme & Merenstein (1990:175), found a significant correlation between clinical signs of asphyxia, organ dysfunction and an Apgar score of less than seven at five minutes.

Waldenström and Nilsson (1992:57) did a retrospective study on women who used water during labour and they reported a lower Apgar score in infants born to mothers who used the water and who had prolonged rupture of membranes.



2.8.5 Cord arterial blood gas

The compensatory mechanisms to regulate acid-base equilibrium are limited by the functional development of the fetus and the surrounding maternal environment. The placenta is the organ of respiration in the fetus and the fetal kidneys play a minor, if any role in regulation of acid-base balance. The fetus becomes hypoxic when the placental function is compromised, umbilical cord compression occurs or the mother is deprived of oxygen (Blechner, 1993:6). Other factors affecting the fetal circulation are: maternal position, uterine

contractions, and maternal blood pressure (Bobak & Jensen, 1993:367).

Blackstone and Young (1993:33,35) define perinatal asphyxia as a depressed neonate manifesting hypoxemia and acidemia. Monitoring acid-base status by arterial cord blood analyses at birth is currently one of the best methods available for documentation of oxygenation at delivery and provides an objective method for evaluating the newborn's condition at birth (Petrie, 1994:1710). The absence of metabolic acidosis in the presence of a low Apgar score can usually exclude asphyxia, and could be due to other causes such as maternal analgesia use during labour (Blackstone & Young, 1993: 33).

The best parameters for clinical use of the various components of a cord blood gas measurement, (lactate, pH, pO₂, pCO₂, bases excess), are umbilical artery pH and base excess. Normal cord blood gas values for the umbilical vein and artery differ and acidemia is defined as an umbilical artery blood gas pH of less than 7.20 with a base deficit of 10mM or more (Chauhan, Cowan, Meydrech, Magann, Morrison & Martin, 1994:1706). pH is measured on a logarithmic scale, and is normally 0.1

units lower than the mother's. When the fetal pH drops, the difference in the fetal hydrogen ion concentration increases to up to fourfold of that of the mother. During fetal hypoxia, acids are produced and the pH decreases. Buffering compensation causes the depletion of the buffer base and creates a base deficit. The changes in the base deficit are usually relatively prolonged due to poor placental permeability to electrically charged bicarbonate. A metabolic acidosis results in excess acid and a decreased buffer base. This is usually expressed as a base deficit or negative base excess (Blechner, 1993:8-11).



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It is recommended that umbilical cord blood sampling be done immediately after the delivery, before or as near to the first breath as possible. Umbilical artery values are the best measure for the detection of the presence, and severity, of fetal acidemia (Riley & Johnson, 1993:14). Double clamping (approximately 25 - 30 cm) of the cord with the first clamp close to the vaginal introitus is recommend. Arterial cord blood should then be collected in a heparinized syringe and kept on ice until analyses (Blechner, 1993:8). A study has found that blood gasses in glass syringes were stable on ice but blood gasses in plastic syringes were stable for up to 30 minutes in room temperature. The

standard anticoagulant that can be used to flush the syringe before the withdrawal of the cord blood is either lithium heparin or calcium heparin (1,000-units / ml). The blood should be analysed within 60 minutes because continued cell metabolism in the syringe may decrease the pH (Chauhan et al. 1994:1708).

Clinicians often refer to acidosis instead of acidemia. Excess acid accumulates in the tissues if oxygenation is insufficient. However, practically it is the levels in the blood that are measured and therefore should be referred to as acidemia and hypoxemia. The umbilical cord artery reflects the uteroplacental-fetal metabolism during the delivery process and indicates oxygenation efficiency just before birth. (Blechner, 1993:4,9).

Contrary to observations of Apgar scores, Hagelin and Leyon (1998:841) found a significant correlation between the duration of second stage of labour and cord arterial blood gas pH. However prolongation of the second stage of labour as long as three hours will only give an expected lowering of cord arterial blood gas pH of 0.05 for nulliparous and 0.09 for multiparous women. Alexander et al. (1986:61) found a significant negative correlation when they plotted cord arterial

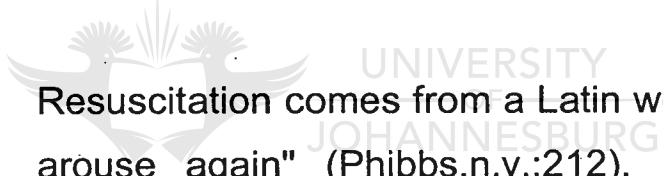
blood pH against duration of the second stage of labour in the group with normal fetal heart rate patterns. These correlation coefficients imply an average decrease in pH of between 0.08 and 0.09 after 100 minutes. The authors did not stipulate what position the women used when pushing. The effect on arterial cord pH is small and in the absence of other risk factors there is no evidence to shorten the duration of the second stage of labour to less than an hour.

The lowering of umbilical artery pH is significantly related to the cord (length, number of vascular coils) and placental morphology and is not associated with intrapartum fetal heart rate decelerations, meconium stained liquor or the mode of delivery. Thus variations in morphology or other causes that can affect maternal - fetal gas exchange [such as positioning during the second stage] may explain the lowering in acid-base status in the newborn (Atalla, Abrams, Bell & Taylor, 1998:865; Berg & Rayburn, 1995:11).

The use of cord blood gas values may sometimes be used in medico-legal cases, but it only provides information regarding the infant at time of the birth. A normal cord arterial pH at birth indicates the absence of

significant fetal hypoxemia during delivery. The use of routine cord arterial blood gas analyses at birth, in high risk obstetrics, can be used as an indicator to differentiate newborns with acidemia from those with clinical depression due to other causes such as maternal analgesia. Severe cord blood acidemia is shown to be a poor indicator of subsequent neurologic dysfunction (Blechner, 1993:8; Chauhan et al. 1994:1705; Fee, Malee, Deddish, Minogue, Min & Socol, 1993:802; Miller, 1994:1710).

2.8.6 Need for resuscitation



Resuscitation comes from a Latin word and means "to arouse again" (Phibbs,n.y.:212). It refers to the actions (O₂ administration, suctioning, intubation, medication) undertaken to make the transition from a dependent fetal life to an independent neonatal life easier for the asphyxiated newborn. It is reported that in some units where delivering in water is an option, fewer babies needed to be resuscitated or needed to go to the intensive care unit (Kitzinger, 1996:vii).

2.8.7 Respiratory system

A series of pulmonary circulation adjustments occurs at birth. The umbilical cord circulation ceases and gaseous exchange is transferred from the placenta to the lungs. The central circulation is in a state of transition for a while, giving the foramen ovale a chance to close due to the hydrostatic pressure changes that occur. The ductus arteriosus constricts and gradually closes. If the newborn does not receive enough stimuli to establish effective ventilation and perfusion directly after birth, the pO_2 will remain low and the ductus arteriosus will take longer to constrict (Phibbs, n.y.: 213).



Sometimes up to 30ml of tracheal fluid can be ejected through the airways as the liquid in the fetal lung is replaced by air when the fetus becomes a neonate (Longo, n.y: 312; Nelson, n.y: 176). The umbilical vessels are very sensitive to stretching. Stretching of the umbilical cord during the birthing process stimulates stretch receptors and the blood vessels constrict (Nathanielsz, 1994:153)

The first inspiratory breath is a vital assertive and independent act and attempts to breathe are usually noted after the head is out of the birth canal (Nathanielsz, 1994:151). The precise reasons for the first air inspiration are still unclear due to the many stimuli the newborn is subjected to at birth. The inspiratory gasp is believed to be due to many stimulating factors including, release of pressure on the squeezed head and chest, tactile stimuli such as exposure to a cooler environment, light, noise, gravity, pain and partial asphyxia due to the natural decrease of oxygenation during contractions in labour and birth (Longo,n.y.: 312; Nelson n.y.:179).



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Hormones, especially high levels of prostaglandins during labour, inhibit breathing efforts in fetal sheep. The source of high levels of prostaglandin stops when the umbilical cord is clamped. Heat may inhibit the secretion of prostaglandins, thus one of the main inhibiting factors of breathing is removed and the low levels may act as a breathing stimulus (Nathanielsz, 1994:152).

A survey by Alderdice et al. (1995:380) reported on the following problems that occurred after women

laboured or gave birth in a pool: general respiratory and circulatory problems, low Apgar scores, hypoglycaemia, infections, neurological problems, congenital abnormalities, hypothermia, cord around the neck and inhalation of water following submersion while breastfeeding.

2.8.8 Cardiovascular system

Fetal tachycardia is associated with maternal fever. If the bath water is too hot it may give rise to increased maternal temperature, which may cause fetal tachycardia and may lead to unnecessary interventions such as caesarean sections. An increase up to 170 - 190 beats per minute was recorded when women were immersed in water during labour (Deans & Steer, 1995:390).

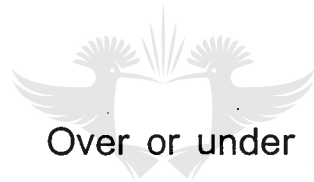
Time of placental separation varies, but directly after birth the uterus contracts and blood flow to the placenta is decreased. There is little further oxygenation to the newborn even though the cord is still pulsating. If the fetus was already distressed, keeping it submerged till the cord stops pulsating may compromise oxygenation to the brain and may cause

hypoxia. Extreme passivity and calmness of the newborn delivered in water are commonly reported, and this could be a response to severe stress (Anderson, 1992:110; Deans & Steer, 1995:390; Walker, 1994:467).

2.8.9 Hypo / hyperthermia

Fetal thermo-regulatory control mechanisms may cause an adverse effect (Alderdice et al. 1995:375) as they are limited and poorly controlled compared to that of an adult. Excessively warm water may cause cerebral vasodilatation, which could lead to hypoxic ischaemic encephalopathy, and could severely compromise the newborn (Zimmermann et al. 1993:8). Heat is transferred from the mother to the neonate which can cause peripheral and cerebral vasodilatation. This may cause an increase in metabolic rate and oxygen requirement, which could jeopardise the susceptible neonate at birth (Rosevear et al. 1993:1048). Cold air is a breathing reflex stimulator; warm water may increase the newborn's temperature and may inhibit respiratory efforts, causing lack of oxygen to the brain.

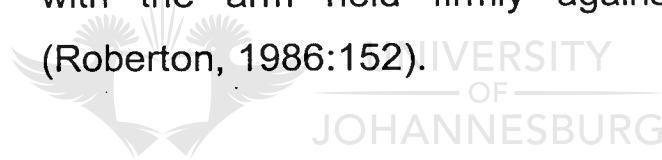
The fetus is dependant on maternal temperature control and usually the fetal core temperature is 0.5 - 1° C above the mother's amniotic fluid environment (Deans & Steer, 1995:391; Johnson, 1996:204). In a study done on thirty women during labour the mean feto-maternal temperature difference was +0.24°C (0.12 -0.36). Fluctuations were noted during uterine contractions. Several other factors such as reduced placental perfusion (due to hypotension during immersion in water) may contribute to the magnitude of temperature differences during labour (Randal, Bond, Macaulay & Steer, 1991:481).



Over or under heating by immersion of the mother's body can cause hyper- or hypothermia with consequences such as fetal tachypnoea, shivering, gasping or inhibition of breathing efforts (Johnson, 1996:204). Water temperatures have also been blamed for neonatal deaths, "Water temperature may have killed birthing pool baby" (Lawrence & Berrington in The Times, October 16, 1993)

Although bonding is important, it is recommended that newborns should be wiped dry and wrapped in a warm blanket as soon as possible after birth, as the greatest

drop in neonatal temperature occurs in the first 15 minutes after birth (Raman & Shahla, 1992:117). The term neonate tries to control its body temperature by vasoconstriction and increasing its metabolic rate, but core body temperature showed a decrease for 40 minutes post delivery at environmental temperatures of between 24°C and 26°C (Sauer, 1991:611). On average the axillary temperature is 0.3°C lower than rectal temperature and the normal mean body temperature for newborns at delivery is 37.8°C. The thermometer should be placed firmly against the roof of the axilla and held in place for about three minutes, with the arm held firmly against the chest wall (Robertson, 1986:152).



2.8.10 Infection

Contamination by organisms from the mother, especially if she has defecated in the water, may increase the risk of infection. Inhalation of water contaminated by blood or faeces may increase the risk of neonatal death, pneumonia, hepatitis or possibly even HIV transmission (Robinson, 1993:7).

Some labour wards allow the partner or other siblings into the pool, which increases the introduction of micro-organisms. Bacteriological surveillance of the birth pool is important as swabs taken from infants' ears directly after birth have grown *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Escherichia coli* (Alderdice et al. 1995:380; Alderdice et al. 1993:1563; Anderson, 1992:110; Coombs, Spiby, Stewart & Nortman, 1994:1089; Zimmerman et al. 1993:7. Hawkens, (1995:38) compared infection rates between women who delivered in water and those who did not. Their comparative study showed no evidence of clinical infection. However, *Acinetobacter* and *Pseudomonas aeruginosa* species were isolated from the water after one delivery. Microbial swabs from the infant's ears, groin and skin lesions tested positive for *Pseudomonas aeruginosa* species. In another case report, despite meticulous cleaning of the tub, *Pseudomonas aeruginosa* serotype two was isolated from the birthing tub as well as the umbilical swab taken from a newborn 11 hours after birth when the infant develop signs of septicaemia (Rawal, Shah, Stirk & Mehtar, 1994:511).

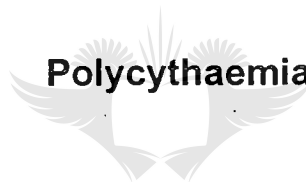
Looms (1990:14) did microbial sampling from the heater system of the birthing tub after cleaning and

disinfection had taken place. The sample still yielded a growth of 10^6 /ml of *Pseudomonas aeruginosa*. This highly virulent pathogen can cause morbidity and mortality if it colonises the infant during birth.

2.8.11 Hypoglycaemia

A small percentage of infants suffered hypoglycaemia after the infant's mother spent some time in the water tub (Alderdice et.al. 1995:380).

2.8.12 Polycythaemia



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Women who opt for a physiological third stage, leaving the cord intact till it stops pulsation may increase the risk of polycythaemia in the neonate. Austin, Bridges, Markiewicz and Abrahamson (1997:1445) postulated that if women stay in warm water during a prolonged physiological third stage of labour, there maybe an increase of placental-fetal transfusion, due to vasodilatation of the cord vessels.

2.8.13 Neurological problems

Extreme passivity and no attempts to cry are often noted in newborns that are delivered in water. Proponents claim that it is due to the gentle-birthing environment. Unfortunately it is also true that infants under stress may be extremely passive due to decreased functional neurological stimulation to enable them to start crying (Anderson, 1992:110). Rosevear et.al. (1993:1049) reported on two cases where both the infants developed grade III hypoxic ischaemic encephalopathy after their mothers were immersed in warm water during labour.



2.8.14 Stillbirth or Neonatal deaths

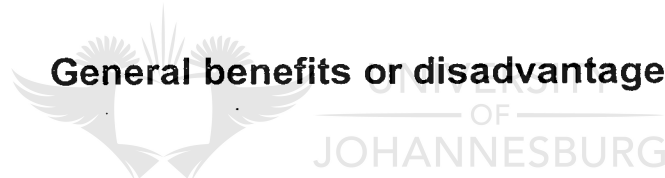
An article in the Guardian (Ward, 1993:October 16), mentioned that "Baby's death raises pool birth concern". Still births and neonatal deaths have been reported after women laboured or laboured and birthed in water. Unfortunately due to the general lack of details in the description of where and what occurred, it is not clear whether these were fresh or macerated stillbirths. Although some of the causes were due to congenital birth defects, no good explanations were given for the majority of the deaths.

The reported perinatal deaths in the UK of 12 babies associated with water births is unacceptably high for a population assumed to be at low risk (Alderdice et.al. 1995:837; Atalla & Weaver, 1995:390; Burke & Kilfoye, n.y.:7; Hurley, 1994:112; Kitzinger, 1992:110).

Parents, midwives and doctors have been taken to court due to two deaths of infants after the women were immersed in water during labour or birth (Santa Barbara News Press, 1989 & Sunday Times, 1990).

2.9

General benefits or disadvantages



There are complaints of baths being too high or too low and midwives may be concerned about injuring their backs. Possible risks to staff of back injuries and infection from contaminated water cannot be excluded. Possible risks to the mother may include slipping and injuring herself or the infant if she is wet (Alderdice et al. 1995: 380; Alderdice et al. 1993:1563; Footner, 1992:273).

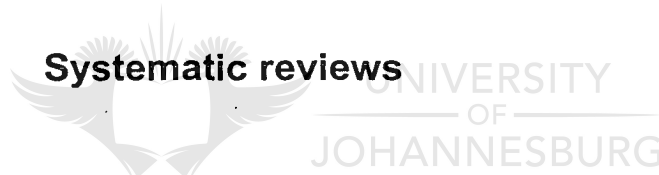
The theoretical risk of vertical transmission of bacterial or viral infections to the infant or horizontal

transmission to the caregiver or the subsequent bath user can not be excluded (Brocklehurst, Garcia & Lumley, 1996:275; Ridgway & Tedder, 1996:275).

Obstetricians and paediatricians in general remain sceptical about using water immersion during childbirth, although confidence is growing amongst midwives (Footner, 1992:274). Large randomised controlled trials are recommended to prove the safety of underwater deliveries (Atalla & Weaver, 1995:390).

2.10

Systematic reviews



The candidate, following the strict scientific approach to systematic reviews demanded by the Cochrane collaboration prepared the review. The methodology is set out in the review. The review was peer reviewed and accepted for publication in the Cochrane Library, which is recognised as the best single source of reliable evidence about the effects of health care.

The review presented on the following pages is directly printed from:

The Cochrane library. 1999 Issue 1.

Immersion in water during pregnancy, labour and birth

Nikodem VC

Date of most recent substantive amendment : 02 June 1997

Objectives: To determine the possible benefits and risks of the use of immersion in water during pregnancy, labour or birth on maternal, fetal, neonatal and caregiver outcomes.

Search strategy: This review has drawn on the search strategy developed for the Pregnancy and Childbirth Group as a whole. Relevant trials were identified in the Group's Specialised Register of Controlled Trials. Authors of published and unpublished trials were contacted for additional information.

Selection criteria: All randomized controlled trials that compare immersion versus non-immersion during labour. Ongoing or unpublished trials are not yet included in this review.

Data collection and analysis: Three randomized controlled trials of immersion in water during labour were identified and included in the analyses by the reviewer from published data. Data for this review have been independently verified. Trials of immersion in water during pregnancy and during birth have not yet been included in this review.

Main results: The results have shown no clear benefits or adverse effects of the use of water during labour. Immersion during the first stage is associated with a trend to decreased use of pain relief methods. Neonatal outcomes showed slightly lower Apgar scores, lower umbilical arterial pH values, and a slight increase in neonatal infection rates in the immersion group.

Conclusions: Although no significant adverse effects have been reported, the use of water immersion during labour should be encouraged only with caution until more evidence to determine the safety of immersion on the fetus and newborn is available.

Background

The use of warm water for relaxation and pain relief has been in practice for many decades. In pregnancy, body immersion has been used to relieve oedema and reduce blood pressure [Cammu 1994]. The bioengineering and physiological principles underlying hydrotherapy, ie buoyancy, hydrostatic pressure, and specific heat, can be applied to labouring women in water. A woman may feel almost 'weightless' and it may be easier for her to support her body and to endure the contractions, while her muscles are less tense because they do not have to support her entire weight (Church 1989). It may also be that the warmth of the water relaxes the muscles while bringing on a state of mental relaxation. This could decrease the release of catecholamines, which may result in better uterine perfusion, relaxation, and contractions, facilitating less painful contractions, shorter labours and a decreased need for augmentation [Schorn 1993]. Another potential benefit of water birth may be the increased elasticity which water imparts to the tissues of the birth canal and perineum, reducing the incidence and severity of tearing and the need for painful stitches or episiotomies (McCandlish 1993).

Adverse effects of the use of birthing pools by women during labour could be associated with unrealistic labour expectations, restriction of choice of analgesia, restriction of mobility, inhibition of effective contractions, increase in perineal trauma, postpartum haemorrhage, uterine infection and other problems such as manual removal of the placenta, abruption and puerperal psychosis (Alderdice et al 1995; McCandlish 1993).

The risk to the mother of water entry into the uterus causing possible infection is always a concern when considering the safety of water immersion. Odent 1983, mention the potential danger of water embolism and advocated moving the mother out of the pool for the third stage.

Changes in maternal temperature, hydration, and blood pressure may also constitute risk factors. Circulatory redistribution may decrease placental perfusion. If warmth has a relaxing effect on the uterine muscles, this could increase bleeding after delivery of the placenta (Deans et al 1995; Church 1989).

Emergency interventions can be substantially delayed if it is difficult to get the mother out of the bath or if the water does not flow out quickly. Injuries to women may occur when trying to get out of the bath as quickly as possible (Zimmermann 1993).

It is claimed that the infant will not breathe under water, but there is little scientific evidence to support this (Rosenthal 1991; Jackson et al 1989; Zimmermann 1993). The baby who is delivered underwater has the potential problem of gasping before his nose and mouth are above the surface, thus inhaling bath water into his lungs. The inhalation of even a small quantity of fresh water can be quickly absorbed into the circulation causing appreciable haemodilution and fluid overload, one of the consequences of fresh water drowning. It is suggested that salt should be added to the water to make the solution more isotonic which presumably could avoid haemodilution and prevent possible hyponatremic convulsions (Barry 1995; Pearn 1995).

In the UK, the House of Commons Health Committee (House 1992) has recommended that all hospitals should allow women the option of a birthing pool, despite the absence of adequate scientific evaluation of the safety and possible dangers of this practice.

The aim of this review is to evaluate the available scientific evidence to gain information about the benefits, possible disadvantages and resource implications for the use of water immersion, and to determine whether further research in specific areas is required.

Objectives

To determine the possible benefits and risks of the use of immersion in water during pregnancy, labour or birth on maternal, fetal, neonatal and caregiver outcomes. The comparisons are structured into the following categories.

- 1 Immersion in water vs no immersion during pregnancy.
- 2 Immersion in water vs no immersion during first stage of labour.
- 3 Immersion in water vs no immersion during second stage of labour.
- 4 Immersion in water vs no immersion during labour and birth.
- 5 The use of a whirlpool/jacuzzi vs a birth tub with still water.
- 6 The use of a salt vs no salt in water.
- 7 The use of a disinfectant vs no disinfectant in water.

Hypotheses

We postulate that the use of water immersion during pregnancy, labour and birth will not influence any of the outcomes cited under 'Types of outcome measures'.

Criteria for considering studies for this review

Types of participants

Pregnant women.

Types of intervention

The main comparison is use of any kind of bath tub which allows immersion of the abdomen in water compared with non-immersion.

Secondary comparisons include:

Comparison of different kinds of baths, ie whirlpool vs bath tub.

Comparison of salt vs no salt.

Comparison of disinfectants or oils vs no disinfectant.

Types of outcome measures

Maternal outcomes.

- 1 Maternal experience and satisfaction of labour.
- 2 Pain.
- 3 Use of analgesia/anesthesia.
- 4 Augmentation of labour.
- 5 High blood pressure.
- 6 Amniotic fluid volume in women with oligohydramnios.
- 7 Duration of labour and birth.
- 8 Mode of delivery.
- 9 Trauma to the birth canal requiring suturing.
- 10 Maternal infection.
- 11 Self esteem.
- 12 Postpartum depression.
- 13 Breastfeeding.

Fetal outcomes.

- 1 Lung hypoplasia.
- 2 Abnormal fetal heart rate patterns, needing intervention.

Neonatal outcomes.

- 1 Neonatal condition.
- 2 Admittance to neonatal intensive care unit (NICU).
- 3 Temperature.
- 4 Neonatal infection rates.
- 5 Perinatal deaths.

Caregiver outcomes.

- 1 Injuries.
- 2 Satisfaction.

Types of studies

Any adequately controlled trial that compare one or more of the following:

- 1 Immersion in water vs no immersion during pregnancy.
- 2 Immersion in water vs no immersion during first stage of labour.
- 3 Immersion in water vs no immersion during second stage of labour.
- 4 Immersion in water vs no immersion during labour and birth.
- 5 The use of a whirlpool/jacuzzi vs a birth tub with still water during labour and/or birth.
- 6 The use of a salt vs no salt in water during labour and/or birth.
- 7 The use of a disinfectant vs no disinfectant in water during labour and/or birth.

Search strategy for identification of studies

See: [Collaborative Review Group search strategy](#)

This review has drawn on the search strategy developed for the Pregnancy and Childbirth Group as a whole.

Relevant trials were identified in the Group's Specialised Register of Controlled Trials. See Review Group's details for more information.

Authors of published and unpublished trials were contacted for additional information.

Methods of the review

Trials were assessed independently by the reviewer and by Rona McCandlish; the names of the authors, institutions, journal of publication were known at the time of assessment. Disagreement would have been resolved by discussion with a member of the editorial board.

Trials under consideration were evaluated for methodological quality and appropriateness for inclusion, without consideration of their results.

Included trial data were processed as described in: Materials and methods used in synthesizing evidence to evaluate the effects of care during pregnancy and childbirth. In: Chalmers I, Enkin MW, Keirse MJNC, (eds), *Effective Care in Pregnancy and Childbirth*. Oxford University Press 1989;pp39-65.

Description of studies

See details under 'Characteristics of Included Studies'.

Methodological qualities of included studies

See details under 'Characteristics of Included Studies'.

Results

Comparisons of immersion versus no immersion before labour or during the second stage of labour are not available yet. Only three trials reported on immersion versus no immersion during labour; two of the trials had only a small number of participants. Many of the outcomes only reflect the results of one trial.

The benefits and risks of the use of water immersion during labour has shown no significant differences on maternal, fetal or neonatal outcomes. No significant adverse effects have been detected.

There is a tendency that the use of water during labour may decrease the use of other pain relief methods during labour. There were no differences between augmentation and duration of first stage of labour, meconium stained liquor and perineal trauma. Neonatal outcomes show a tendency towards better outcomes in the non-immersion group, with slightly lower Apgars, lower pH values and a slight increase in neonatal infections in the immersion group.

Summary of analyses

MetaView: Tables and Figures

Discussion

Meta-analysis of the available data from these few randomized controlled trials provide no significant evidence of any benefits or risks of the use of water immersion during labour.

Consistency of results across trials

Only a few outcomes were reported in more than one trial. There appears to be consistency across trials where more than one trial reported on the same outcome.

Conclusions

Implications for practice

It is recommended that the routine use of immersion in water during labour should be used with care. Although no significant adverse effects have been reported, the possibility of adverse outcome for the neonate should not be ignored. Until good evidence is available on the possible benefits and harmful effects, it is suggested that labour in water be limited to controlled trials or

situations with ongoing audit of possible complications.

Implications for research

There is an urgent need for large collaborative, randomized controlled trials of the use of immersion in water during pregnancy, labour and birth. The potential harmful effects on the fetus and neonate should be the main outcomes under observation. Large numbers of participants are required to study the most important outcomes such as neonatal morbidity and mortality and potential secondary drowning of infants. Researchers interested in this field should collaborate and report on outcomes in a similar way, and should all include fetal and neonatal morbidity and mortality as outcomes.

Potential conflict of interest

None known.

Acknowledgements

I would like to thank the following people for their assistance:

Rona McCandlish

Justus Hofmeyr

Iain Chalmers

Jim Neilson

Sonja Henderson

Claire Winterbottom

Characteristics of included studies

Table: Characteristics of included studies

Characteristics of excluded studies

Study : Nikodem

Immersion during second stage of labour only.

References

References to studies included in this review

Cammu 1994 *{published data only}*

Cammu H, Clasen K, Van Wettere L, Derde M. 'To bathe or not to bathe' during the first stage of labor. *Acta Obstetrica et Gynecologica Scandinavica* 1994;73:468-472. [8405]

Rush 1996 *{published data only}*

Rush J, Burlock S, Lambert K, Loosley-Millman M, Hutchison B, Enkin M. The effects of whirlpool baths in labor: A Randomized, Controlled Trial. *Birth* 1996;23:136-143. [9151]

Schorn 1993 *{published data only}*

Schorn MN, McAllister JL, Blanco JD. Water immersion and the effect on labor. *Journal of Nurse-Midwifery* 1993;38(6):336-342. [8087]

** indicates the major publication for the study*

References to studies excluded from this review

Nikodem

Nikodem VC. Immersion in water during birth: A Randomized Controlled Trial. Unpublished Thesis.

Ongoing studies

Bastide

Bastide A. A randomized controlled trial of the effects of a whirlpool bath on labour, birth and postpartum. [5789]

De Jager

De Jager M, Nolte AGW, Hofmeyr GJ, Nikodem VC. Immersion in water during first stage of labour. A randomised controlled trial. Coronation Maternal and Child hospital, Johannesburg, South Africa.

Eckert

Eckert K, MacLennan Alistair. Immersion in water in labour trial.

Additional references

Alderdice et al 1995

Alderdice F, Renfrew M, Marchant S, Ashurst H, Hughes PM, Berridge G, Garcia J. Labour and birth in water in England and Wales: survey report. British Journal of Midwifery 1995;3(7):376-382.

Barry 1995

Barry CN. Water births. Could saline in the pool reduce the potential hazards? BMJ 1995;310:1602.

Church 1989

Church LK. Water birth: One birthing center's observations. J Nurs Midw 1989;34(4).

Deans et al 1995

Deans AC, Steer PH. Temperature of pool is important. BMJ 1995;311:390-391.

HOUSE 1992

House of Commons Health Committee. Maternity Services. Second report. Her Majesty's Stationery Office, London 1992.

Jackson et al 1989

Jackson V, Corsaro M, Niles C, Stange C, Haber B. Incorporating water birth into nurse-midwifery practice. J Nurs Midw 1989;34(4):193-197.

McCandlish 1993

McCandlish R, Renfrew M. Immersion in water during labor and birth: the need for evaluation. Birth 1993;20(2):79-85.

Odent 1983

Odent M. Birth under water. Lancet 1983;2:1476-1477.

Pearn 1995

Pearn J. Water births. Could saline in the pool reduce the potential hazards? BMJ 1995;310:1602.

Rosenthal 1991

Rosenthal MJ. Warm-water immersion in labor and birth. *The Female Patient* 1991;16:33-77.

Zimmerman 1993

Zimmerman R, Huch A, Huch R. Water birth - is it safe? *J Perinat Med* 1993;21:5-11.

Coversheet

Title

Immersion in water during pregnancy, labour and birth

Short Title

Immersion in water during pregnancy and childbirth

Reviewer(s)

Nikodem VC

Date of most recent amendment : 27 November 1997

Date of most recent substantive amendment : 02 June 1997

This review should be cited as :

Nikodem VC. Immersion in water during pregnancy, labour and birth (Cochrane Review). In: *The Cochrane Library*, Issue 1, 1999. Oxford: Update Software.

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For information on the editorial group see: [Cochrane Pregnancy and Childbirth Group](#)

Extramural sources of support to the review

- *UK Cochrane Centre UK*

- *Cochrane Pregnancy and Childbirth Group Editorial Office UK*

Intramural sources of support to the review

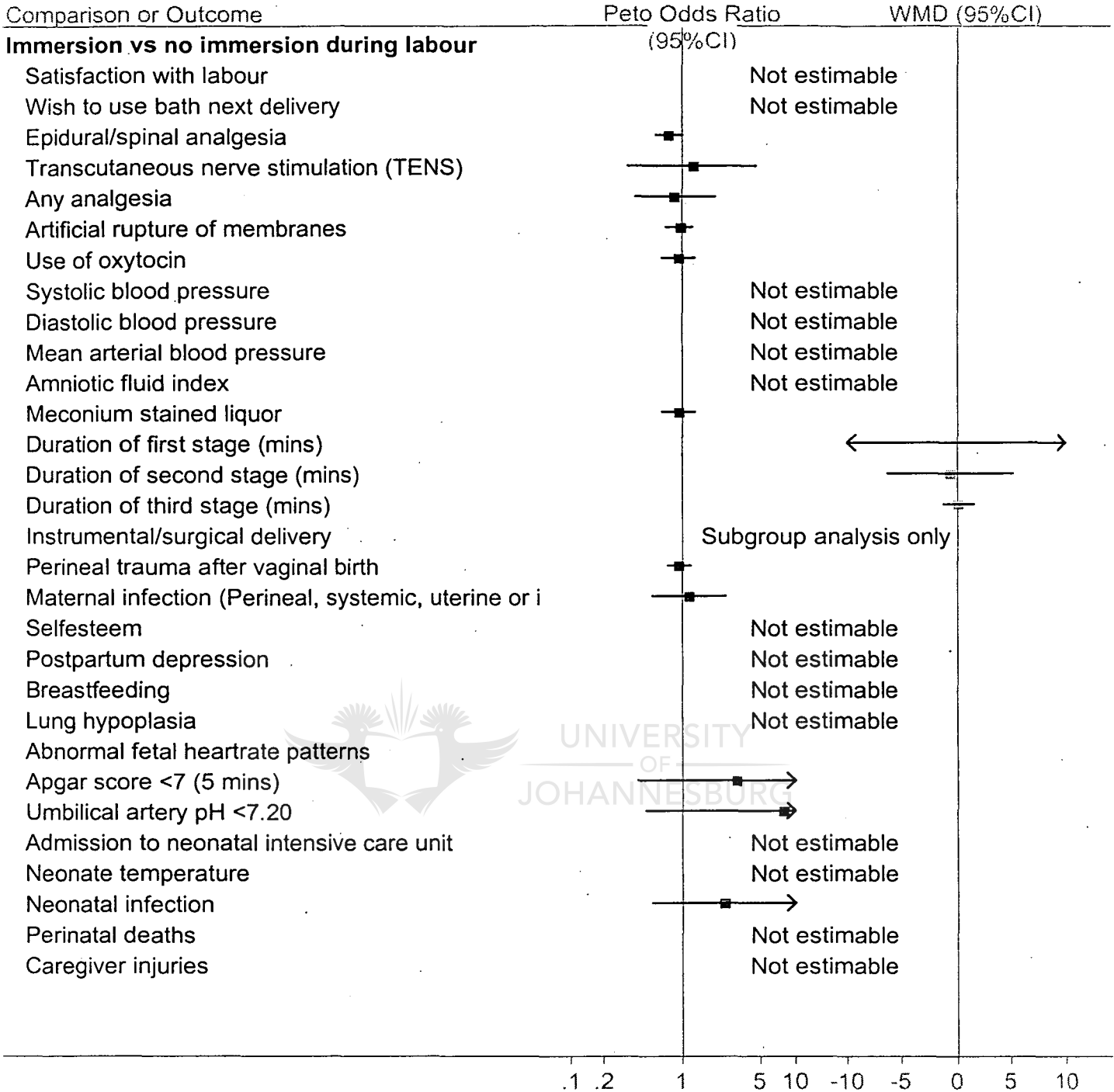
- *University of the Witwatersrand South Africa*

Keywords

HUMAN; FEMALE; PREGNANCY; WATER / adverse-effects; BATHS; NATURAL-CHILDBIRTH / methods; DELIVERY/ methods; META-ANALYSIS; TREATMENT-OUTCOME; INFANT-MORTALITY;;

CRG Code: HM-PREG

Review: Immersion in water during pregnancy and childbirth



Immersion in water during pregnancy and childbirth
Characteristics of included studies

Study	Methods	Participants	Interventions	Outcomes	Notes
Cammu 1994	Randomization took place by means of sealed opaque envelopes containing the method indicator card.	Academic hospital, Brussels, Belgium. Inclusion criteria: Gestation >36 weeks Low risk Nulliparous Singleton Cephalic presentation Active labour between 4-5cm cervical dilatation Ruptured membranes with clear liquor on entry Ambulation and analgesics were allowed.	Study group: n=54. The use of an oval shaped hot tub during labour. Bath temperature not exceeding 37 degrees celsius. No chemicals were added. Control group: n=56. No water immersion during labour.	Outcomes reported. (* = used in this review) Maternal age Gestational age Duration in tub *Use of analgesia *Augmentation Cervical dilatation *Duration of first stage of labour *Duration of second stage of labour *Method of delivery Fetal heart rate patterns *Apgar score at five minutes *Postnatal maternal infections *Neonatal infections *Admission to NICU	Methodological qualities: Selection bias: Low risk - adequate concealment at time of randomization. Performance bias: High risk of bias could have been introduced because researcher cannot be blind to group allocation after randomization. Exclusion bias: Moderate risk of bias - 57 were randomly allocated to bath, 3 refused to bath and results were not included in analyses. Main outcome: Pain relief and maternal experience. All subjects had ruptured membranes and scalp electrodes.
Rush 1996	Random allocation by means of consecutively numbered, computer generated random allocation in sealed opaque envelopes.	Academic hospital, Ontario, Canada Inclusion criteria: Gestation >37 weeks Previous Caesarean sections included (VBAC) Twins included Active labour >3cm cervical dilatation Ruptured membranes on entry also eligible Ambulation, analgesics and anesthesia were allowed.	Study group: n=393. The use of a Parker whirlpool hot tub with jets during labour. Bath temperature between 38-39 degrees celsius. No births in tub. Control group: n=392. No water immersion during labour.	Outcomes reported. (* = used in this review) Gestational age Maternal age Gravida Parity *Use of analgesia *Augmentation Cervical dilatation Duration in tub *Duration of first stage of labour *Duration of second stage of labour *Duration of third stage Duration of admission to delivery *Rupture of membranes *Meconium stain liquor *Method of delivery *VBAC Fetal presentation Birth position *Perineal outcome Apgar score at one minute *Apgar score at five minutes	Methodological qualities: Selection bias: Low risk - adequate concealment at time of randomization. Performance bias: High risk of bias could have been introduced because researcher cannot be blind to group allocation after randomization. Exclusion bias: Moderate risk of bias - 800 women were randomized, 15 were withdrawn 8 from study group and 7 from control group. NEARLY HALF (46%) of the women in the study group did NOT use the tub but were still considered experimental subjects with the intent to treat. Forty one of the women did not meet eligibility criteria but were still included and results were analysed.

Primary outcome:
Use of pain relief.
Mean total time in tub was 54 minutes.
Data table 1 incorrect awaiting response from authors. Experimental group add up to 394.

Methodological qualities:
Selection bias: High risk - the researcher knew group allocation before obtaining informed consent.
Performance bias: High risk of bias could have been introduced because researcher cannot be blind to group allocation after randomization.
Exclusion bias: Low risk of bias - no exclusions.
Main outcome not stated.
Determine safety and effect of water immersion on women in labour.
Most women stayed in the tub for 30-45 minutes.

Neonatal weight
*Neonatal infections
*Maternal satisfaction
*Postnatal maternal infections

Outcomes reported. (* = used in this review)
Maternal age
Gestational age
Ethnicity
Parity
Water temperature
Duration in tub
*Use of analgesia
*Augmentation
Cervical dilatation
*Duration of first stage of labour
*Duration of second stage of labour
Duration of admission to delivery
Duration of ruptured membranes
Blood pressure
Pulse
Maternal temperature
*Method of delivery
*Fetal heart rate patterns
Apgar score at one minute
*Apgar score at five minutes
Neonatal weight
*Postnatal maternal infections
Readmissions to hospital.

Study group: n=45. The use of a hot tub with air jets and with a moulded seat during labour.
Bath temperature between 32-41 degrees Celsius.
Control group: n=48. No water immersion during labour.
Showers were allowed.

Academic hospital, Houston, Texas.
Inclusion criteria:
Gestation between 36-41 weeks
No major obstetric or medical complication
Active labour between 4-7cm cervical dilatation
Intact membranes on entry
Normal fetal heart rate patterns
Ambulation and analgesics were allowed.

Random allocation by means of packets containing random computer generated codes.

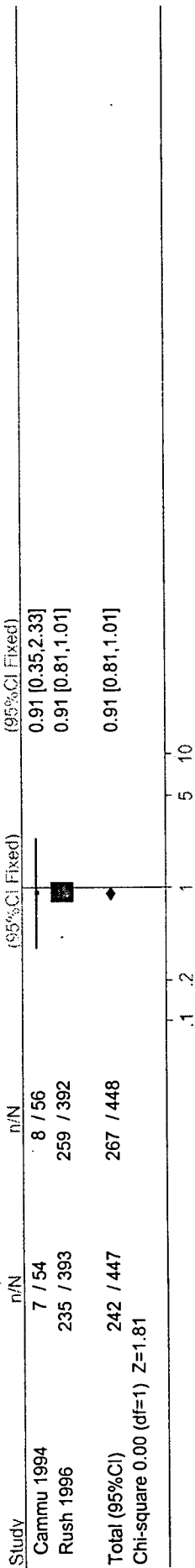
Schorn 1993



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NICU = neonatal intensive care unit
VBAC = vaginal birth after Caesarean section

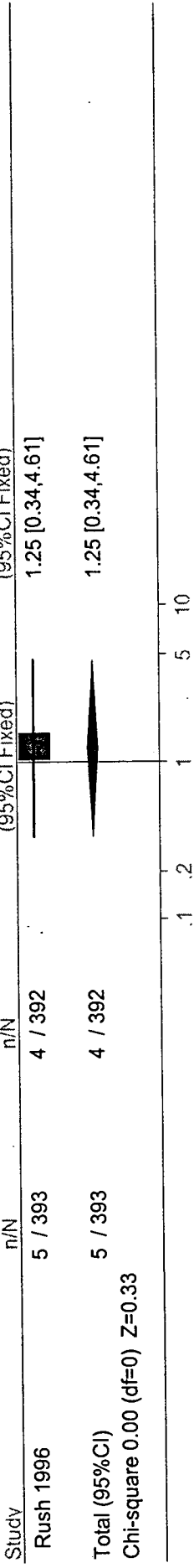
Review: Immersion in water during pregnancy and childbirth
 Comparison: Immersion vs no immersion during labour
 Outcome: Epidural/spinal analgesia



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Review: Immersion in water during pregnancy and childbirth
Comparison: Immersion vs no immersion during labour
Outcome: Transcutaneous nerve stimulation (TENS)

100



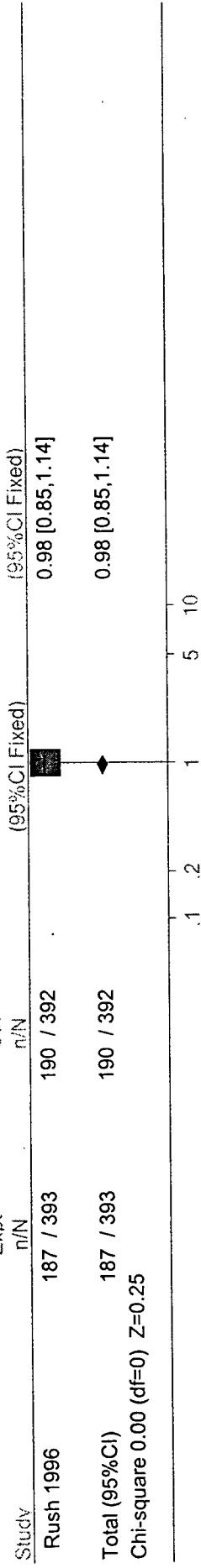
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Review: Immersion in water during pregnancy and childbirth
 Comparison: Immersion vs no immersion during labour
 Outcome: Any analgesia

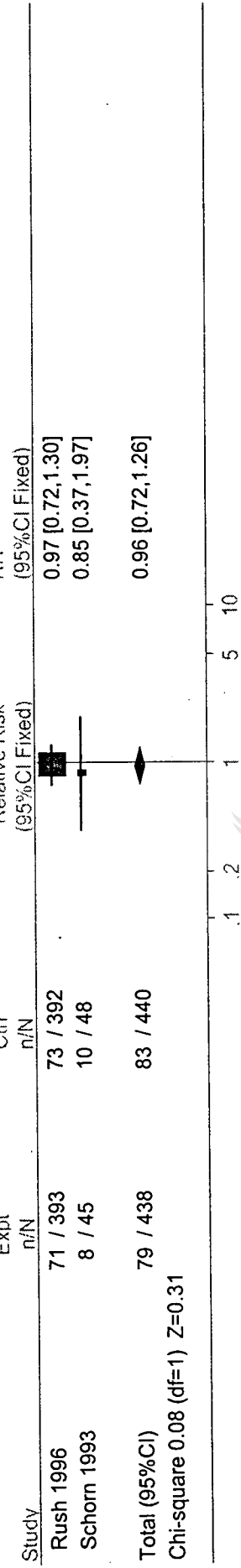
Study	Expt n/N	Ctrl n/N	Relative Risk (95%CI Fixed)	RR (95%CI Fixed)
Schorn 1993	21 / 45	24 / 48		0.93 [0.61,1.42]
Total (95%CI)	21 / 45	24 / 48		0.93 [0.61,1.42]
Chi-square 0.00 (df=0) Z=0.32				



Review: Immersion in water during pregnancy and childbirth
Comparison: Immersion vs no immersion during labour
Outcome: Artificial rupture of membranes



Review: Immersion in water during pregnancy and childbirth
Comparison: Immersion vs no immersion during labour
Outcome: Use of oxytocin

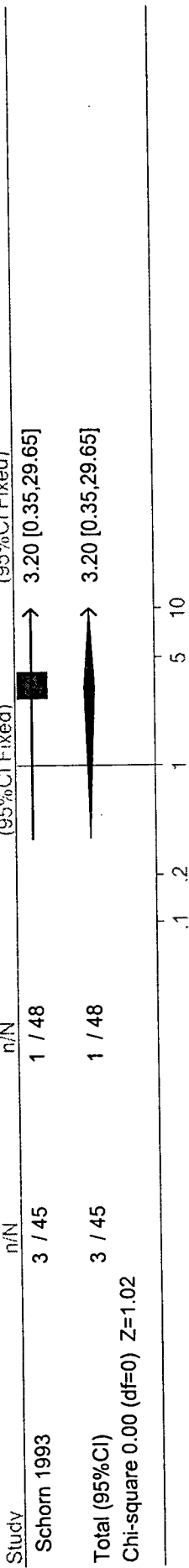


Review: Immersion in water during pregnancy and childbirth
 Comparison: Immersion vs no immersion during labour
 Outcome: Maternal infection (Perineal, systemic, uterine or increase temp)

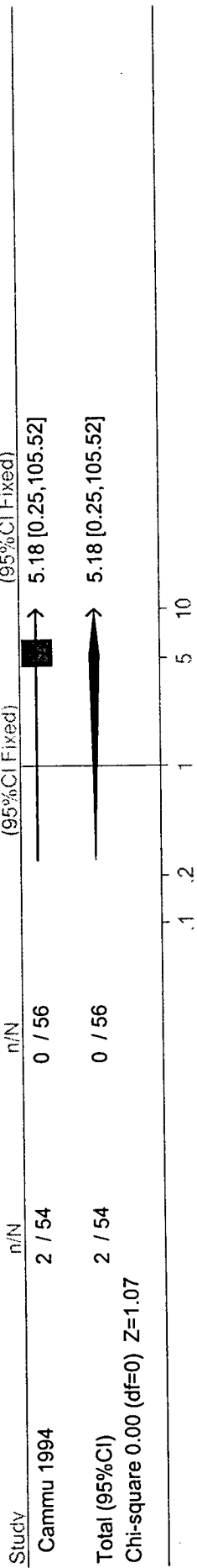


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Review: Immersion in water during pregnancy and childbirth
 Comparison: Immersion vs no immersion during labour
 Outcome: Apgar score <7 (5 mins)

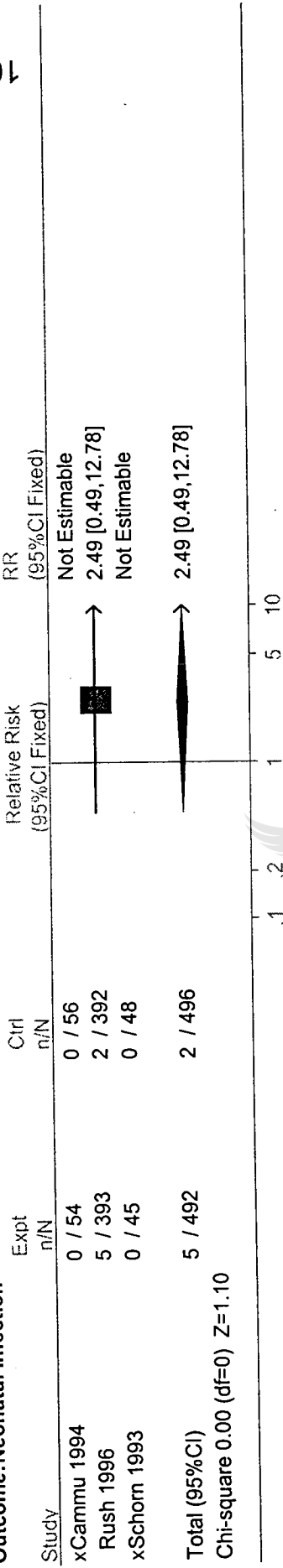


Review: Immersion in water during pregnancy and childbirth
 Comparison: Immersion vs no immersion during labour
 Outcome: Umbilical artery pH <7.20



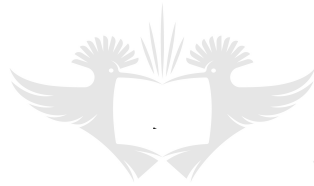
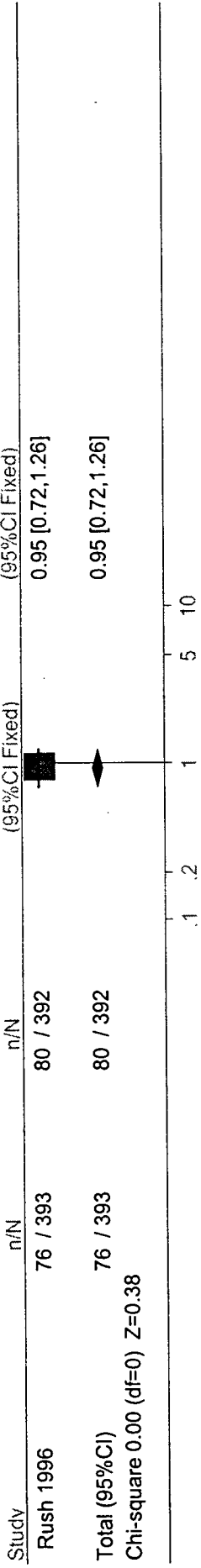
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Review: Immersion in water during pregnancy and childbirth
Comparison: Immersion vs no immersion during labour
Outcome: Neonatal infection



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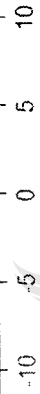
Review: Immersion in water during pregnancy and childbirth
Comparison: Immersion vs no immersion during labour
Outcome: Meconium stained liquor



Review: Immersion in water during pregnancy and childbirth
 Comparison: Immersion vs no immersion during labour
 Outcome: Duration of first stage (mins)

Study	Expt n	Expt mean(sd)	Ctrl n	Ctrl mean(sd)	WMD (95%CI Fixed)	WMD (95%CI Fixed)
Cammu 1994	54	244.00 (139.00)	56	264.00 (170.00)	-20.000 [-77.940,37.940]	-20.000 [-77.940,37.940]
Rush 1996	393	403.00 (596.00)	392	405.00 (555.00)	-2.000 [-82.566,78.566]	-2.000 [-82.566,78.566]
Schoen 1993	45	846.00 (432.00)	48	846.00 (348.00)	0.000 [-160.076,160.076]	0.000 [-160.076,160.076]
Total (95%CI)	492		496		-12.762 [-57.893,32.369]	-12.762 [-57.893,32.369]

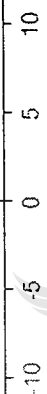
Chi-square 0.15 (df=2) Z=0.55



Review: Immersion in water during pregnancy and childbirth
Comparison: Immersion vs no immersion during labour
Outcome: Duration of second stage (mins)

Study	Expt n	Expt mean(sd)	Ctrl n	Ctrl mean(sd)	WMD (95%CI Fixed)	WMD (95%CI Fixed)
Cammu 1994	54	33.00 (20.00)	56	34.00 (22.00)	-1.000 [-8.852,6.852]	-1.000 [-8.852,6.852]
Rush 1996	393	56.70 (61.00)	392	57.90 (57.60)	-1.200 [-9.500,7.100]	-1.200 [-9.500,7.100]
Schorn 1993	45	108.00 (222.00)	48	36.00 (42.00)	72.000 [6.057,137.943]	72.000 [6.057,137.943]
Total (95%CI)	492		496		-0.552 [-6.234,5.131]	-0.552 [-6.234,5.131]

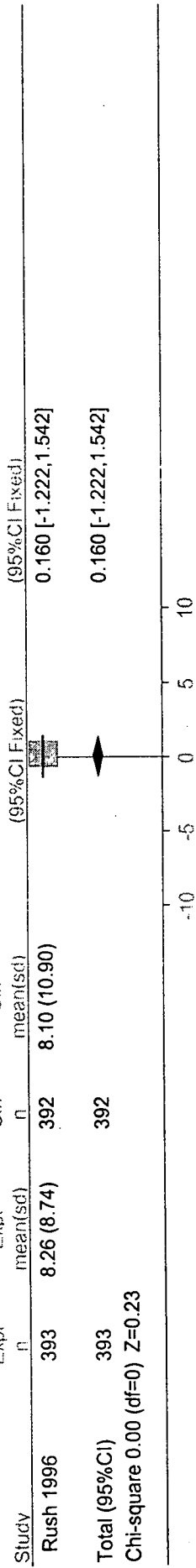
Chi-square 4.69 (df=2) Z=0.19



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Review: Immersion in water during pregnancy and childbirth
Comparison: Immersion vs no immersion during labour
Outcome: Duration of third stage (mins)

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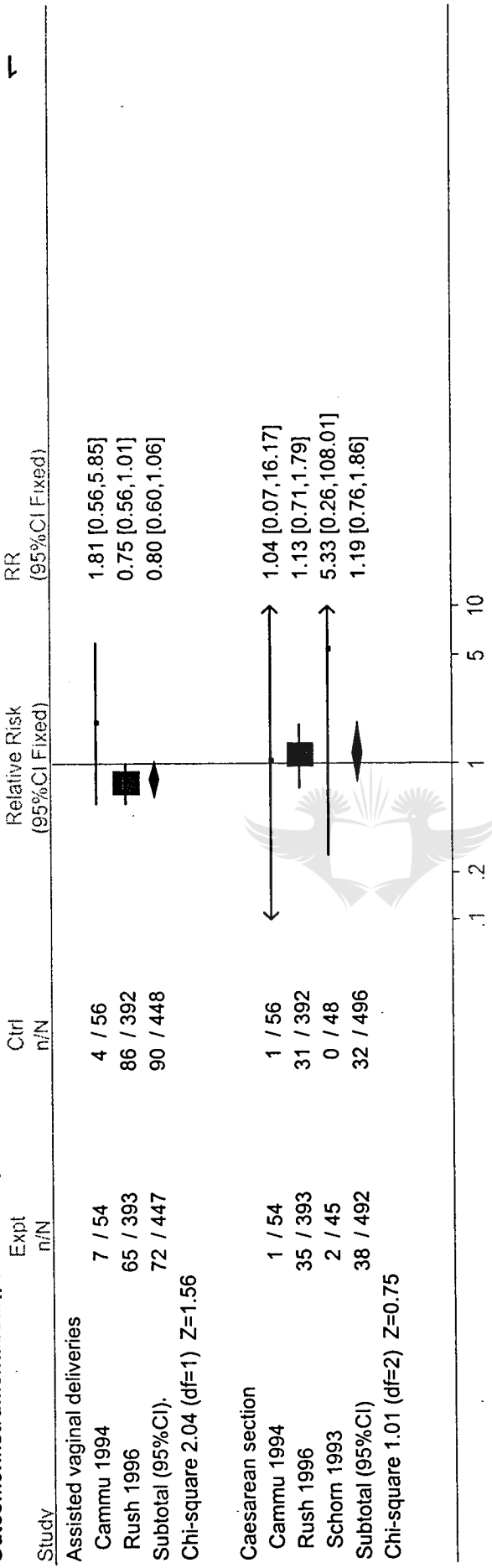


Chi-square 0.00 (df=0) Z=0.23



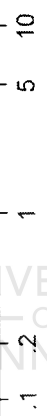
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Review: Immersion in water during pregnancy and childbirth
Comparison: Immersion vs no immersion during labour
Outcome: Instrumental/surgical delivery



Review: Immersion in water during pregnancy and childbirth
Comparison: Immersion vs no immersion during labour
Outcome: Perineal trauma after vaginal birth

Study	Expt n/N	Ctrl n/N	Relative Risk (95%CI Fixed)	RR (95%CI Fixed)
Episiotomy				
Rush 1996	135 / 358	147 / 361		0.93 [0.77, 1.11]
Subtotal (95%CI)	135 / 358	147 / 361		0.93 [0.77, 1.11]
Chi-square 0.00 (df=0) Z=0.83				
Second degree tear				
Rush 1996	58 / 358	56 / 361		1.04 [0.75, 1.46]
Subtotal (95%CI)	58 / 358	56 / 361		1.04 [0.75, 1.46]
Chi-square 0.00 (df=0) Z=0.25				
Third or fourth degree tears				
Rush 1996	6 / 358	4 / 361		1.51 [0.43, 5.31]
Subtotal (95%CI)	6 / 358	4 / 361		1.51 [0.43, 5.31]
Chi-square 0.00 (df=0) Z=0.65				
Total (95%CI)				
	199 / 1074	207 / 1083		0.97 [0.83, 1.14]
Chi-square 0.91 (df=2) Z=0.38				



2.11 Literature pertaining to the first primary research hypothesis of maternal experience

Maternal experience of the second stage of labour refers to the emotional and physiological sensations or feelings that the mother lived through during the period or process of parturition which commenced from full cervical dilatation of the cervix to delivery of the fetus (Goldenson, 1985:275). The optimal management of the second stage of labour remains one of the most controversial issues in modern obstetric practice. The onset of second stage of labour can be diagnosed on a clinical vaginal examination, or on the emotional signs accompanying full dilatation of the cervix (Paterson, Saunder & Wadsworth, 1992:378). Three phases of second stage of labour have been described: phase one refers to the period from full dilatation until the urge to bear down; phase II starts with the rhythmic onset of bearing down efforts until crowning of the presenting part, (thus the presenting part no longer retreats between the bearing down efforts); the third phase starts with crowning of the presenting part until the birth of the entire body (Aderhold & Roberts, 1991:272). Piquard, Schaefer, Hsiung, Dellenbach, Haberey (1989:717), describe two phases of the second stage of labour. The first phase is usually diagnosed after a clinical vaginal examination. This phase could last

quite a while and there is no change in the acid-base status of the fetus. The second phase of the second stage of labour occurs during the active bearing down period. During this phase the fetus is at a high risk and its condition can deteriorate quickly.

Traditional teaching defined the duration of the second stage of labour as two hours for primigravidae and one hour for multigravidae. The acceptable duration has been change to 45 minutes for primigravidae and 30 minutes for multigravidae, even though studies have shown that 95% of primigravidae have a second stage of two hours, with no significant changes to neonatal outcomes if there are no obstetrical problems associated with the duration (Derham, Crowhurst & Crowther, 1991:35.) An important factor is not so much the duration of second stage, but rather the duration of phase II (the expulsive phase). It is recommended that phase II of the second stage be limited to 30 - 45 minutes for primigravidae and 20 - 30 minutes for multigravidae as the fetal pH decreases significantly with longer expulsion phases (Derham et al. 1991:35). The above authors did not comment on the position of the mother during the second stage. Some trials have shown that the pH decreases in the supine position and not in the lateral tilt position.

The optimal management of the second stage remains one of the most controversial issues in current obstetric practice. The controversy concerning the length of the second stage is usually about the necessity of speeding up the birth in the interest of the neonate. Arguments to shorten the duration of the second stage of labour have been based on neonatal state as assessed by cardiotocograph tracings, fetal scalp or cord blood gas analysis, or Apgar scores. No correlation has been observed between Apgar scores and length of the second stage. The exact significance of cord pH changes with increased duration of the second stage of labour is not evident. It may merely reflect a similar decrease in maternal pH during the expulsion phase and may further be compromised by the woman's position during the pushing stage (Alexander *et al.* 1986: 62/63). The clinical and prognostic significance of cord pH and cardiotocograph tracings still need to be investigated taking into consideration the position the mother adopts during the second stage of labour.

2.11.1 Maternal experience of the second stage of labour

Cultural beliefs associated with childbirth are some of the most significant variables that influence women's

perceptions of their childbirth experience (Callister, 1995:327). It is said that "Childbirth is an intimate and complex transaction whose topic is physiological and whose language is cultural" (Jordan, 1982:182). Thus their experience is internalised together with their beliefs and is verbalised in patterns of expression.

Women experience joy and pain simultaneously during childbirth and the event is one of life's most memorable recollections. Childbirth is very painful but the joy of realising that your body has brought a new human life into existence overwhelms the pain associated with the birth. Not all women express enjoyment of labour experiences and some express feelings of guilt, anger, failure, or embarrassment (Chalmers & Meyer, 1994:217).

Childbirth experience is deeply felt, both emotionally and spiritually, and long-term recollection of memories shows that precise details can be recalled decades after the birthing experience (Bennett, 1985:153; Simkin, 1992:64). Women experience feelings of purification and renewal after giving birth, which cannot be described adequately by means of quantitative analyses alone. Some women describe their feelings

during the pushing stage as a relief, while others describe it negatively as a miserable or terrible experience and verbalise it as the "hardest part" or "pushing hurt like hell" (McKay, Barrows & Roberts, 1990:194).

Satisfaction with childbirth is very difficult to assess. Satisfaction is ambiguous in nature and women can be satisfied with one aspect of the birth experience and dissatisfied with another. Most researchers use a Likert type scale rated between satisfied and dissatisfied (Burns & Grove, 1993:377). The Labor and Delivery Satisfaction Index is a new scale under validation, but appears to be useful in clinical evaluations of satisfaction (Lomas, Dore, Enkin & Mitchell, 1987:128). There is good correlation between satisfaction and the perception of the birth experience. Satisfaction is multidimensional and therefore should be selective for specific aspects of the birth experience. It has been found that women who reported that their experience was better than expected were more satisfied with their birth experience (Bramadat & Driedger, 1993:24).

Women experience less satisfying births, with an increased risk of perineal trauma, and the use of other

interventions to expedite labour and the second stage of labour, if the physician supports the liberal use of episiotomies (Klein, Kaczorowski, Robbins, Gauthier, Jorgensen & Joshi, 1995: 770). Many women may feel very satisfied with their labour even though there may have been interventions. Beech (1996:51) stated that nothing has change as she referred to the following quote "Elizabeth Nihell, a midwife, wrote in 1760, he (the doctor) used instruments unnecessarily to hasten the birth and save his own time, as well as to impress the family with his dexterity and justify charging a higher fee.....Worse still, the male practitioner, adding insult to injury, was so adept at concealing his errors with a cloud of hard words and scientific jargon, that the patient herself was convinced that she could not thank him enough for the mischief he had done".

2.11.2 Maternal experience of pain during the second stage of labour

The response to pain during childbirth is a complex, personal, perceptual experience modified by physiological and psychological mechanism that may arises naturally from an endogenous source or an external stimulus (Cheung, 1994:212). It is difficult to describe because labour pain is qualitatively different

from any other pain (Wright,1994:22). A labouring woman's ability to cope with labour is critical in the perception of pain that she experiences (Lowe,1991:8). The nature of pain changes during the different stages of labour. Not only is it laden with emotions and anxiety and difficult to measure, but pain during the second stage of labour has also been described as pain that far exceeds any disease condition (Mander, 1998:1060).

Most studies assessing labour pain have been conducted after an elapsed time period. It has been shown that the intensity of remembered labour pain is valid within an interval of two days post partum (Algom & Lubel, 1994:133; Baker & Kenner, 1993:384; Cheung, 1994:213).

Pain is usually conceptualised as an unpleasant sensation that occurs in response to an offending stimulus (Abram, 1990:23). The emotional component has been accepted as an essential dimension to describe the experience of labour pain (Moore, 1997:10). Thus the severity of pain is a consequence of affective, cognitive and sensory events during labour. The way women vocalise during labour may provide an insight

into the nature of the pain that they are experiencing. Vocalisations are part of verbal behaviour and can change from a soft moan to shrieks and screams during the different stages, giving the caregiver information about their emotional state (Baker & Kenner, 1993:384).

Women may experienced lower back ache during labour and birth as the same afferent neurones of the dorsal horns of spinal segments T10 –L1 that supply the skin also supply the cervix and corpus of the uterus. Referred pain from the uterus can also be transferred to the skin as low as S2 (Ader, Hansson & Wallin, 1990:133,136).

Various factors affect the perception of pain during childbirth. Previously it has been said that pain during childbirth is similar to menstruation pain and that labour becomes more painful as cultures advance. It was claimed that women from 'primitive' cultures had painless labours. Researchers have now shown that labour pain, for most women including those from 'primitive' cultures, is much worse than menstruation pain. Pain differs between individuals. Physical factors such as age, parity, condition of the cervix at

the onset of labour, size of the fetus and condition of the parturient, play a role in the experience of pain. Psychological factors that may affect labour pain include the following: previous experience, attitude, mood, anxiety, self-esteem, fear and companionship. Education, level of verbal fluency and psychological preparation may play a role in pain perception. Racial, cultural and ethnic factors do influence pain tolerance and the way pain is expressed during labour and birth. The absence of crying or moaning does not mean that there is no pain. It is merely due to the fact that different women use different coping mechanisms (Bonica & Chadwick, 199:482-487; Cheung, 1994:

214).



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Previous childbirth experience is the most important factor that influences the experience of pain perception (physical, hot or cold). Thus a painful childbirth can raise a woman's threshold for any pain. It is said "nothing compares to labour pain" (Hapidou & DeCantanzaro, 1992:177)

2.12 Literature pertaining to the second primary research hypothesis concerning trauma to the birth canal

The first recorded surgical widening of the perineum to prevent perineal tears was recorded in 1741 (Ould, 1741:145). The most authoritative pronouncements in favour of episiotomy most probably descend from the DeLee article published in 1920 (DeLee, 1920:34). Midwives in the UK have only been allowed to perform episiotomies since 1967 (Blunt, 1995:168).

An episiotomy refers to a surgical incision through the perineum, to enlarge the vaginal opening, making the birth of the fetus easier. It is performed by the caregiver during the second stage of labour and needs repair by suturing (Thacker, 1983:322).

An intact perineum refers to no lacerations to the fibromuscular pyramid between the lower border of the vagina and the anal canal. A first degree laceration involves the fourchette, the perineal skin and the vaginal mucosal membrane. A second degree laceration involves the fourchette, perineal skin, vagina mucosal membrane, perineal fascia and

muscle (bulbocavernosus, ischiocavernosus and transverse perineal muscle). A third degree laceration involves all of the above-mentioned structures and the anal sphincter. A fourth degree laceration extends through the anal sphincter, through the rectal mucosa and exposes the lumen of the rectum (Blunt, 1995:168). Lateral vaginal wall, labial or para-urethral tears refers to any laceration involving these anatomical structures.

2.12.1 Trauma to the birth canal

Regardless of poor evidence as to its benefits and recommendations that routine episiotomy should be abandoned and that rates above 30% are not justified, it is still one of the most frequently performed procedures (0.3% - 90%) during the second stage of labour (Anthony, Buitendijk, van Zonder, Rijssel & Verkerk, 1994:1064; Argentine episiotomy trial collaborative group, 1993:1518; Doherty & Cohen, 1993:532).

Perineal trauma that needs suturing is as low as 17.3% in some countries (Doherty & Cohen, 1993:532). Extension of episiotomies into third and

fourth degree tears has occurred in up to 15% of women. Nodine and Roberts (1987:123) reported that extension of episiotomies was observed in 4.4% of the women who had episiotomies (34.2%) and Klein et.al. (1992) report that the extension of episiotomies occurred in up to 15% of primiparous women and in 1.8% of multiparous women. First degree tears are reported to occur in 19% of women and 15.8% experience second degree tears. Para - urethral or labial tears occur in 12.8% of women (Nodine & Roberts, 1987:123). In restricted episiotomy allocation groups, spontaneous perineal and vaginal tears at delivery differ between primiparous (35%) and multiparous (38%) women because more primiparous women received episiotomies. Para-urethral or labial tears were reported to occur in 22% and 30% respectively (Klein et.al. 1992).

The incidence of third and fourth degree tears were evaluated over a ten year period by Legino et.al. (1988:423) and they reported an occurrence of 10.7% and 6.4% respectively. Anthony et.al., (1994:1065) reported a much lower incidence (1.4%) of third degree tears.

Indications given for episiotomies are: to shorten the duration of the second stage of labour, for poor maternal effort, a rigid perineum, previous vaginal repair, to prevent severe lacerations such as third degree tears or to prevent shoulder dystocia in macrosomic neonates (Blunt, 1995:169). Some believe that sexual function is improved and that there is a reduced risk of faecal and urinary incontinence if the muscles of the pelvic floor are preserved against over stretching by cutting an episiotomy. Medical textbooks such as Williams Obstetrics states that reasons why obstetricians perform episiotomies are that it provide a nice straight surgical incision that is easier to repair than a ragged wound, and that it heals better (Cunningham, MacDonald & Gant, 1989).

Suggested benefits for the neonate include decreased fetal asphyxia by shortening the second stage of labour and prevention of possible cranial trauma, cerebral haemorrhage, and mental retardation (Leveno & Gilstrap, 1993:371; Gainy, 1955:800; Thacker, 1983:322).

Wagner, (<http://www.gentlebirth.org/archives/perinealprotection.html>. 3 May 1999) says that an episiotomy is a "MD-sanctioned female genital mutilation", and states there is no difference between it and female circumcision. Davis-Floyed, (1992) a medical anthropologist points out that by cutting an episiotomy we reinforce the belief about the inherent defectiveness and untrustworthiness of the female body. He further states that the "destruction and reconstruction of women's genitals, allows men to control the powerfully sexual, creative and male-threatening aspects of women...trying to surgically restoring virginal conditions" (<http://www.efn.org/~djz/birth/obmyth/epis.html>. 3 May 1999). There is an urgent plea that obstetricians should stop the unscientific ritual approach of cutting episiotomies, which mirrors the African feminist outrage over ritual genital mutilation of women in East Africa, which is also associated with painful and disabling sequelae (<http://www.changesurfer.com/Hlth/episiotomy.htm>. 3 May 1999).

Vaginal delivery and perineal injury (episiotomy) have been implicated as a major factor in the development of urinary or faecal incontinence, dyspareunia and uterine prolapse (Bex & Hofmeyr, 1987:97;

Blunt,1995:167, Haadem, 1994:326; Handa, Harris & Ostergard, 1996:470). The effects of vaginal births on urinary and faecal continence mechanisms may be primarily due to the birthing process. Caesarean section appears to be protective against injury to the pelvic floor and showed no changes in strength or injury in women who underwent caesarean sections. Risk factors for pelvic floor muscle injury include prolonged second stage of labour, episiotomy, forceps delivery and increased birth weight. A significant decrease in intravaginal and intra-anal pressure was observed in all women who delivered vaginally (Handa et.al. 1996:470; Meyer, Schreyer, De Grandi & Hohlfeld, 1998: 613). Left pudendal nerve damage occurs significantly more in women who experience a vaginal delivery. Women who deliver for the first time also experience a significant increase in pelvic floor stretching (Sultan, Kamm & Hudson, 1994:22).

Perineal trauma is also associated with maternal death due to haemorrhage (Blunt,1995:167). Episotomies are also a major risk factor for increased pain, infection, loss of sexual pleasure, incontinence, increased extension of the incision, an increase in length of hospital stay and longer healing times (Hendriksen, Bek, Hedegaard & Secher, 1992:950;

Hueston, 1996:1001; <http://www.changesurfer.com/Hlth/episotomy.htm>.3 May 1999).

Complications when repairing the episiotomy such as asymmetry or excessive narrowing of the introitus, recto-vaginal fistulas, haematomas, pain, oedema, infections, and dehiscence can also occur.

Avoidance of routine episiotomy is associated with an increased risk of anterior lacerations (para-urethral, labial and vaginal wall) and a decreased risk of posterior (perineal) injuries, perineal pain, and dehiscence of perineal suturing after tears (Belizan, Campodonico, Carolli, Gonzalez, Lede, 1993:1517). There is always a risk of damaging the anal sphincter or rectum by an unavoidable extension of the episiotomy or by cutting through it. The incidence of third degree tears during childbirth is associated with higher birth weight babies, first time mothers, assisted forceps deliveries and episiotomies (Walsh, Mooney Upton & Motson, 1996:218). Third and fourth degree tears appear to be associated with caregiver management and large neonates (Klein et al. 1997:403). Helwig, Thorp and Bowes (1993:276) after adjusting for birth weight and primiparity found that episiotomy more than doubled the risk of a third or

fourth degree tear during instrumental delivery.

Physicians who favour the use of routine episiotomy are also more likely to use other interventions to expedite labour, such as oxytocin and assisted deliveries. Their patients are more likely to have perineal trauma and they tend to be less satisfied with their birth experience (Klein et.al., 1995:769).

Borgatta, Piening and Cohen (1989:294) found a significant association between episiotomy rates and the use of the lithotomy position during the second stage as well as between episiotomy rates and an increase in second and third degree tears. Women giving birth in the supine position and the attendant's experience of delivering may contribute to an increased risk of second degree tears (Nodine & Roberts, 1987:123). Significantly less severe perineal trauma and fewer episiotomies were observed in women who squatted during the second stage of labour (Golay, Vedam & Sorger, 1993:73).

Studies have shown that women who have episiotomies experience a greater intensity and longer duration of pain after birth than women who experience tears. Perineal pain can be described more expressively and plays an important role in the woman's sexuality following childbirth. Dyspareunia at three months has been found in up to 47% of women, and perineal pain was the most common reason given by women as to why sexual relationships had not been resumed (Wright, 1994:22).

Suturing methods vary. The Ipswich Childbirth Study has shown that a two layer repair (skin unsutured) of an episiotomy or second degree tear appears to reduce pain and dyspareunia at three months post partum with no evidence of an increased risk in resuturing or break down of the wound (Gordon *et al.* 1998:435). Kettle and Johanson (1999:Cochrane library) support their view and in their systematic review they suggest that a continuous subcuticular (skin unsutured) technique should be used to repair perineal trauma. The availability and cost of suturing materials and sterilisation of equipment may also be an important issue in developing countries.

Current evidence supports the use of polyglycolic or polyglactin absorbable synthetic suture material for the use of perineal repair after childbirth (Kettle & Johanson, 1999:Cohrane library).

No clear answer is available yet on the issue of midline versus mediolateral episiotomy. Anthony et.al. (1994:1064) investigated the relationship between the use of mediolateral episitomies and the occurrence of perineal trauma. They support the restrictive use of episiotomies to prevent severe perineal tears and claim that mediolateral episiotomies decrease the incidence by four fold. In the United Kingdom and in South Africa midwives are taught to perform mediolateral episiotomies as it is claimed that they have a lower risk of extension into a third degree tear. Midline episiotomies are favoured in the United states, but appear to be associated with an increased risk of third and fourth degree tears in spontaneous and assisted deliveries (Helwig et al. 1993:276; Naugle, Sorenson & Kiser, 1994:487; Klein et al. 1994:592). Shiono, Klebanoff and Carey (1990:765) reported that the risk for severe injury to the perineum is 50 times more likely in women who had a midline episiotomy and eight times more likely


in those who had a mediolateral episiotomy compared to women who had no episiotomies. The suggested advantages of a midline episiotomy are better healing and less future sexual dysfunction (Shiono et al. 1990:765).

An observational study conducted by Brink, Moller, Hedegaard and Secher (1992:950), on the influences of mediolateral episiotomies on the perineum after spontaneous deliveries, revealed that women who did not receive an episiotomy had a higher incidence of perineal lacerations. Mediolateral episiotomies showed an increased risk of third degree tears. It is known that episiotomies do not necessarily prevent third degree tears or prevent laxity of the pelvic floor, but do shorten the second stage of labour (Homsí, Daikoku. Littlejon & Wheelless, 1994:803).

The WHO recommended that episiotomy rates should be around 10% and no more than 20% (http://www.gentlebirth.org/archives/perineal_protection.html. 3 May 1999). Hendriksen et al. (1992:950) support a rate of 20% to take into consideration the condition of the

fetus. There is evidence to support a policy of restrictive rather than the routine use of episiotomies in the second stage of labour (Carroli, Belizan & Stamp, 1999:Cochrane library). Against all available evidence that episiotomies cause more harm than they provide benefits, the episiotomy rate in the normal labour wards of the two trial hospitals before implementation of the trial were higher than 40% in some months (maternal birth registers of trial hospitals).

2.13 Literature on guidelines for the use of water



The Royal College of Midwives (RCM), (1994) has published a position paper on "The use of water during birth". They acknowledge that more women are requesting the use of water during labour and delivery. The RCM recognises that this practice is still unevaluated, but proposed some guidelines to assist midwives who do wish to support women's choice of labour and delivery. The need for protocols and policies on the use of water during labour are emphasised.

They propose that midwives need to acquire skills and experience before conducting underwater deliveries unsupervised. Only low risk women with, term, singleton, vertex presentations and normal progress of labour should be given the option to use a water tub. Women who received analgesia within the last four hours or who experienced rupture of membranes for longer than twenty-four hours should not be allowed in the tub.

Equipment used should be in good functioning order, with regular infection control. Long gloves should be available for vaginal examinations and delivery and caution should be taken to prevent back injuries if low baths are in use. A water bath of approved standards, a waterproof cardiocotograph and water thermometer to maintain water temperature at around 37°C should be available. Deans and Steer (1995:311) recommend the water temperature to be between 36°C - 37°C. A step for getting in and out of the pool and a water pump for quick emptying of the tub in emergencies is recommended. Warm towels to cover the mother and the infant and a sieve to remove faeces or debris from the tub is also suggested. An emergency trolley should be in the room.

Minimal stimulation of the fetal head should be applied during the second stage of labour and the baby should be brought directly to the surface immediately after birth. A dry area or empty bath is recommended for the third stage of labour. They do not recommend pharmacological analgesia but allow nitrous oxide and aromatherapy oils. Women should always be removed from the water in case of an emergency and records should be well kept.

It is known that some babies during conventional birth do attempt to cry even if their chests have not been delivered yet. This may also happen during water births and the question arises that if a small amount of fluid is inhaled, what fluid would be the safest for an infant to inhale. Barry (1995:1602) and Hofmeyr, Nikodem and DeJager (1997:121) suggested that given the lack of present evidence the choice of fluid for births should be based on theoretical considerations until new evidence becomes available. They therefore recommend the use of an isotonic saline solution, which in theory should be safer than fresh water. It is physiologically more neutral fluid, and is more similar to the amniotic fluid environment, to which the fetus is accustomed, than is fresh water.

The inhalation of fresh water may be more likely to suppress breathing and may cause haemodilution, lung damage, or hyponatraemia. Pearn (1995:1602) maintained that it would be wrong to add salt to birth water until experiments on animals were undertaken. Many facilities do not add anything to the water whilst others add aromatherapy oils.

Midwives from Maidstone Hospital, formulated guidelines for the use of their "Lagoon room". Practical applications, professional accountability, and medico-legal risks were considered. They only allowed low risk, term women in established labour to enter the bath. They maintained a bath water temperature of between 37°C - 38°C and recommended that the infant should be brought to the surface immediately following the birth. The placenta should not be delivered in the water and if any unexpected abnormal situation occurs the women are advised to leave the water. Records are kept concerning parity, labour duration, and complications (Blair-Myers, 1989:73).

Guidelines for the use of a pool during labour or delivery at Good Hope Maternity Unit in West

Midlands, restrict the use to women who are at term and have no known obstetric or medical problems or conditions. They should not have meconium-stained liquor or their membranes ruptured for longer than 24 hours (Brown, 1994:32). Burke and Kilfoye (n.y.:2) support the above criteria. They also advised that it should be a singleton cephalic presentation, the women should have had no analgesia (except Entonox) administered in the four hours prior to entering the pool, and no signs of infection should be present. They suggest an optimal 40-minute cardiotocograph tracing prior to immersion in the pool.



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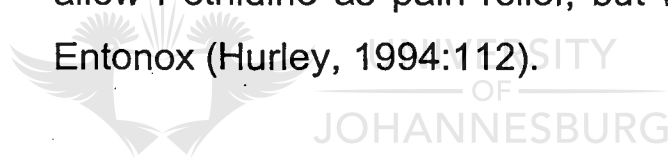
The Family Birthing Center of Upland, California used the following guidelines in their birthing centre. The bath tubs are scrubbed with detergents after every delivery and weekly bacterial cultures are done. They do not add any solutions to the water during labour or birth. They allow high risk patients (such as women with previous caesarean section) to deliver in water. Women are encouraged not to use the tub until they are at least five cm dilated. Women are encouraged to bring companions with, change their position often and to drink and eat freely. During pushing they are encouraged to use instinctive grunts and to help deliver their infants. They lift the women out of the

water if they need to cut the umbilical cord, when there is meconium liquor present and to deliver the placenta. They bring the infant to the surface immediately after birth and keep the bath water temperatures warm (90°F - 100°F) (Church, 1989: 165).

Footner (1992:272-276) recommends a waterproof fetal doptone, a heater to regulate water temperature between 37°C - 38°C and a waterproof light built into the tub. Midwives at Rochford maternity unit have been offering under water deliveries since 1989. Their criteria for assessing women's suitability are term pregnancy with a normal sized fetus and no associate risk factors. Only women with a cephalic presentation and reactive fetal cardiotocograph tracing with no meconium stained liquor are allowed to use the water. It is also policy to have two midwives present at the delivery. They recommend that women have an enema prior to entering the bath tub and use antiseptic solutions to clean the bath and hoses. They recommend shining a lamp onto the perineal area to visualise what is happening and to control the head at crowning. If the umbilical cord is tight it is not cut under the water as the fetus may gasp due to carbon

dioxide build-up. The women are asked to get out of the water, the cord is clamped, and the baby delivered outside the water. The babies are brought to the surface immediately and the placenta is not delivered in water (Harmsworth, 1994:31).

Guidelines from the John Radcliffe Hospital (UK) stipulate that the pregnancy must be term and uncomplicated. Labour must have a spontaneous onset and the cervix must be at least four cm dilated before the woman gets into the pool. They do not allow Pethidine as pain relief, but woman may inhale Entonox (Hurley, 1994:112).



2.14 Summary of chapter two

Chapter two reviewed the literature on the effect of immersion in water during labour and birth. Conclusions drawn from the review confirm the need for a randomised trial to evaluate possible benefits or risks to the mother or infant associated with the use of water immersion during birth, as no randomised trial addresses the issue. Very large multi centre trials would be needed to investigate morbidity and mortality in the neonate.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

Research methodology is the theory of correct scientific decisions, which are taken within the framework of the determinants for research. It is a method of logical reasoning in the decision making process during scientific research. A scientific method has been used because logical reasoning is a human process and therefore liable to error. The quality of the research findings is directly dependent on the accountability of the research methodology. It was therefore necessary to follow a specific methodological process to exclude obvious wrong decisions and to enhance the validity of the research findings. There is a reciprocal relationship between methodological and theoretical considerations both are mutually dependent for the direction of research (Mouton & Marais, 1991:17; Treece & Treece, 1986:75).

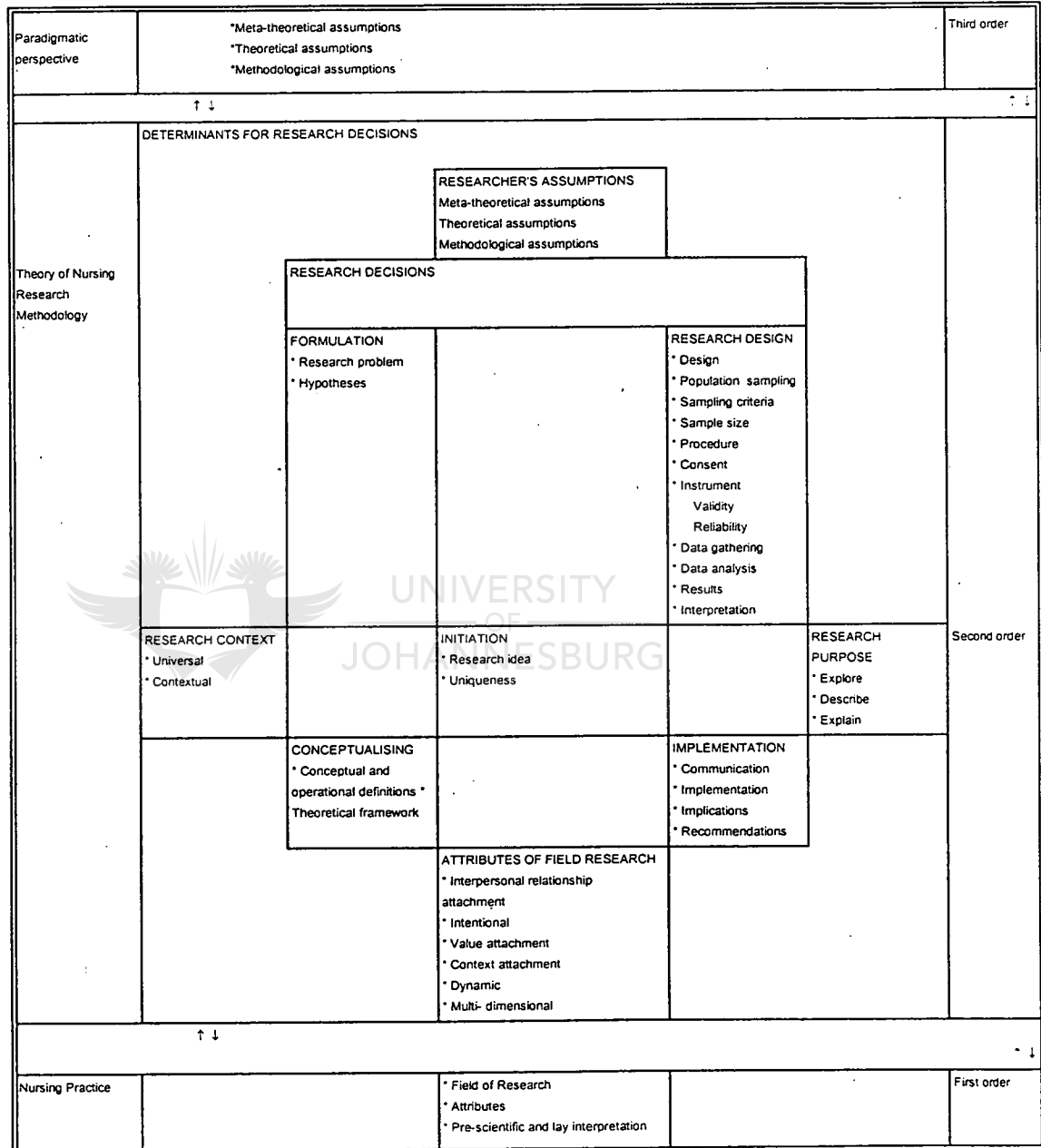
Chapter three will give a detailed description of the scientific methods used to execute or replicate the study.

3.2 Research model

The first and third order of the model has been discussed in chapter one. The second order (research methodology) will be discussed in detail in this chapter.



Figure 3.1 A research model in Midwifery (Based on Botes, 1989:245)



A research model in Midwifery (Based on Botes, 1989:245).

3.3 Second order (Theory of nursing and research methodology)

The second order is the theory and methodology of Nursing. Activities that take place in this order are research and theory development. The practice of science in midwifery is a meta-practical activity. The researcher identifies, explores, describes and explains problems that occur in the midwifery practice and attempts to find a solution for the problem. Problems identified by the researcher are the lack of scientific evidence on the advantages and disadvantageous of immersion in water during birth. The researcher wishes to explore, describe, and explain the concept of using water during the second stage of labour as an alternative delivery method by means of a randomised controlled trial.

Through midwifery science and research the author aimed to give action-related guidelines for safe underwater deliveries. The research process was a logical decision taking process, although a specific chronology was not followed. However, the research decisions were always taken within the framework of the determinants for research (Figure 3.1).

3.4 Determinants for research decisions.

The research determinants provided a framework within which the research decisions were taken. The research determinants influenced the researcher's decisions and contributed to the congruency and logic of the research process. Figure 3.1 depicts the four components that influenced the research decisions:

- ◆ researcher's assumptions (discussed in chapter one)
- ◆ research purpose
- ◆ research context
- ◆ attributes of field research



3.4.1 Research purpose

The research purpose was generated from the research problem, and gave a brief, clear statement of the goal of the study. The goal of this project was to explore the possibilities of the use of water during the second stage of labour. Presenting problems in the current practise were explored, identified and described. Explanations on how to overcome the present problems were attempted by formulating

evidenced based guidelines for the practising midwife as far as the use of water during birth is concerned (Burns & Grove, 1993:293). To reach the goal a specific research design (Figure 3.1) was followed.

A randomised controlled trial was conducted at two academic state hospitals serving the same low to middle income group urban population in the midwestern suburbs of Johannesburg. It was conducted over a time period of two years, from May 1994 to May 1996. Women in active labour who met the inclusion and exclusion criteria ^(See xxx) were asked to participate in the study.

3.4.2 Research context

One of the main principles of research is that the data must be interpreted within the setting (Burns & Grove, 1993:571). The trial took place in two labour wards, but the context of the two hospitals was very similar and there was no change in the research midwives. Setting the context contributed to the internal validity of the project. The setting was further controlled by the use of randomisation, estimated population

sample size and a detailed protocol. The latter also contributed to the external validity of the project that further contributes to the universality or generalisation of the conclusions (Mouton & Marais, 1988:51). The setting of the trial was the labour wards and postnatal wards of two academic state hospitals serving a low to middle income group urban population in the midwestern suburbs of Johannesburg.

3.4.3 Attributes of the research field

The fourth measurement used to make scientific research decisions (Figure 3.1) were the attributes of the research field. Interpersonal relationship attachment, premeditation, value and context attachment, dynamic transformation and multi-dimensionality were a few characteristics in the field of midwifery practice that required additional thought during the research and the decision making process. The impediments in the field of the research project were acknowledged and interference was limited by the use of randomisation.

Precautions were taken not to influence or bias

subjects' responses by using a written subject information sheet, thus limiting the "Hawthorne" effect (Burns & Grove, 1993:41). Recognition is given to the fact that the values of this sample group of low to middle income group of women may differ from those of other women. Dynamic changes and advances in the multi-dimensional field of midwifery are acknowledged in the tentativeness of the conclusions.

3.5 Research decisions

The research decisions (Figure 3.1) did not follow a specific chronological order, but a specific strategy was followed to enable the researcher to strengthen the credibility of the data analysis (Burns & Grove, 1993:564).

3.5.1 Initiation

The researcher contemplated the research concept. Literature was reviewed and a tentative hypothesis was formulated. The researcher then discussed the problem and the feasibility of the study with her two supervisors (Professors AGW Nolte and GJ Hofmeyr).

Consideration was given to the issue of whether the study would be of national and international interest and whether it would contribute to midwifery science. The feasibility of conducting the study was determined by the researcher's experience, time, money, level of commitment, availability of equipment, facilities and subjects, availability of responsible field workers, co-operation of nursing and medical staff members and ethical considerations (Burns & Grove, 1993:132).

3.5.1.1 Uniqueness of the study

The doctoral committee and the supervisors agreed that this trial would contribute to the practice of midwifery on a national and international level as this was the first randomised controlled trial to examine the effects of parturition in water in South Africa. At the time the author was also unaware of any previous published randomised controlled trials in the broader international field of immersion in water, that examined the effects that may occur during second stage of labour.

3.5.2 Formulation

Firstly the research problem was identified, thereafter the purpose and objectives of the trial was clearly stated and a hypotheses was formulated.

3.5.2.1 Research problem

The research problem refers to what one knows and to what one needs to know to eliminate the problem (Diers, 1979:12). A research problem had occurred in midwifery practice that was in need of a solution (Burns & Grove, 1993:43). It occurred after an intervention (delivering in water), had been implemented in the field without proper evaluation as it had been thought to be beneficial to women whilst giving birth. The UK House of Commons Health Committee recommended that "all hospitals make it their policy to make full provision whenever possible for women to choose the position which they prefer for labour and birth with the option of a birthing pool where this is practicable" (House of Commons Health Committee, 1992). The WHO recommended that governments should consider developing regulations to permit the use of new birth technology only after

adequate evaluation. Some maternity units rejected the fact that the use of a bath tub was a new technology as it had been seen as a "natural, non-intervening" approach to childbirth (Jenkins,1996;53), and implemented it as part of their service to labouring women. We took a viewpoint that from the conventional midwifery perspective birthing in water is indeed an intervention and therefore needed to be assessed before it was introduced into the practice of midwifery.

McCandish and Renfrew (1993:80) conducted a review of available evidence about immersion in water during labour and birth, and concluded that little scientific evidence is available on benefits and disadvantages of immersion in water during labour and birth. They believed that there existed an urgent need for research on this intervention before it became so widespread that proper evaluation might become impossible.

The problem identified was that the use of water for delivery had been introduced as a birthing method without adequate randomised evaluation of the safety,

effectiveness or possible disadvantageous of this alternative childbirth option, to the mother, infant or care giver (Reid, 1994:28).

3.5.2.2 Hypotheses

The null hypotheses stated that there is:

no difference in maternal experience of the second stage of labour and no difference in trauma to the birth canal.

Using the experimental hypotheses, it was postulated that the use of a water bath during delivery would:

enhance maternal experience of the second stage of labour and decrease trauma to the birth canal.

The primary objective of the study was to ascertain the effects of the use of water during the second stage of labour on maternal outcomes. The main maternal outcomes evaluated were: maternal experience of the second stage of labour and trauma of the birth canal.

The second objective was to set guidelines for the midwife in order to conduct or not to conduct deliveries under water.

Additional outcomes were assessed. This did not form part of the primary or secondary outcomes, because the sample size was not adjusted for significance of multiple outcomes. Additional maternal outcomes collected were: mode of delivery, duration of second and third stage of labour, blood loss, randomisation till delivery time, presence of meconium stained liquor and complications that occurred during the second and third stage of labour.

Neonatal outcomes evaluated were: presence and tightness of a cord around the neck at delivery of the head, Apgar scores, temperature, cord arterial blood gas pH, the need for resuscitation, the need for specialist paediatric care, admission to the special care unit and neonatal death.

3.5.3 Conceptualisation

The research topic had been conceptualised within a specific conceptual framework (Figure 3.1). The concepts were synthesised to provide analytical meaning to the outcomes under investigation (Burns & Grove, 1993:173).

3.5.3.1 Conceptual framework

Nursing for the Whole Person Theory and a conceptual model in nursing (Figure 3.1) was used to explain the phenomena of interest, to express the assumptions and to reflect the philosophical attitude of the researcher. Literature was reviewed and conceptual and operational definitions were synthesised and formulated. Operational definitions were developed to enable measurement of variables (Burns & Grove, 1993:228). This specific research model was used as it offers a conceptual framework that facilitates congruency in the execution of research and supported the Nursing for the Whole Person Theory.

3.5.3.1.1 Conceptual and operational definitions

Operational definitions were formulated to describe the measurement of the main outcome variables and the concepts in the study. Statistical comparisons of nominal, ordinal and non-parametric variables were done using Epi Info version 6.02 and Revman 3.01 software (see data analyses).

Main outcomes:

- ◆ Maternal experience of second stage of labour
- ◆ Trauma of the birth canal



3.5.3.1.1.1 Maternal experience of the second stage of labour

Conceptual definition - Maternal experience of second stage of labour

Maternal experience of the second stage referred to the emotional and physiological sensation or feeling the mother lived through during the period or process of parturition which commenced from full cervical dilatation of the cervix to delivery of the foetus (Goldenson, 1985:275).

Operational definition - Maternal experience of second stage of labour

An interview was conducted within 24 hours after delivery. Five questions in the format of ordinal rating scales that focussed on the subjects' descriptions of physical and emotional sensations, were used to measure maternal experience of the second stage of labour.

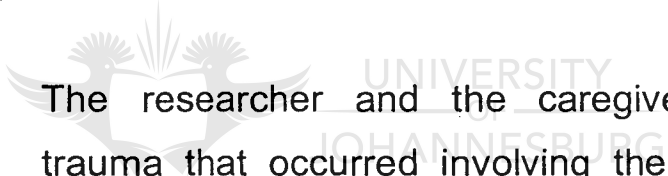
3.5.3.1.1.2 Trauma to the birth canal

Conceptual definition - trauma to the birth canal

The researcher observed para-urethral, vaginal wall and perineal lacerations or incisions (Figure 3.2). Perineal laceration was categorised according to involvement of different anatomic structures of the birth canal. Episiotomy referred to a surgical incision in the perineum, to enlarge the vaginal opening, performed by the care giver during the second stage of labour. Intact perineum referred to no perineal lacerations. A first degree laceration involved the fourchette, the perineal skin and the vaginal mucosal membrane. A second degree laceration involved the fourchette, perineal skin, vagina mucosal membrane,

perineal fascia and muscle (bulbocavernosus, ischiocavernosus and transverse perineal muscle). A third degree laceration involved all above-mentioned structures and the anal sphincter. A fourth degree laceration extended through the anal sphincter, through the rectal mucosa and exposed the lumen of the rectum (Blunt, 1995:168). Vaginal wall, labial or para-urethral tears referred to any laceration involving these anatomical structures.

Operational definition - Trauma to the birth canal



The researcher and the caregiver assessed the trauma that occurred involving the birth canal after delivery of the placenta, as described under conceptual definitions.

Consensus between caregiver and researcher were reached to define the trauma that occurred. Trauma was classified according to the level of injury of the anatomical structures of the perineum as discussed under conceptual definition, as well as whether suturing was needed when vaginal wall, labial, para-urethral or perineal structures were involved. One

ordinal question was included in the self-administered questionnaire enquiring about the perineal pain the subject might experience.

Figure 3.2 Pelvic floor muscles

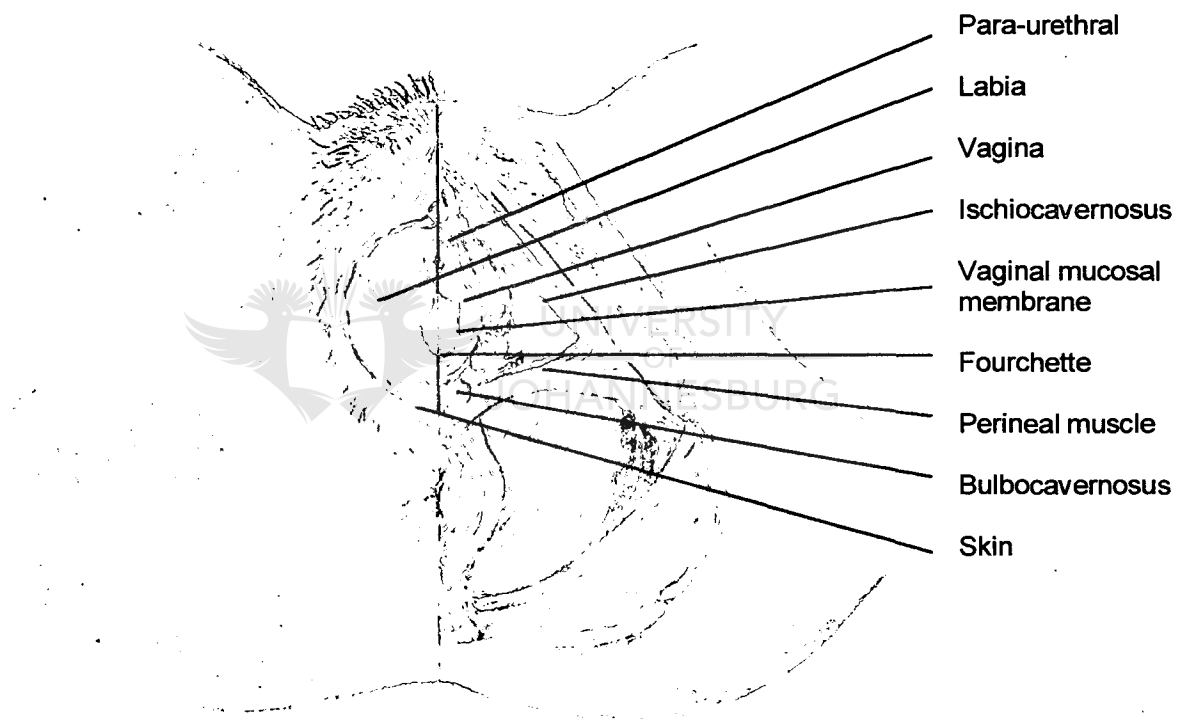


Diagram of the pelvic floor

3.6 Research design

A research design was used as a blueprint for conducting the study as it established control over components, which could have interfered with the validity of the conclusions. The research design that was used required the development of a framework based on the theory and concepts mentioned earlier. This enabled the researcher to organise the procedures that were followed. It also assisted in the analyses of the data in a manner that aimed to add significance to the research purpose. The aim of using a research design was to increase the validity of the results (Burns & Grove, 1993:261; Treece & Treece 1986:43; & Mouton & Marais, 1991:34/35).

The term *research design* in this context refers to the trial design, population sampling, sample size, procedure, instrument, validity, reliability, data gathering, data analysis, results and interpretation (Figure 3.1).

3.6.1 Trial design

A randomised, controlled, prospective, experimental study design was used during this research project to evaluate the maternal experience during the second stage of labour and trauma to the birth canal.

The three essential elements of an experimental design were met by using random sampling, researcher-controlled manipulation of the independent variable and a control and study group (Burns & Grove, 1993:316). An intervention was under investigation and therefore it was decided to do an experimental trial. The experimental design was used to test for differences between the results after the manipulation of the independent variable by the intervention (water bath) and measure this effect on the dependent variables (Hicks, 1996:49 - 51). The study was controlled because an intervention was used to manipulate the independent variable (Burns & Grove, 1993:264). By using an intervention and a control group, the study was able to demonstrate whether the intervention had any benefits or adverse effects over and above any background changes that might have occurred by chance or for reasons other than the intervention.

The Experimental-Posttest Control Group Design, instead of the pretest-posttest control group design, was used as it was not possible to measure the dependent variables before the treatment in this situation because some of the where women had not experienced labour or birth before. Baseline data were collected to ensure that the groups were equally randomised. This design allowed good control over confounding and interfering variables, which involved the least effort for the most gain in reliability of results (<http://www.his.ox.ac.uk.casp/statistics.html>. 3 May 1999; Treece & Treece 1986:193):



Cells three and four were used to compare the outcomes. This meant that there was a post-test to compare the outcomes. Cells one and two were used to collect and compare baseline data. This ensured that the group randomisation was equal and provided the possibility to evaluate any differences in baseline data between the two groups that may have occurred (Treece & Treece, 1986:183; Burns & Grove, 1993:317).

Figure 3.3 Experimental-Post-Test-Control-Group-Design

	Before	Intervention	After
Control group	Baseline data Data sheet ¹	None	Post-test Questionnaire ³
Experimental group	Baseline data Data sheet ²	Deliver in water	Post-test Questionnaire ⁴

The fundamental principle of using randomisation was to ensure that every member of the target population who met the inclusion criteria and who was willing to participate had an equal opportunity to deliver in water or not (Hicks, 1996:21). Randomisation further ensured that the intervention and control group were similar at the start of the trial. It is acknowledged that those not willing to participate may differ from the sample and records were kept of who and why women declined to participated in the trial (<http://www.his.ox.ac.uk.casp/statistics.html>. 3 May 1999).

Stratified random allocation according to parity was used to ensure that there would be equal numbers of women who had never given birth before in each group. A computerised random table was used to generate random numbers for allocation into the two groups. The labelled allocation card was be put into a numbered opaque enveloped and sealed. Envelopes were opened in consecutive number order. The allocation of randomisation and packing of cards was done by a person other than the researchers (Burns & Grove, 1993:239,241).

3.6.2

Population sampling and sampling criteria

The target population was the accessible population of women who attended the two selected academic state hospitals. These hospitals served a low to middle income group urban population in the midwestern suburbs of Johannesburg.

The use of inclusion and exclusion criteria limited the generalisability of the conclusions to women who meet similar criteria. Women were included if they were in

established labour, had a singleton pregnancy, and a vertex presentation. There had to be no reason for exclusion from the trial and they had to understand English or Afrikaans before they could be enrolled onto the trial. Consent was explained and it was ensured that all women fully understood the trial before written consent was obtained.

Exclusion criteria: women with high risk pregnancies were identified according to the Guidelines for Obstetric Patient Care at Coronation, Johannesburg and Natalspruit hospitals (Department of Obstetrics and Gynaecology, University of the Witwatersrand, 1995:9). The exclusion criteria for midwifery care identified in the guidelines are:

grande multiparae

nulliparous patients aged 35 or over

poor obstetric history (perinatal loss or handicapped child).

previous Caesarean section or other uterine surgery

Previous complicated delivery

major medical complications eg. anaemia (Hb < 9mg%), cardiorespiratory disease, renal disease, diabetes

rhesus and other antibody sensitisation

pre-eclampsia
hypertension
trial of pelvis
rupture of membranes > 6 hours without labour
significant antepartum haemorrhage
multiple pregnancy
preterm labour (< 37 completed weeks)
postterm labour (> 42 completed weeks)
severe impaired fetal growth
macrosomia (estimated weight > 4000g)
abnormal presentation or lie
suspected fetal compromise e.g. poor fetal movements, fetal heart decelerations on cardiotocograph or on auscultation.
pyrexia > 37,9°C
thick meconium stained liquor
prolonged labour or poor progress during first stage of labour or any doubt regarding normal vaginal delivery

3.6.3 Sample size

A computer program, Epi Info version 6.02 was used to determine the sample size. The sample size was estimated on the basis of a 5% level of statistical significance ($\alpha=0.05$) and a power of 80% ($\beta=0.20$).

One of the primary hypotheses to be tested in the trial was whether the use of a water bath during delivery could result in a 35% reduction in birth canal trauma (episiotomy) as defined under operational definitions.

An estimated sample size of 114 subjects had to be enrolled to reduce the current 40% incidence of birth canal injury including episiotomy to a suggested 15% incidence. In some countries the episiotomy rate is 0.3% and perineal trauma needing suturing is as little as 17,3% (Doherty & Cohen, 1993:532).



3.6.4

Procedure to execute the trial

A series of actions conducted in a specific order was followed to enhance the validity and reliability of the study. Women in established labour who met the inclusion / exclusion criteria were asked to participate in the study. The details of the study were explained and informed written consent was obtained. Baseline clinical details were recorded on the data sheet (annexure 5). Participants were randomised once the diagnoses of fully dilated cervixes was made or when multiparous women experienced bearing down

efforts with cervixes at least nine centimetres dilated. They were then allocated to an experimental or control group by means of stratified randomly ordered cards in sealed opaque envelopes. A random table was used to generate the random allocation sequence that was used to assign subjects to one of two groups: immersion in the water bath during second stage or routine care. The assignments were placed in numbered, sealed, opaque envelopes and were opened sequentially after a subject had consented to participate and baseline data had been collected. The women were asked to complete a self-administered questionnaire within 24 hours after the birth.



The following procedure was compiled after the background literature was studied (Chapter two). The procedure was tested several times on voluntary women. The procedure was sent for comments to three other midwives who had experience in water births. The doctoral committee, researcher and her supervisors agreed upon the final procedure.

The procedure that was followed during the trial:

- ◆ the labour ward was checked at least every hour to see if there was a patient in labour
- ◆ the researcher introduced herself to the patient and read her file to ensure that she met the inclusion criteria
- ◆ the woman was asked if she could read and understand English or Afrikaans
- ◆ women were included onto the study if they were in active labour, could read and understand English or Afrikaans and when they met the inclusion and exclusion criteria
- ◆ inclusion and exclusion criteria as above
- ◆ the study was explained to the subject, she was shown the bath and the information sheet was given to her to read
- ◆ time was given to her to think about the request to take part. The researcher returned in about ten - twenty minutes to discuss her possible participation
- ◆ she was asked if she had any questions that she would like to ask and these questions were answered without any bias. If in doubt about her level of understanding someone who could converse in the subject's own home language, if other than Afrikaans or English, was asked to talk to her

- ◆ once the researcher was sure that the subject understood the study and had had the opportunity to ask questions about the trial, she was asked to sign the consent form
- ◆ the woman was moved to the active birth unit once consent was given. She was not left alone, at least one person was always present
- ◆ the same clinical care was given to all the women. A one to one service was offered if the woman consented to partake in the study.
- ◆ observations of blood pressure, pulse, temperature, hydration and urine output were recorded hourly. The fetal heart rate was observed and recorded every half hour
- ◆ vaginal examinations were done two hourly or when indicated e.g. if spontaneous rupture of membranes occurred.
- ◆ routine artificial rupture of membranes was not done due to the possible vertical transmission of Human Immuno-deficiency virus
- ◆ analgesia was offered as required. Women were urged to be ambulant and were supported to walk up to full dilatation
- ◆ if the subject requested to lie on the bed, she was asked her to lie on her side or sit in an upright

position. She was motivated to change position every half an hour

- ◆ subjects were continuously motivated to sit on a chair leaning forwards onto the back of the chair with their legs apart and to walk to the toilet and to drink something every hour.
- ◆ all the connections of the bath were checked. The bath and the drain were rinsed with full strength sterilising solution. The bath was filled with water and a hypochloride solution was added (two litres in full bath of approximately 220 litres). The temperature of the water was kept between 34 and 38°C. The bath was washed and the drain cleaned before and after each delivery with 1:20 sterilising solution and scrubbed with a commercial cleaning agent.
- ◆ the resuscitation area and the emergency equipment in the delivery room were checked
- ◆ if possible cardiotocographic (CTG) monitoring was done for at least 20 minutes every hour. After eight cm dilatation, a CTG tracing was used continuously and the blood pressure was recorded every half hour
- ◆ once the woman's cervix was fully dilated or she experienced the urge to bear down (multi gravida >

eight cm cervical dilatation) baseline observations were made and recorded.

- ◆ the next numbered envelope was opened and the woman was informed about the outcome
- ◆ if the woman was allocated to the water group she was helped into the bath
- ◆ the water temperature before immersion of the woman in the bath was recorded and kept between 34° and 38° Celsius throughout the duration of the second stage of labour. Faeces or debris was removed using a small sieve.
- ◆ women were encouraged to use their natural instinct to bear down, whether it was an exhalatory or valsalva method. A directive approach was only used when needed e.g. fetal distress or poor maternal effort
- ◆ to avoid pressure on the aorta, upright positions such as squatting, kneeling, "all fours" or lateral posture for delivery was used during the pushing stage of labour
- ◆ various pushing positions were encouraged even for the woman in the tub, but it was ensured that the fetal head was completely submerged at birth.
- ◆ the method of delivery: the researcher ensured that one other person was available to assist with the delivery. The other person could have been a

medical or nursing student or a qualified medical or nursing person.

- ◆ the routine "hands on" method, that is, encouraging flexion, extension, restitution and rotation of the fetal head was used. The perineum was supported if the subject did not object.
- ◆ after extension of the head had taken place, the caregiver felt for a possible cord around the neck
- ◆ if the cord was loose it was slipped over the head: if it was tight, it was clamped and cut under the water
- ◆ the woman was encouraged to help with the delivery of the body of the baby
- ◆ if the delivery took place in the water, the baby was brought to the surface immediately
- ◆ excessive mucus (and water) was wiped from the baby's face
- ◆ a paediatrician was called if meconium stained liquor was observed. Suction of the mouth and nose was done before delivery of the body or as soon as the baby's face was out of the water. If meconium stained liquor was present, the baby was handed over to the paediatrician for suctioning of the oropharynx under direct laryngoscopic vision
- ◆ the cord was first clamped closest to the introitus and the second clamp was placed \pm seven cm from

baby. The cord was double clamped at both sites and cut. This piece of cord was kept to obtain arterial blood for blood gas analyses. The cord blood in the heparinised syringes was kept on ice until analysis was possible (all within 60 minutes after the sample was obtained)

- ◆ the baby's axillary temperature was taken one minute after birth
- ◆ the baby was dried with a warm dry towel and the Apgar score was noted
- ◆ the bath water was let out
- ◆ Syntocinon 10IU was given intramuscularly to the mother's thigh before delivery of the placenta
- ◆ the baby was identified (label) and wrapped in a warm, dry towel and a woollen cap was placed on it's head
- ◆ the mother was offered to hold and / or breastfeed her baby
- ◆ if the mother did not wish to hold the baby, it was placed it in a crib next to mother and wrapped warmly
- ◆ the placenta was delivered by supporting the uterus whilst continuous controlled cord traction was given
- ◆ both the mother and the baby were observed during the third stage of labour

the mother's cervix and perineum were examined. An agreement was reached between the caregiver and the researcher regarding perineal tears

- ◆ the baby was examined in front of the mother and feed back was given about the observations
- ◆ routine cleaning and observation of the mother and baby were done. If the mother was in the control group she was offered to take a bath or a shower
- ◆ the postnatal ward was notified
- ◆ the hospital records, data collection sheet and birth register were completed
- ◆ both the mother and the baby were transferred to the postnatal ward and informed that a research midwife would visit her the next day
- ◆ the mother was visited the next day and she was asked to complete the 24-hour questionnaire.
- ◆ a doctor was called if any complication was anticipated or occurred at any stage
- ◆ the women were allowed companionship of their choice during labour and birth

3.6.5 Consent

A subject information sheet was given to the patient to read. This was accompanied by verbal explanation. Written consent was obtained from subjects before enrolment. Ethical consent was obtained from the

Committee for Research on Human Subjects, University of the Witwatersrand. Consent from the superintendents of the specific hospitals was also obtained (Annexure 1-4.)

3.6.6 Instruments (Annexure 5 & 6)

Instruments refer to both the data collection sheet and the self-administered questionnaire. The scientific method of research requires instruments to be used to measure the phenomena under investigation. A data collection sheet (annexure 5) and a structured self-administered questionnaire (annexure 6) were used to gain information as set out in the objectives. The following concepts were considered when the data collection sheet and the structured questionnaire were designed. Topics were chosen that would reflect the objectives. An initial draft was constructed and piloted to collect feedback on unclear or ambiguous questions. The drafts were revised and then only used in the trial (Hicks, 1996:15). Decisions on which data were collected were made after discussions with the two supervisors and the doctoral committee. The data collection form was developed for easy and accurate recording. Codes were inserted when

needed and a coding list was compiled for those questions where codes were not inserted on the data sheet. The master list of coding was kept in a secure place (Burns & Grove, 1993:408).

Baseline data were recorded on a data collection sheet before randomisation. This included the following parameters: parity, to allow for stratification of randomisation to ensure that an equal number of nulliparous and multiparous women would be allocated to each group. The subject's name was recorded and kept confidential for identification purposes. The birth date and gestational age were recorded to determine whether the inclusion and exclusion criteria were met. Biographical data concerning her employment, home language and marital status was collected to assess the demographic characteristics of the subject samples (Burns & Grove, 1993:415). Cultural characteristics such as religion and language in the population were diverse. We did not ask ethnic origin due to the political sensitivity in the country at the time of the trial. Also ethnic grouping could be heterogenous, as women of Indian origin may be Hindu, Moslem, Christian, Catholic or Jewish, and these different

beliefs may influence her childbirth experiences extensively. The diversity is the same in the black, white and mixed-race populations (Chalmers & Meyer, 1004:211).

Time and date of onset of labour were recorded. The colour of the amniotic fluid was observed and women with thick meconium stained liquor were not included in the trial as this was one of the exclusion criteria. Baseline temperature, blood pressure, pulse, and fetal heart rate were recorded to ensure that the woman was a low risk patient that could be cared for by a midwife. The time and need for analgesia before randomisation was recorded to ensure that the woman was not too drowsy and to exclude the possible risk of drowning or loss of consciousness. A final vaginal examination was performed and recorded to ensure that the woman was in the second stage of labour or more than eight cm dilated if she was a multigravida who had the urge to bear down. The randomisation time was recorded to compare the time from randomisation till delivery between the two groups. Group allocation was not recorded to ensure that entering of data would be done without knowledge of group allocation.

Delivery and neonatal data were recorded on the same data sheet after delivery and completion of the maternal records. Mode of delivery, duration of second stage and third stage of labour, blood loss and complications during second and third stage of labour were collected as additional outcomes.

One of the primary outcomes was injury to the birth canal. The researcher and another health care worker did a thorough examination of the birth canal. Agreement was reached and then only was trauma to the birth canal entered onto the maternal record and the data sheet. The birth canal data included the following categories: perineum intact, first degree tear, second degree tear, third degree tear, fourth degree tear, episiotomy or caesarean section. Vaginal wall, labial, and para-urethral tears were recorded. Suturing of tears and episiotomies were also recorded.

Neonatal data on gender and weight were recorded for biographical description of the sample. Presence and tightness of a cord around the neck at delivery of the head, Apgar scores, cord arterial blood pH, need

for specialist paediatric care, need for resuscitation, admission to special care unit and neonatal death were recorded as additional data.

The subject was asked to complete a self-administered questionnaire within 24 hours after delivery. The subject's name did appear on the self-administered questionnaire for identification purposes but their privacy and confidentiality were preserved and would not be made available to anyone other than the researcher. The questions covered the primary objectives of the trial, viz. maternal experience of labour and perineal trauma. Ordinal response scales were used in order to rank the outcomes according to a dimension from least to most.

The self-administered questionnaire consisted of eight closed-ended questions. Five ordinal questions were included to enquire about her birthing experience. These questions addressed the primary objective of her experience of the second stage of labour and included the following: how she felt during the pushing stage of her labour, the pain she experienced during the pushing stage, the pain she experienced during

the pushing stage compared to what she expected it would be, how satisfied she felt with her coping during the second stage of labour and how easy or difficult she would describe her pushing stage of labour. One ordinal question assessed the perineal pain experienced at the time of the questionnaire. A nominal categorical scale was used to address the question enquiring whether she would like to deliver in or out of the water if she has another child (Hicks, 1996:25). Women who had experienced birth before were asked to complete an ordinal scale question comparing this birthing experience with her previous birthing experience. The researcher is aware of the Labor and Delivery Satisfaction Index (LADSI), but after piloting the questionnaire on a sample in the population it was found to be too difficult to understand by the women (Lomas, Dore, Enkin & Mitchell, 1987:125).

This data collection and self-answer questionnaire format were chosen, as it was anticipated to be easy and efficient to administer. The format was easily readable and understandable by the women. The collected data was easily quantifiable and amenable to statistical analysis and generalisation was possible.

The assessment was strengthened because all the subjects responded to the same questions. This instrument was also easy to test for reliability and validity. Questions were spaced and followed a specific order. The instrument was kept short and there were no built in clues in the questions.

We respected and appreciated the diverse sociocultural-spiritual background that our population sample consisted of and we were aware that childbirth experience is a phenomenon that cannot be adequately or comprehensively studied by quantitative means alone. Despite our beliefs we decided to use a simple quantitative method of analyses, due to the population sample that we were working with (multicultural, low education,) and this is acknowledge as a possible weakness of this instrument. Other weaknesses of the questionnaire could be that some important information might not have been examined. Closed-ended questions were a weakness, as they did not give the subject all the available choices. They were used due to the diversity of the population under examination, as it would have been very difficult to allow expression of their feelings in their own language and to translate 13 languages to obtain a

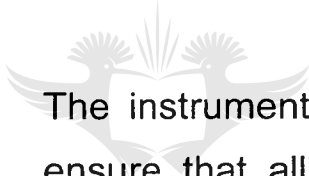
common denominator. This would also have introduced subjectivity into the evaluation of the responses. Close-ended questions have the advantage of greater objectivity.

The midwife researcher visited the subject within 24 hours of delivery in the postnatal ward. She left the self-administered questionnaire with the woman and returned after about thirty minutes to collect the form. The instrument was screened as to whether all the questions had been answered. Sometimes the midwife researcher was not blind to the group allocation, as she could have been present at the delivery, but she was consistent in all her requests to the women to complete the self-answered questionnaire.

3.6.7 Validity

Validity is a reflection of the relationship between a concept being measured and the measurement itself. It is a judgement of the extent to which the data sheet and questionnaire (instrument) reflects the measurable outcome variable as it is intended to do

(Seaman & Verhonick, 1986:237 & Diers, 1979:230). It is recommended that at least five experts should validate an instrument (Burns & Grove, 1993:344). The instrument was given to the supervisors (AGWN & GJH), a research medical officer (AMG) and two members of the doctoral committee (HU & CD) for validation. The instrument was also discussed at a departmental doctoral presentation. A pilot testing of the instrument was also conducted with five women in the postnatal ward to determine the clarity of the questions and the completeness of their responses.



The instrument was evaluated for content validity to ensure that all the objectives had been addressed. Results of the validity testing were consequential and all the reviewers found the instrument to be experimentally valid as it measured what it was purporting to measure. The five women understood the questions. The only problem occurred when one woman felt she did not want to complete the question concerning the choice of how she would like to deliver her next baby, in or out of water. She said that she was going to be sterilised and therefore she was determined that she would have no more children. It was decided to keep the question in. If the same

problem would occur during the trial, the woman would be asked to think about it and choose an answer that she thought she would choose if she had not chosen sterilisation as a means of contraception.

Face validity was assessed on by studying the instrument and deciding whether the format approved acceptable. Entries on the data sheet and questionnaire had specified spaces and blocks for answers. All the reviewers were in agreement that the instrument had good face validity in that all the questions were appropriately spaced and an acceptable format had been chosen to present the questions, and that the wording was clear.

Construct validity measures the relationship between the conceptual and operational definitions (Burns & Grove, 1993:268). The instrument evaluators assessed the instrument and concluded that all the operational definitions had been addressed. It was felt that the questions addressed the problem under investigation. The pilot study women who evaluated the instrument were not asked to comment on the construct validity.

Inferential validity refers to the validity of the logical inferences (inductive and deductive) or conclusions that were drawn from the results of this research project (Mouton and Marais, 1991:112). Statistical tests of chance (p value), confidence intervals and relative risk were used to determine the differences between the outcomes of the two groups. Conclusions were made, based on the differences between the outcomes in the two groups.

Operationalisation of major concepts contributed to the theoretical validity of the project. External (universal) validity is concerned with the extent to which the results can be applied beyond the sample population. External validity was achieved by using a detailed trial procedure, with specific inclusion and exclusion criteria as well as a calculated sample size adequate to give reliable results.

3.6.8 Reliability

Reliability is concerned with how consistently an instrument measures the phenomenon of interest. It refers to the consistency and dependability of an

instrument or measurement, or to the accuracy of the data in the sense of their stability or repeatability (Burns & Grove, 1993:778).

Reliability testing were done to measure the amount of random error in the instrument. Reliability testing focused on the stability, equivalence, and homogeneity of the measurement. The test - retest method was used with five women to test the reliability of the self-administered questionnaire. The reliability coefficient varied between the different questions from .80 - .88. These were all within the acceptable coefficient for behaviour measurements (Wilson, 1989:358).

A detailed trial procedure (protocol) was used to ensure inter - researcher reliability for the execution of the project. The protocol was constructed from guidelines that concerned the use of water during labour and birth and was scrutinised by the supervisors, doctoral committee, and three midwives with experience in water births. The implementation of the protocol was tested on volunteers to determine whether it could be followed with ease and executed in a reliable way. Both the research midwives ^{Pxv111}

found the procedure easy to follow and clear, with no weaknesses. The other evaluators were in agreement that it was easy to follow and that the statements were clear.

Fully functional equipment was used to ensure measurement reliability in the project when physiological data such as blood pressure, foetal heart rate, temperature, and arterial blood gas were obtained.

3.6.9 Data gathering

The instrument used during this project consisted of a data sheet and a self-administered questionnaire. The midwife researcher collected baseline data from the subject's records as well as from the woman directly. Labour, delivery and neonatal data were completed after delivery and were taken from the hospital records. The woman was reminded that the midwife researcher would visit her the next day and ask her to complete the self-administered questionnaire. The questionnaire was handed to the subject and she was asked to complete it as best as she could. She was asked not to discuss the answers

with any person and was informed that the midwife researcher would collect the form back from her after about thirty minutes' time. The midwife researcher checked the form for completeness after collecting it from the woman. The completed forms were filed and put away until enrolment was completed. Two people checked for accuracy on entering the data onto the computer. Group allocation was entered after the data had been entered.

3.6.10 Data analysis

Inferential statistics were used to test the hypotheses when the results were analysed (Hicks, 1996:12). Statistical comparisons of nominal, ordinal and continuous variables were done by using Epi Info version 6.02 and Revman 3.01 software. Bartlett's test for homogeneity of variance was applied to continuous variables. If homogenous the Anova test was used. If differences between the samples were detected the Mann-Whitney U or Kruskal Wallis H test were applied. The chi-square test was used for categorical data and the Fisher exact test if any number was less than five. The Taylor series 95% confidence intervals were used for relative risks.

The midwife assessing the primary outcome on birth canal trauma was not blinded. To minimise bias, an agreement was reached between the researcher and another health care giver on the outcome. The participants themselves were obviously also not blinded due to the nature of the trial, but the persons entering and analysing the data were blinded to group allocation.

The results were analysed according to the intention to treat, because the whole purpose of original randomisation would have been wasted if the results were not analysed according to intention to treat. Using intention to treat analysis makes the result more believable. It may weaken the observed effect, but does not exaggerate the effectiveness of the intervention (<http://www.his.ox.ac.uk/casp/statistics.html>. 3 May 1999).

3.6.11 Results

The results are presented in chapter four by graphic depictions (graphs, bar graphs, pie charts) and

descriptive tables (Hicks, 1996:32/32). Concise summary statements of the findings were formulated from the analysis. Discussions and conclusions were drawn in association with the reports from other publications and presented in chapter five. Implications and recommendations for further research are discussed in chapter five.

The secondary objective of this project was to set guidelines for a safe delivery. Guidelines were drawn up to conduct water births and are presented in chapter five.



3.6.12 Data interpretation

The results were interpreted within the conceptual framework of the project. The 95% confidence interval (CI) was used to give the range within which the true answer lies with 95% certainty. The smaller the CI the more sure we are of the true result. Differences between the groups were expressed as the relative risk (RR). If the 95% CI line (horizontal line), on the blobbogram (----■----) does not cross 1 (the vertical

line), then the result is statistically significant at $p = 0.05$ (<http://www.his.ox.ac.uk/casp/statistics.html>. 3 May 1999).

Tentative conclusions were formulated. Guidelines were compiled on how to conduct a delivery under water.

3.7 Implementation

Results are presented in chapter four. Discussion of the findings, implications, and recommendations for practice and research are addressed in chapter five. Research findings were presented at local and international conferences and were submitted for publication, as well as being considered for inclusion in an electronic systematic review.

Guidelines will be published separately and distributed to health care givers via national and international midwifery networks, provincial health care administrators and private clinics to assist them in

making decisions based on evidence based health care.

3.8 First order (Nursing practice)

Field attributes, pre-scientific and lay interpretations are determinants of the first order. The first order represents the reality or the practice. Within this project the first order was the practice of midwifery (labour ward, midwife and parturient). The delivery environment was the field of midwifery science. Midwifery practice holds specific attributes that guided the researcher. The activities that took place on the primary level or first order are referred to in the model (Figure 3.1). Nursing is the interaction between the midwife researcher, the parturient, and her partner during and after the birth of the baby. Most midwifery actions were based on knowledge of midwifery, but many actions took place that was based on pre-scientific interpretations.

The actions of the parturients were mostly based on lay interpretations and on previous experiences, or

beliefs. The researcher explored, described, analysed, tested and explained the interpretations concerning delivering in water by means of a randomised controlled trial. The interpretations were incorporated in the knowledge content of midwifery science in the form of guidelines.



3.9 Summary

Chapter three covered the aspects of the scientific approach that were taken within a specific framework to ensure that the problem under investigation was properly evaluated. This ensured the validity and reliability of the instrument, which provided a scientific basis from which informed evidence based decisions could be made.



CHAPTER FOUR
RESULTS

4.1 Introduction

The results of data obtained will be presented in this chapter. The aim of the analysis was to examine any differences between the immersion group and the control group with respect to the following variables.

Primary outcomes:

Maternal experience of labour.

How the subject felt during the pushing stage of labour.

The pain she experienced during the pushing stage of labour.

How she experienced her pushing pain in comparison to what she expected it to be.

How satisfied she felt with the way she coped during the pushing stage.

How easy or difficult she described her pushing stages.

If she were to give birth again, what would her choice be?

If she experienced birth before, how did this birth compare to the previous birth?

Trauma to the birth canal.

Perineal, vaginal wall, labial or para-urethral injuries

The perineal pain she experienced after delivery

Additional outcomes:

Maternal outcomes:

Mode of delivery

Duration of second stage of labour

Duration of third stage of labour

Blood loss

Randomisation until delivery time

Presence of meconium stained liquor

Complications during second stage of labour

Complications during third stage of labour

Neonatal outcomes:

Cord around the neck at delivery of head

Apgar scores

Temperature

Cord arterial blood gas pH

Need for resuscitation

Need for specialist paediatric care

Admissions to special care unit

Neonatal death

Biographical and baseline data will be presented to show that randomisation was successful in providing two similar groups.

Parity

Maternal age

Gestational age

Employment

Home language

Marital status

Maternal temperature

Blood pressure

Pulse

Fetal heart rate

Analgesia used before randomisation

Time of last analgesia

Neonates gender

Neonates weight

Statistical comparisons of nominal, ordinal and continuous variables were analysed using Epi Info version 6.02 and Revman 3.01 software. Bartlett's test for homogeneity of variance was applied to continuous variables. The Anova test was applied

if samples were homogenous. If the samples differed the Mann-Whitney U or Kruskal Wallis H test were applied. The Chi-square test was used for proportions and the Fisher exact test if any number was less than five. The Taylor series 95% confidence limits was used for relative risks. Graphical depictions, using bar graphs, pie charts, blobbograms (----■----), descriptive tables and discussion of findings were used for the presentation of the results. Concise summary statements of the findings were formulated from the analysis and accompany the displays.

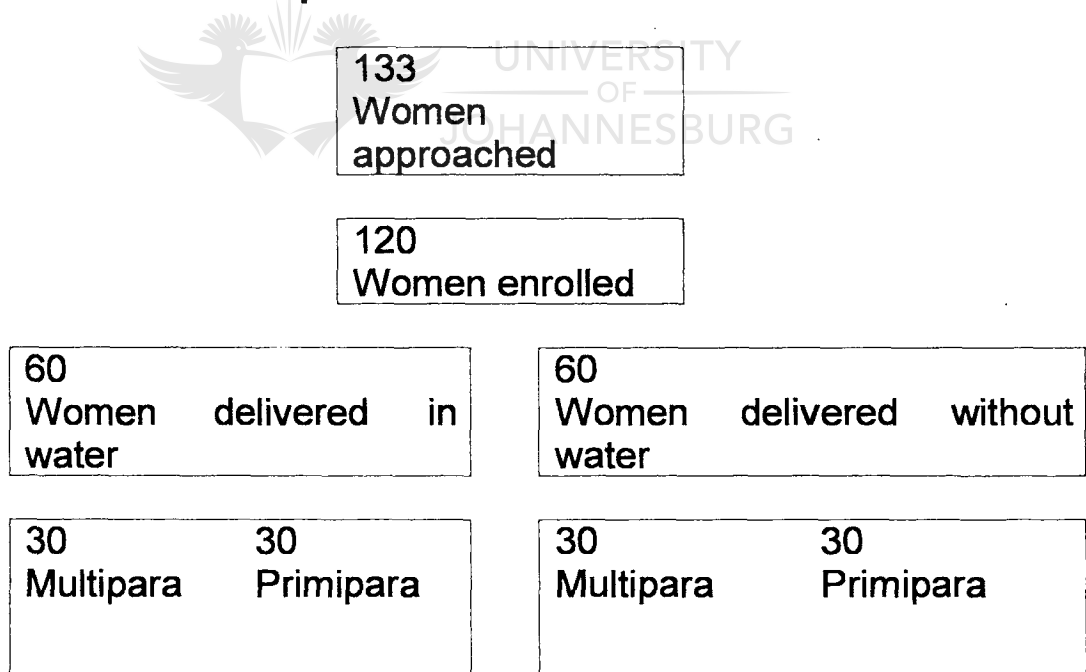
For uniformity, the results were expressed in terms of the incidence of the less favourable outcome in each case. A relative risk (RR) of less than one indicates a better outcome in the experimental group. If the 95% confidence interval does not include one, then the result is statistically significant at $p=0.05$. Variables were analysed according to the intention to treat.

4.2 Sample size

Of 133 women approached, eight multiparous and five primiparous women declined to participate. Reasons given for non-participation were "scared" or "wish to

deliver in bed, not use to a bath". The 120 women who agreed to take part in the study were randomly allocated to immersion in water (w60) and to a control group (c60) who delivered without the use of water (Figure 4.1). There were no withdrawals after randomisation. Three women in the control group left the hospital before they completed the post delivery questionnaire. The research midwives were unable to trace them within the next two days.

Figure 4.1 Sample size



Sample size of study

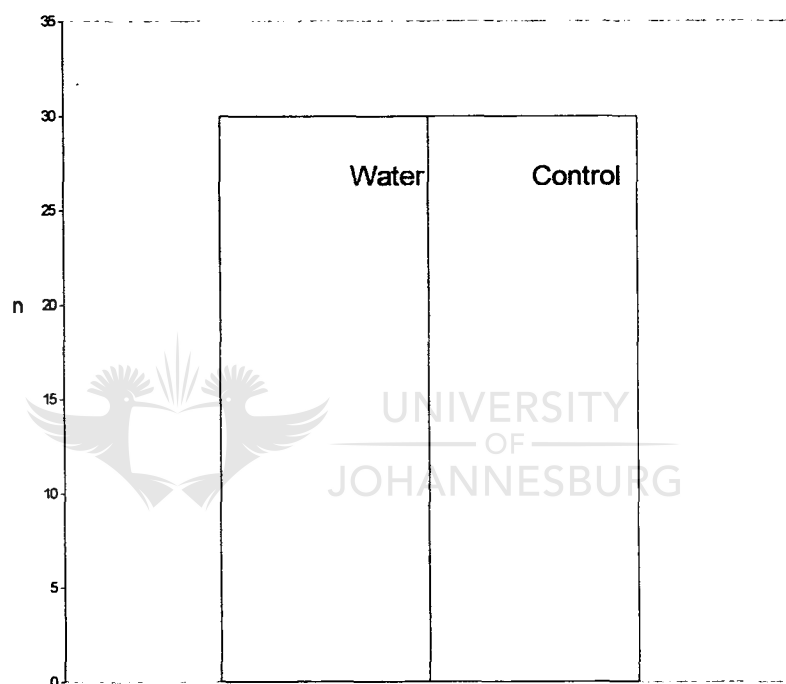
4.3 Biographical and social status baseline data

Biographical and social details of the sample collected before enrolment included the following variables: parity, maternal age, gestational age, employment, home language and present marital status (Figures 4.2 - 4.7.) Neonatal biographical data were collected after birth and included neonatal gender and weight (Table 4.1).

Baseline variables showed no statistically significant difference, which indicates that the randomisation process was successful in producing well-matched data with respect to biographical and social variables.

There were 30 multiparous and 30 primiparous women in each group (Figure 4.2).

Figure 4.2 Parity



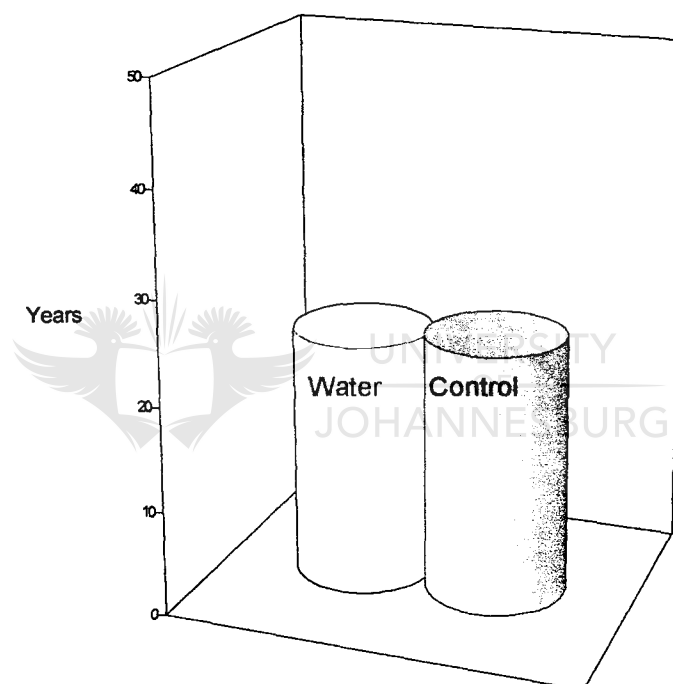
Parity of the women in the trial

Parity = 0

Water 30/60 (50%) Control 30/60 (50%)

The women were all of childbearing age, the majority being less than thirty years of age (w47.5% and c52.5%) (Figure 4.3).

Figure 4.3 Maternal age (years)



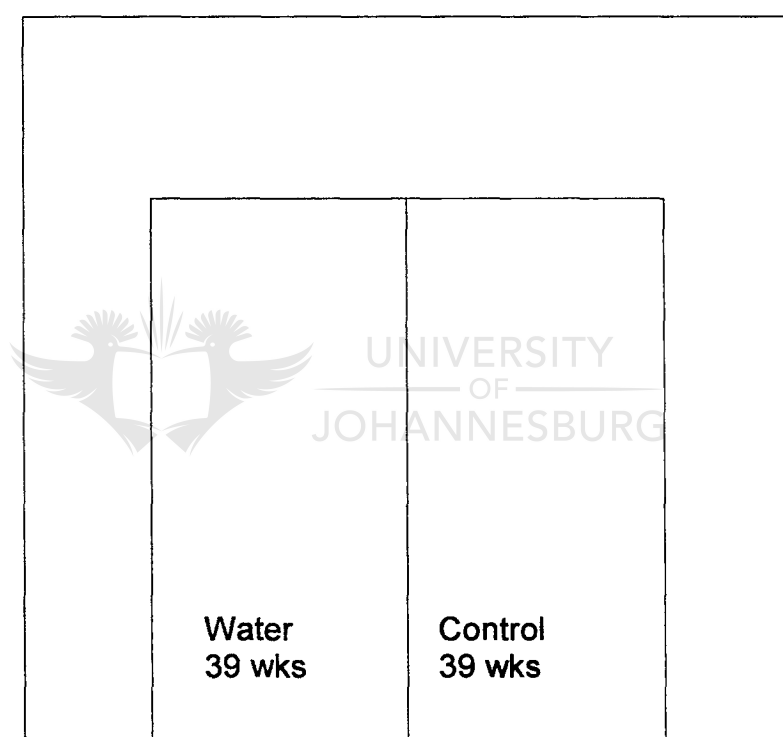
Median maternal age of participants

Maternal age (years)

	n	median	range
Water	60	23	17 - 40
Control	60	24	17 - 49

All women met the entry criteria of more than 37 completed weeks of gestation. Three women in the control group had a gestation period of 42 weeks at the time of delivery (Figure 4.4).

Figure 4.4 Gestational age



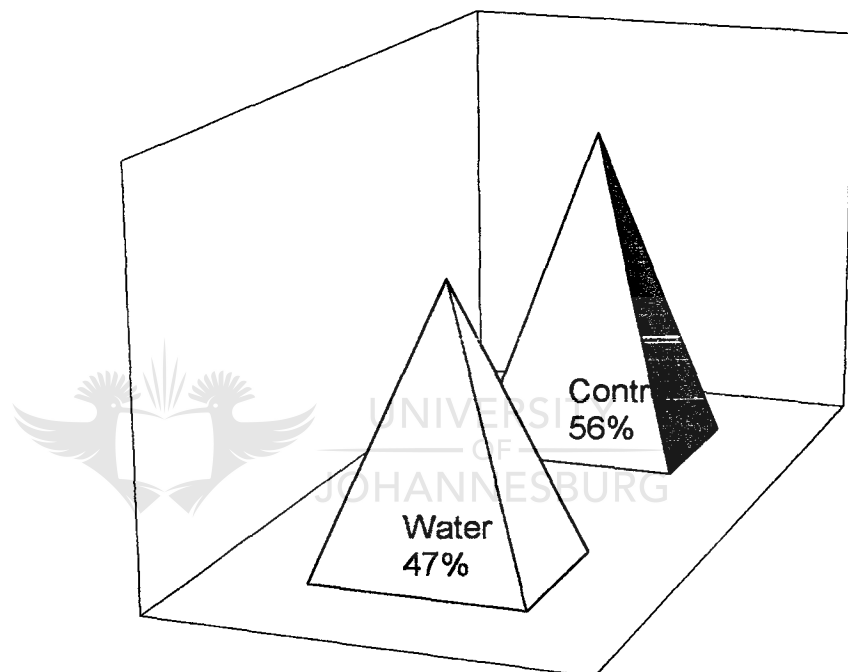
Median gestational age at time of delivery

Gestational age (weeks)

	n	median	range
Water	60	39	37 - 41
Control	60	39	37 - 42

Slightly more mothers in the control group were unemployed when they fell pregnant, but this difference was not statistically significant (Figure 4.5).

Figure 4.5 Unemployed



The proportion of women who were unemployed when they fell pregnant

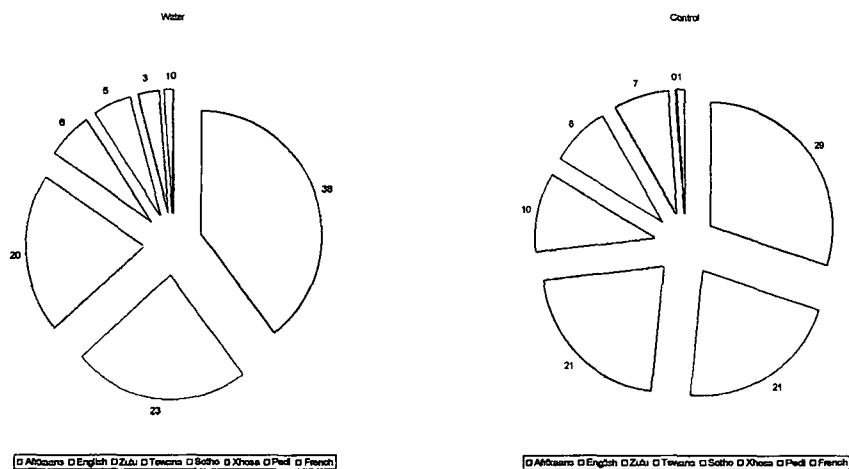
Unemployed

Water	Control	RR	CI
28/60 (47%)	32/57 (56%)	0.83	0.58 - 1.19

Inclusion criteria before entry into the trial stated that the women should be able to read English or Afrikaans. Nearly half of the women in the control group did not speak English at home (w38% vs c49%) (Figure 4.6b). Fewer than twenty five percent of women in both groups reported that English was their home language (w23% vs c21%). Afrikaans was the most used home language in both groups (w38% vs c29%). The home languages of the other respondents were Zulu (w20% vs c21%), Tswana (w6% vs c10%), Sotho (w3% vs c8%), Xhosa (w3% vs c7%), Pedi (w1% vs c0%) and French (w0% vs c1%) (Figure 4.6a).

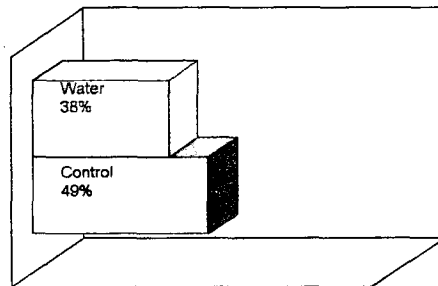


Figure 4.6a Home language



Different languages

Figure 4.6b Home language not Afrikaans or English



Women who's home language was not Afrikaans or English

Not Afrikaans or English as home language

Water

Control

23/60 (38%)

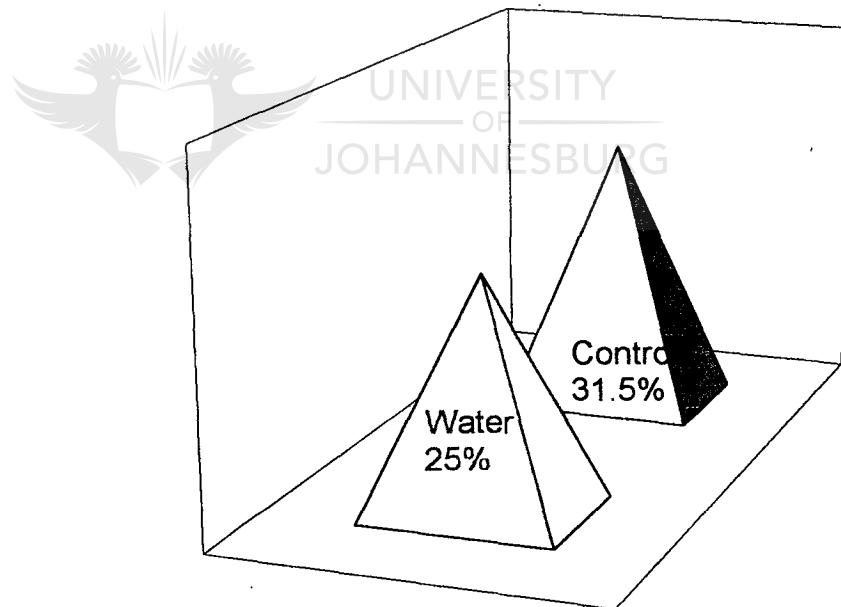
28/57 (49%)

Differences not statistically significant.



The subjects were asked to complete their present marital status. South Africa law did not accept traditional marriages at the time of the study, therefore many women would not say that they were married when asked the question. We therefore asked whether they were married (w38% vs c28%) lived with a partner (w36% vs c40%) or were single (w25% vs c31.5%) (Figure 4.7).

Figure 4.7 Marital status



Proportion of women who were single

Single

Water

Control

15/60 (25%)

18/57 (31.5%)

Comparison of neonatal outcomes between women randomly allocated to deliver in water or not, showed no significant differences. There were slightly more males born to the mothers in the water group (w56% vs c47%). The birth weights were similar (Table 4.1).

Table 4.1 Neonatal baseline data (gender and weight)

Comparison of neonatal baseline data after birth expressed as medians and ranges or number and percentages.

Outcome	Water	Control
Gender (male)	34/60 (56%)	28/60 (47%)
Weight (grams)		
Group	n	median range
Water	59	3200 2235 - 4000
Control	57	3100 2200 - 4200

4.4 Clinical baseline data

Clinical data collected just before randomisation included maternal temperature, blood pressure, pulse, fetal heart rate and the use and time of analgesia

before randomisation (Table 4.2). Although all the blood pressures were taken between contractions, some women still presented with systolic pressures of higher than 140mmHg (w21 vs c27), or diastolic blood pressures of higher than 90mmHg (w8 vs c8). None of the women experienced any adverse effects due to their increased blood pressures and none received medication. There were no cases of maternal (>120bpm) or fetal tachycardia (>160). None of the women had a temperature higher than 37.7 °C on entry to trial. Slightly more women in the water group had used analgesia (Pethidine) during the first stage of labour (w19, c15). Only three women (w2, c1) had received analgesia within the last 60 minutes prior to randomisation. One woman who had analgesia during labour experienced a brief moment of lack of consciousness about five minutes after entering the water. She was held in an upright position and quickly regained full consciousness. She was offered some glucose water and thereafter proceeded with pushing. Both she and her baby were well. All the clinical baseline data were similar in the two groups. We can thus conclude that randomisation had been successful in providing us with two group that were very similar before the introduction of the intervention.

Table 4.2 Comparison of maternal clinical baseline data

Comparison of clinical baseline data before randomisation expressed as medians, standard deviations (SD) and ranges or number, percentages, relative risk (RR) and 95% confidence interval (CI)

Temperature (°C)

Group	n	median	SD	range
Water	52	36.2	0.44	35.3 - 37.2
Control	57	36	0.61	35.0 - 37.7

Systolic blood pressure (mmHg)

Group	n	median	SD	range
Water	58	138.5	20.0	71 - 176
Control	60	136.5	13.2	110 - 169

Diastolic blood pressure (mmHg)

Group	n	median	SD	range
Water	58	76.5	10.7	52 - 98
Control	60	80.0	10.1	57 - 99

Pulse (beats per minute)

Group	n	median	SD	range
Water	58	85.0	15.5	47-119
Control	59	86.0	12.4	54 -114

Time lapse between analgesia received and randomisation time (minutes).

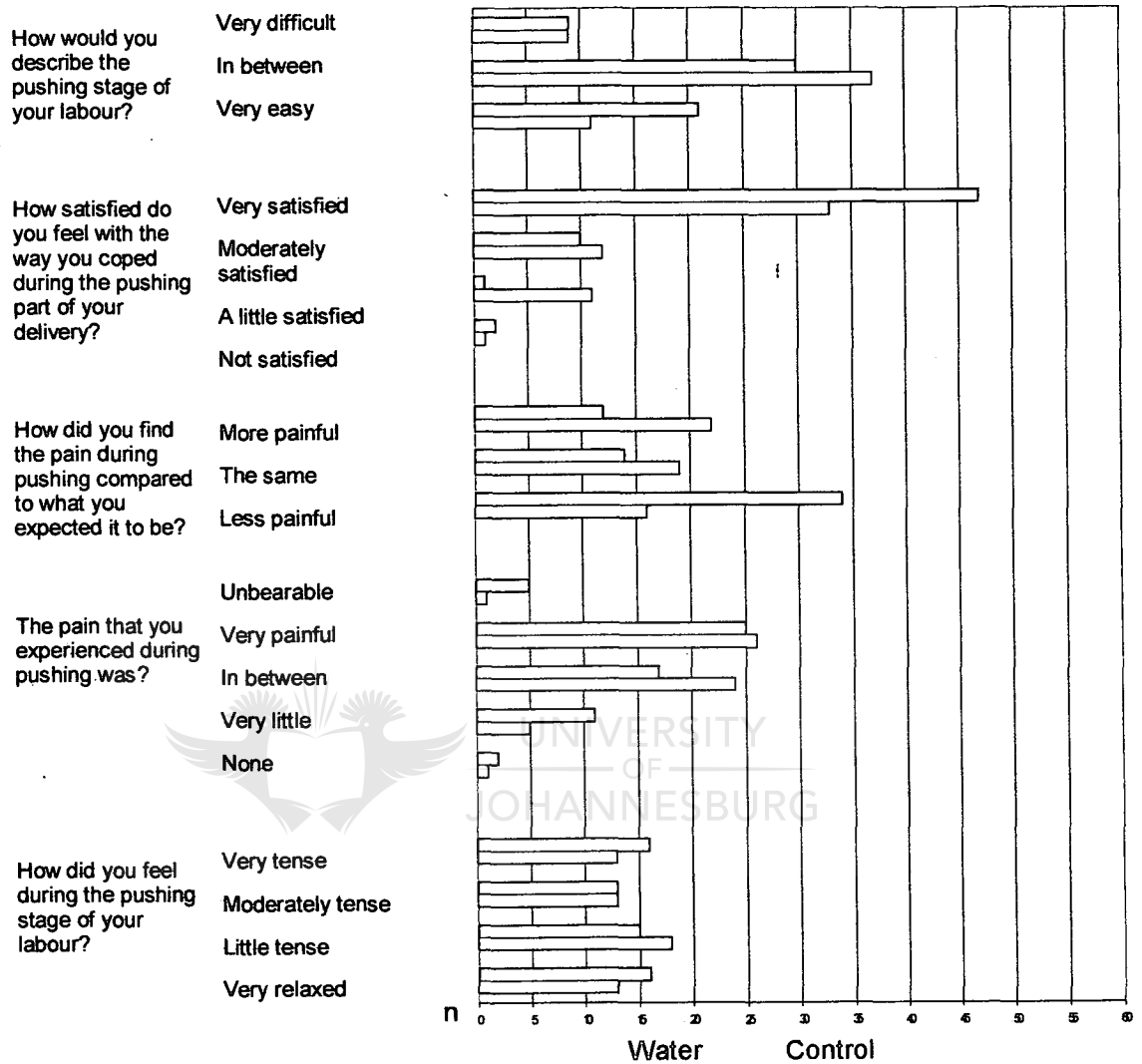
Group	n	median	SD	range
Water	19	170	118.9	35 - 460
Control	15	220	134.4	30 - 625

Analgesia (Pethidine) used before randomisation				
Group	n	%	RR	CI
Water	19/60	32%	1.27	0.71 - 2.25
Control	15/60	25%		

4.5 Maternal experience outcomes

Maternal experience of the second stage of labour was evaluated within twenty-four hours of delivery. The emotional and physiological sensations the mother experienced during the process of parturition were assessed by five questions in the format of ordinal rating scales that focussed on the subjects' descriptions of physical and emotional sensations (Figure 4.8a).

Figure 4.8a Experience during the second stage of labour



Maternal experience during the second stage of labour

Table 4.3a Maternal experience during the second stage of labour

Comparison of maternal experience during the second stage of labour expressed as proportions (percent)			
Outcomes:			
How did you feel during the pushing stage of your labour?			
	Water	Control	p = 0.845
Very relaxed	16/60 (27%)	13/57 (23%)	
A little tense	15/60 (25%)	18/57 (31%)	
Moderately tense	13/60 (22%)	13/57 (23%)	
Very tense	16/60 (27%)	13/60 (23%)	
The pain that you experienced during the pushing was?			
	Water	Control	p = 0.171
None	2/60 (3%)	1/57 (2%)	
Very little	11/60 (18%)	5/57 (9%)	
In between	17/60 (28%)	24/57 (42%)	
Very painful	25/60 (42%)	26/57 (46%)	
Unbearable	5/60 (8%)	1/57 (2%)	
How did you find the pain during the pushing compared to what you expected it to be?			
	Water	Control	p = 0.006
Less painful	34/60 (57%)	16/57 (28%)	
The same	14/60 (23%)	19/57 (33%)	
More painful	12/60 (20%)	22/57 (38%)	

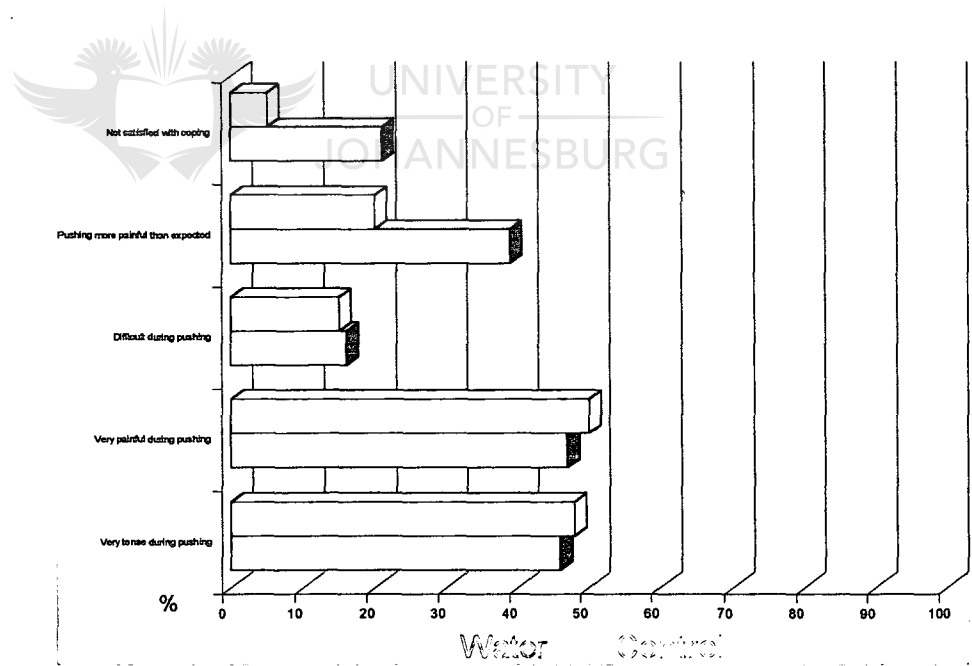
How satisfied do you feel with the way you coped during the pushing part of your delivery?			
	Water	Control	p = 0.010
Not satisfied	2/60 (3%)	1/57 (2%)	
A little satisfied	1/60 (2%)	11/57 (19%)	
Moderately satisfied	10/60 (17%)	12/57 (21%)	
Very satisfied	47/60 (78%)	33/57 (58%)	
How would you describe the pushing stage of your labour?			
	Water	Control	p = 0.150
Very easy	21/60 (35%)	11/57 (19%)	
In-between	30/60 (50%)	37/57 (65%)	
Very difficult	9/60 (15%)	9/57 (16%)	

Ordinal scales have been used during the assessment of the women's experienced during pain. The results of the ordinal scales are presented in Table 4.3. For the purpose of a better understanding we have also analysed the results using categorical divisions given in Figure 4.8b.

Nearly half the women in both groups reported that they felt moderately to very tense during the pushing stage (w49% vs c46%) and experienced the pain during the pushing stage to be very painful or unbearable (w50% vs c48%). Similar percentages of

women described their birth as very difficult (w15% vs c16%). Significantly fewer mothers in the water group experienced the pain to be more painful than they expected it to be (w20% vs c38%) and were minimally or not satisfied with the way they coped during the pushing part of their labour (w5% vs c21%) (Table 4.3b).

Figure 4.8b Experience during the second stage of labour (categorical deviations)



Maternal experience during the second stage of labour using categorical divisions

Table 4.3b Maternal experience during the second stage of labour (categorical scale)

Comparison of maternal experience during the second stage of labour expressed as number, percentages, relative risk (RR) and 95% confidence interval (CI) (categorical scale)

Felt moderately to very tense during the pushing stage

Water	Control	RR	CI	p =
29/60 (49%)	26/57 (46%)	1.06	0.72 - 1.56	0.912

Experienced the pain during the pushing stage to be very painful or unbearable

Water	Control	RR	CI	p =
30/60 (50%)	27/57 (48%)	1.06	0.73 - 1.53	0.920

Described their birth as very difficult

Water	Control	RR	CI	p =
9/60 (15%)	9/57 (16%)	0.95	0.41 - 2.22	0.890

Experienced the pain to be more painful than they expected it to be

Water	Control	RR	CI	p =
12/60 (20%)	22/57 (38%)	0.52	0.28 - 0.95	0.044

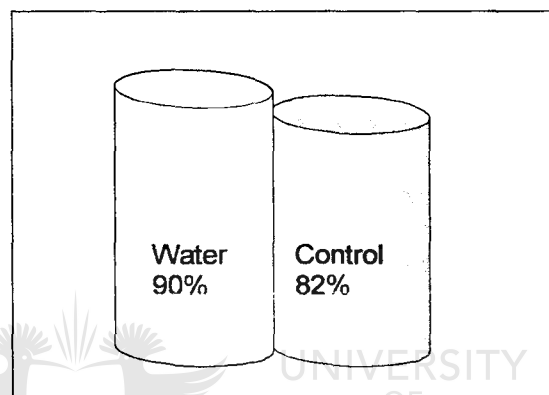
Not satisfied with the way that they coped during the pushing part of their labour

Water	Control	RR	CI	p =
3/60 (5%)	12/57 (21%)	0.24	0.03 - 0.80	0.020

4.6 Women's feelings about past and future births

Most mothers expressed the wish to deliver in water if they were offered the option with their next birth (w90% vs c82%) (Figure 4.9).

Figure 4.9 Next baby in water



Proportion of women who wish to deliver their next baby in water

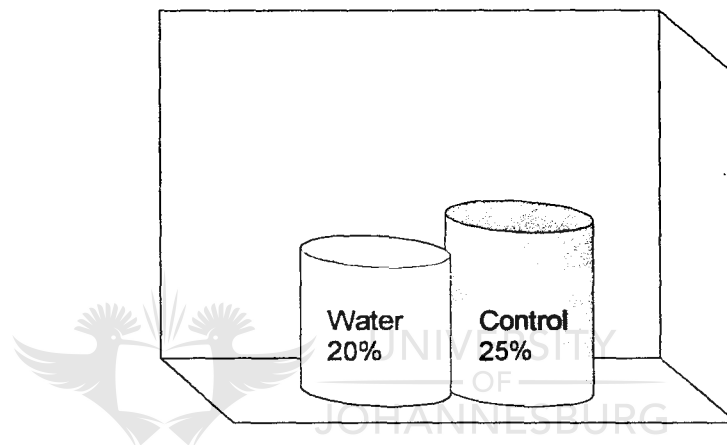
If you were to have another baby would you like to give birth in water or out of water?

Outcome: Wish to deliver in water.

Group	n	%	RR	CI	p =
Water	54/60	90%	1.09	0.94 - 1.26	0.358
Control	47/57	82%			

Slightly fewer multiparous mothers in the water group found this birth more difficult than their previous birth (w20% vs c25%) (Figure 4.10).

Figure 4.10 This birth more difficult (parity >0)



The proportion of women who experienced this birth as more difficult than their previous birth

This birth more difficult

Water	Control	RR	CI	p =
6/30 (20%)	7/28 (25%)	0.80	0.31 - 2.09	0.88

4.7 Birth canal outcomes

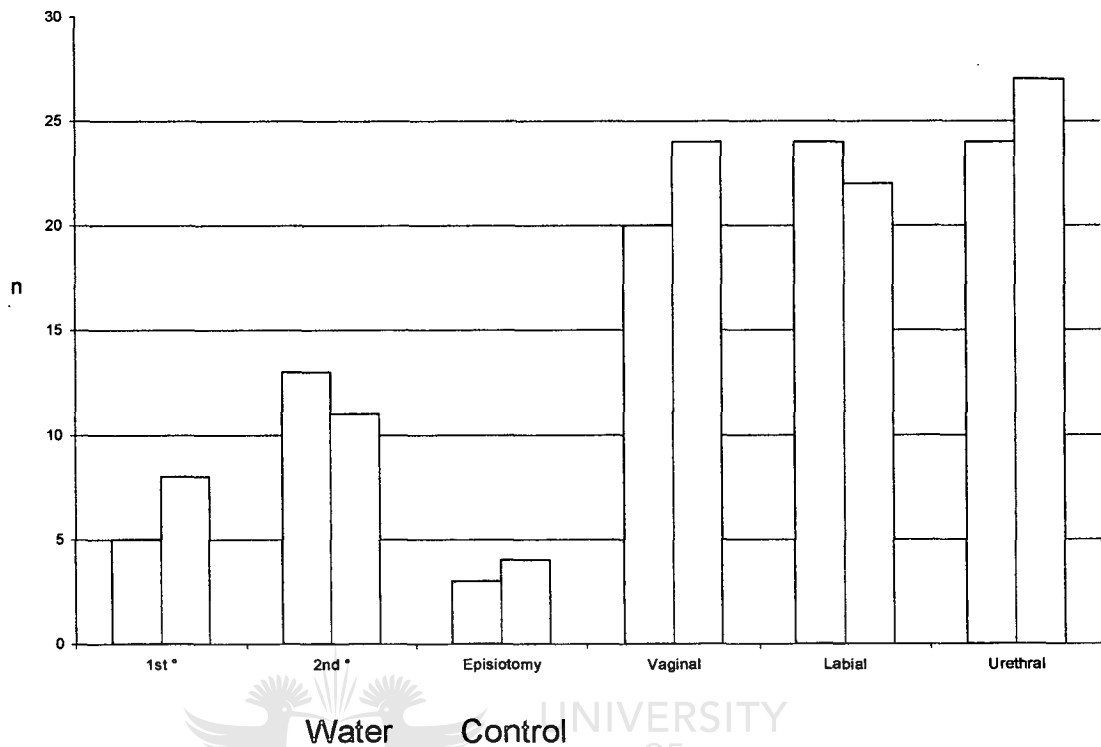
One of the primary outcomes of the trial was to compare trauma to the birth canal between the two groups. Deliveries were always supervised by one of the two research midwives (VCN, MDJ), both of whom followed the practice of performing an episiotomy only when needed such as in fetal distress, and not as routine practice. There was no difference in the episiotomy rate between the two groups. The overall episiotomy rate was low (w5% vs c6.7%) in comparison to previous labour ward statistics (40%). Perineal laceration was categorised according to the involvement of different anatomic structures of the birth canal. First degree tears, which involved laceration to the fourchette, perineal skin and the vaginal mucosal membrane, occurred slightly less frequently in the water group (w8.3% vs c13.5%). A few more women in the water group experienced second degree tears (w21.6% vs c18.6%), involving the fourchette, perineal skin, vagina mucosal membrane, perineal fascia and muscle (bulbocavernosus, ischiocavernosus and transverse perineal muscle). There were no third or fourth degree lacerations involving all above-mentioned structures and the anal sphincter, or rectal mucosa. Women in the water group experienced slightly fewer

vaginal (w33% vs c 40.6%), and para-urethral tears (w40% vs c 45.7%), but a slight increase in labial tears (w40% vs c 37.2%). These differences were not statistically significant (Figure 4.11).

One woman in the control group had a caesarean section and one woman in each group had a vacuum assisted delivery. None of these differences were statistically significant.



Figure 4.11 Birth canal trauma outcome



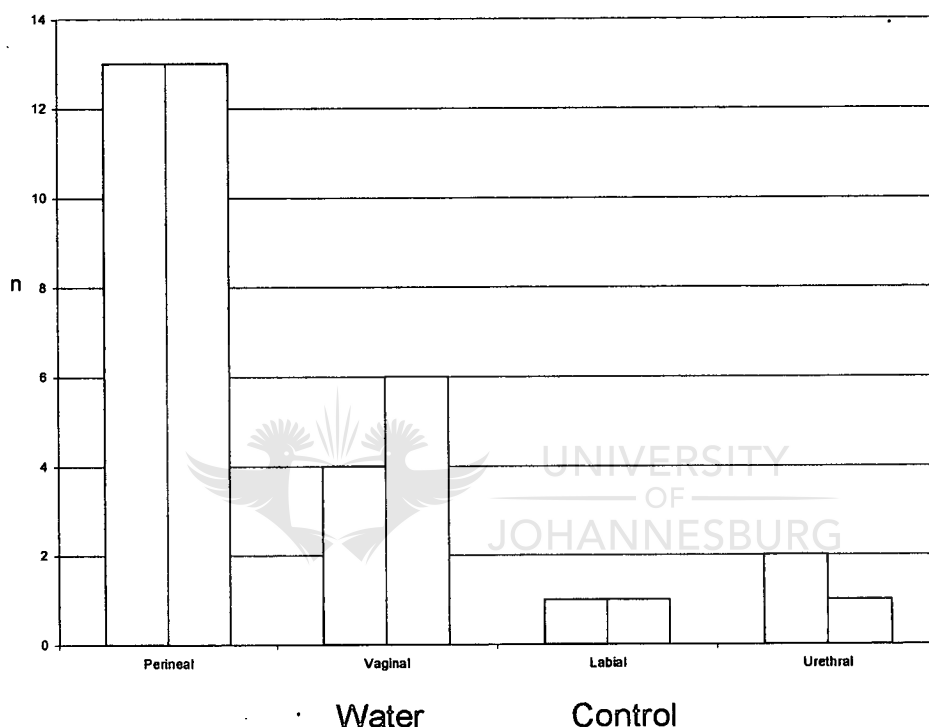
The number of women who experienced trauma to the birth canal during the second stage of labour

Outcome	Water	Control	RR	CI	p =
1 st ° Tears	5/60 (8.3%)	8/59* (13.5%)	0.61	0.21 - 1.77	0.535
2 nd ° Tears	13/60 (21.6%)	11/59 (18.6%)	1.16	0.57 - 2.38	0.855
Episiotomy	3/60 (5%)	4/59 (6.7%)	0.74	0.17 - 3.15	0.717
Vaginal tears	20/60 (33%)	24/59 (40.6%)	0.82	0.51 - 1.31	0.522
Labial tears	24/60 (40%)	22/59 (37.2%)	1.07	0.68 - 1.69	0.908
Para -Urethral tears	24/60 (40%)	27/59 (45.7%)	0.87	0.58 - 1.33	0.652

* One woman had a caesarean section

All episiotomies and most of the second degree tears were sutured. A few second degree tears were not sutured as the tears were very small and not bleeding (Figure 4.12).

Figure 4.12 Suturing of birth canal trauma



Number of women who required suturing after they experienced trauma to the birth canal

Outcome	Water	Control	RR	CI	p =
Suturing of					
Perineum	13/59* (22%)	13/59** (22%)	1	0.51 - 1.97	0.824
Vaginal wall	4/59 (7%)	6/59 (10%)	0.80	0.26 - 2.45	0.734
Labia	1/59 (1%)	1/59 (1%)	0.92	0.06 - 13.79	1
Urethra	2/59 (3%)	1/59 (1%)	2.25	0.22 - 23.28	0.595

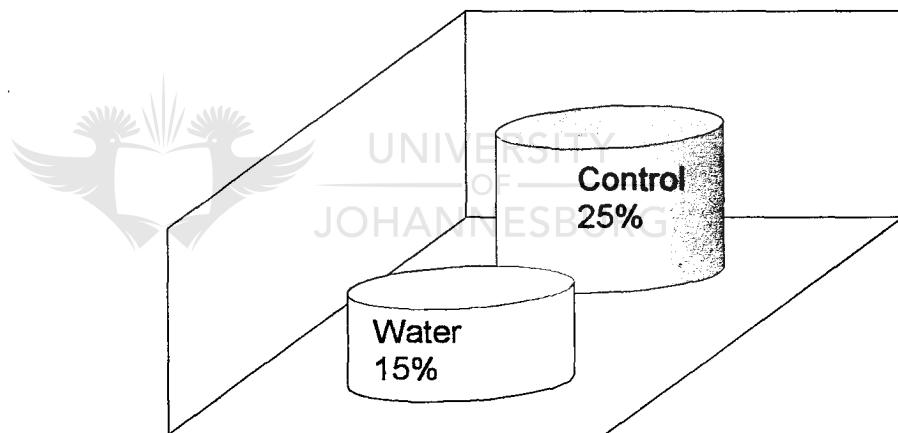
*missing data ** One woman had a caesarean section.

First degree tears were never sutured. Nearly a quarter of women in both groups needed suturing of the perineum. Vaginal, labial and para-urethral tears were only sutured if there was active bleeding. Very few vaginal, labial and urethral lacerations were sutured in either groups.



When asked to rate their perineal pain within twenty four hours after delivery fewer mothers in the water group said that their pain was unbearable (w3% vs c5%), a lot (w11% vs c19%) or moderate (w15% vs c19%). More women in the water group said that they experienced a little (w50% vs c40%) or no perineal pain (w20% vs c15%). These differences were not statistically different (Figure 4.13).

Figure 4.13 Perineal pain at 24 hours post partum



The proportion of women who experienced a lot or unbearable perineal pain at 24 hours after the delivery

A lot of or unbearable perineal pain at 24 hours after delivery

Water	Control	RR	CI	p =
9/60 (15%)	14/57 (25%)	0.61	0.29 - 1.30	0.28

4.8 Additional maternal clinical outcomes

Additional maternal outcomes compared were: mode of delivery, duration of the second and third stages of labour, duration of rupture of membranes, randomisation till delivery time, blood loss, meconium stained liquor and complications during the second and third stages of labour.

Table 4.4 Additional maternal outcomes

Comparison of additional maternal outcomes expressed as medians, standard deviations (SD) and ranges or number, percentages, relative risk and 95% confidence interval (CI)

Outcome	n	median	SD	range	p=
Duration of the second stage of labour (minutes)					
Water	60	28	41.30	5 - 193	0.738
Control	60	30	39.49	4 - 195	
Duration of third stage of labour (minutes)					
Water	60	10	5.18	1 - 24	0.025
Control	58	7	8.18	2 - 60	

Outcome	n	median	SD	range	p=
Duration of rupture of membranes (minutes)					
Water	60	186	316.2	0 - 1805	0.781
Control	60	179	270.2	5 - 1350	
Outcome	n	median	SD	range	p=
Randomisation till delivery time (minutes)					
Water	60	30.5	49.0	3 - 210	0.944
Control	60	30	41.8	5 - 193	
Outcome	n (%)	RR	CI	p =	
Mode of delivery					
Vacuum					
Water	1/60 (1%)	Undefined			
Control	1/60 (1%)				
Outcome	n (%)	RR	CI	p =	
Caesarean section					
Water	0/60	Undefined			
Control	1/60 (1%)				
Outcome	n (%)	RR	CI	p =	
Blood loss > 500mls					
Water	0/60	0.00	0 -2.35	0.118	
Control	3/59 (5%)				
Outcome	n (%)	RR	CI	p =	
Meconium stained liquor					
Water	7/60 (11.6%)	1.40	0.47 - 4.17	0.760	
Control	5/60 (8.3%)				

Outcome	n (%)	RR	CI	p =
Had complications during the second stage of labour				
Water	7/60 (12%)	1.17	0.42 - 3.27	1.00
Control	6/ 60 (10%)			

Description of complications during second stage of labour

Increased duration of the second stage of labour (w3, c3).

Ante partum haemorrhaged during the second stage of labour before delivery of the infant (w2, c0).

Shoulder dystocia (w2, c2).

Increased duration of the second stage of labour with a persistent occipito posterior position and fetal distress (w0, c1)

Outcome	n (%)	RR	CI	p =
Had complications during the third stage of labour.				
Water	0/60	Undefined		
Control	3/60			

Description of complications during the third stage of labour

Three women in the control group experienced a post partum haemorrhaged > 500 mls during the third stage of labour.

There was no statistical difference in the duration of the second stage of labour or complications experienced during this stage. Duration of the second stage longer than two hours was recorded as a complication (w3, c3). One woman in each group needed a vacuum assisted delivery because of the increased duration of the second stage with no

progress. A caesarean section was done on one woman in the control group who experienced an increased duration of second stage due to a persistent occipito posterior position that caused fetal distress.

The duration of third stage of labour showed a statistically significant difference between the median duration in minutes of the two groups (w10 vs c7). Only one woman in the control group had a third stage duration of longer than 30 minutes. Only three women in the control group suffered a post partum haemorrhaged of > 500mls. These women all received an intravenous line with 2.5% dextrose saline with an additional 20 IU of Syntocinon added to the infusion.

The median duration of randomization till delivery was similar (w30.5min vs c30min) and there were no differences in the median blood loss (w200mls vs c200mls). Blood loss was collected in a stainless steel receiver starting directly after the birth of the baby (control group) or once the bath was emptied for the water group.

Slight meconium stained liquor (MSL) was noted in 13 of the women. As there was no evidence of thick MSL these women were entered into the trial. The infants' oro-pharynx was suctioned once the baby was lifted out of the water. If the baby was born out of the water it was suctioned at delivery of the head. Paediatricians were called to attend the deliveries of all the women who had MSL. Direct laryngoscopy was used to visualise the presence of meconium at or below the level of the vocal cords. No infant had visible meconium at or below the level of the vocal cords.



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One woman in the water group had her membranes ruptured for longer than 24 hours by the time of delivery. No complications were noted and she did not receive any antibiotics. The HIV status of all women was not known. Because of the possible increased risk of vertical transmission of HIV to the neonate, artificial rupture of membranes was discouraged and left till onset of the second stage of labour. One woman in the water group started pushing the moment she got into the water and the membranes were ruptured in the water with slight difficulty after the head was delivered.

4.9 Additional neonatal outcomes

Comparison of neonatal outcomes between women randomly allocated to deliver in water or not, showed no significance differences (Table 4.5). About 1/3 of all the babies born had a cord present around their necks at delivery (w38% vs c29%). Less than 10% had the cord so tightly around their necks that it could not be slipped over their heads as is the normal procedure, and it had to be cut before delivery of the body (w10% vs c6%). The nuchal cords of six babies in the water group were cut from around their necks while immersed. Only two babies had an Apgar score less than seven at five minutes (w3% vs c0%). Similar proportion of neonates had a temperature of less than 36,2°C at one minute after birth (w9% vs c 9%). Although the proportion of neonates with an increased temperature at one minute after delivery was low, the water group had a three times greater incidence of having an elevated temperature of greater than 37.5°C (w14% vs c5%). More than 40% of the infants had a cord arterial blood gas pH of less than 7.2 (w21% vs c 24%), however only a few neonates required resuscitation with oxygen (w6% vs c3%). A doctor on the paediatric call list was called to attend eighteen of the deliveries (w8 vs c10).

The reasons for their attendance were when meconium was noted in the amniotic fluid (w7 vs c5), neonatal respiratory distress (c1), decreased fetal heart rate on the monitor before delivery (c2) and to care for the infants after assisted delivery or caesarean section (w1 vs c2). After assessment by the doctor some of the infants were admitted to the neonatal nursery for observation (w3 vs c5).

Table 4.5 Additional neonatal outcomes

Comparison of additional neonatal outcomes expressed as percentages, relative risk and 95% confidence interval (CI)

Outcome	Water	Control	RR	CI	p =
Cord around the neck at delivery	23/60 (38%)	17/59 (29%)	1.33	0.80 - 2.22	0.365
Cord cut before delivery of the body	6/60 (10%)	4/59 (6%)	1.48	0.44 - 4.96	0.743
Apgar < 7 @ five minutes	2/60 (3%)	0/59 (0%)	Undefined		

Outcome	Water	Control	RR	CI	p =
Temperature at one minute post delivery					
< 36,2 °C	5/55 (9%)	5/54 (9%)	0.98	0.30 - 3.20	1.000
> 37.5° C	8/55 (14%)	3/54 (5%)	2.62	0.73 - 9.35	0.215
Outcome					
Resuscitated	4/60 (6%)	2/60 (3%)	2.00	0.38 - 10.51	0.339
Outcome					
Cord ABG	Water	Control	RR	CI	p =
< 7.2	12/57 (21%)	14/59 (24%)	0.89	0.45 - 1.75	0.900
Outcome					
Paediatrician called to delivery	Water	Control	RR	CI	p =
	8/60 (13%)	10/60 (16%)	0.80	0.34 - 1.89	0.798
Reasons why paediatrician was called					
Meconium stained liquor (w7, 5c).					
Respiratory distress (c1).					
Assisted delivery or caesarean section (w1, c2).					
Decreased fetal heart rate before delivery (c2)					
Outcome					
Admit to neonatal nursery	Water	Control	RR	CI	p =
	3/60 (5%)	5/60 (8%)	0.60	0.15 - 2.40	0.717
Outcome					
Neonatal death	Water	Control	RR	CI	p =
	1/60 (1%)	0/60	Undefined		

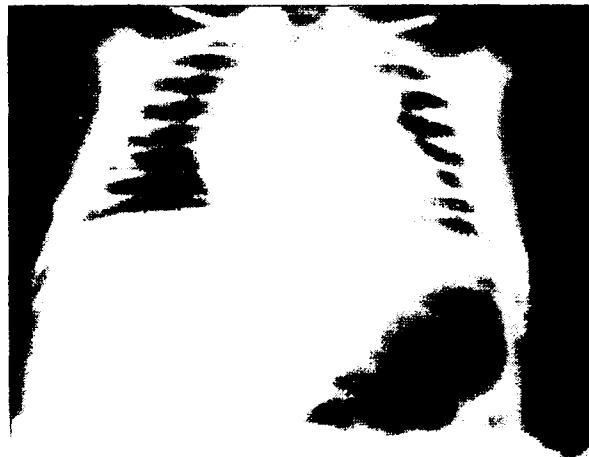
One neonatal death occurred in the water group. The mother was a 25 year old, Zulu speaking woman who had one child. She was diagnosed during an ante natal visit as being HIV positive. She had been admitted to the admission ward 16 days before the delivery for a purulent vaginal discharge and burning on micturition. She had been treated and allowed home. She did not attend the ante natal clinic again and presented to the admission ward again 16 days after her previous admission, in active labour at seven cm cervical dilatation. She was informed about the trial and written consent was obtained. Artificial rupture of membranes (AROM) was performed and thinly meconium stained liquor was observed. She was randomised at full cervical dilatation 30 minutes after AROM and was asked to enter the bath. The duration of the second stage was five minutes. The cord was not around the baby's neck and a very easy birth was conducted by a student midwife under the supervision of MdJ. The baby was immediately suctioned according to the hospital protocol for meconium stained liquor and no meconium was noted in the larynx. The Apgar scores were 9/10, 10/10 and 10/10 at one, five and 10 minutes after delivery. The mother and baby were moved to the postnatal area for observation. The baby was kept in a crib next to the mother and the baby was heard crying and seen to be

breastfed and nappy changed by VCN two hours after the delivery. Two and a half hours after delivery the mother and baby were transferred to the postnatal ward. On handover at the postnatal ward the baby was observed not to be breathing. The baby was rushed to the paediatric ward for resuscitation, which was unsuccessful. The importance of an autopsy was explained to the parents, but consent was refused. Neonatal creatine reactive protein (22,5) and white cell count (18,9) were abnormally elevated and haemoglobin (9,8mg%) and platelets (129) abnormally decreased. Red cell fragmentation was also noted. Chest x-rays (Figure 4.14) were examined independently by a radiologist and paediatrician who were unaware of the group allocation or possible cause of death. Both diagnosed that the lungs showed possible infective changes or hyaline membrane disease. In view of the preceding clinical history and the laboratory findings the most likely cause of death was intrauterine infection.

4.10 Summary

The results of this study show that the use of water during birth significantly reduces the mothers' perception of the pain experienced compared to what they expected it to be, and enhanced their satisfaction with their ability to cope with labour. Therefore the first experimental hypotheses can be accepted. No differences were noted in trauma to the birth canal and therefore the second hypotheses need to be rejected. No adverse maternal effects were noted. The primary hypotheses of this thesis did not include neonatal outcomes, but one neonatal death occurred in the water group. The results will be discussed in relation to the previous literature in chapter two.

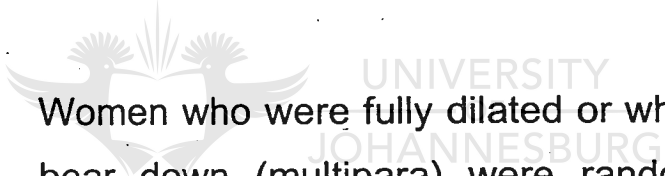
Figure 4.14 Chest x-ray of infant



CHAPTER 5**DISCUSSION, IMPLICATIONS, CONCLUSIONS AND GUIDELINES
FOR THE USE OF IMMERSION IN WATER DURING BIRTH**

5.1 Introduction

The primary objectives of this thesis were to evaluate the effects of immersion in water during the second stage of labour on maternal experience and trauma to the birth canal. The second objective was to set guidelines for the midwife in order to conduct or not to conduct deliveries under water.



Women who were fully dilated or who had the urge to bear down (multipara) were randomly assigned to deliver immersed in water or in the conventional way. The effects of the intervention were examined by comparing the outcomes ^(Chapter four) between the group who received the intervention and the group who did not.

The cultural upbringing of women influences their experience of labour (Hayes, 1997:77). Many cultures considered parturition to be a secretive matter, which needs to be hidden from view and not to be discussed

with other people (Hayes, 1997:78). Women who are not able to communicate fluently in the language of their care givers, may not express their birthing experiences clearly. Although care during labour and birth is mainly service orientated it was important that we only enrolled women onto the trial that could read English or Afrikaans. Not only do we acknowledge the diversity of the different cultures in this trial, but we also recognise the differences among individuals even if they were from the same cultural background.

As far as it is known this is the first randomised controlled trial which has examined the effects of immersion in water during the second stage of labour. The candidate use Revman 3.01 to meta-analyse studies which compared the use of water during labour or birth with conventional births. It must be noted that most of the articles referred to in these meta-analyses are **not** randomised trials, therefore the conclusions of the meta-analyses must be interpreted with care, and thoughtful consideration should be given before it is incorporated in the practice of midwifery.

This chapter will discuss the results, acknowledge the limitations, set guidelines for the implementation of the use of water immersion during the second stage of labour and make recommendations concerning further research.

5.2 Maternal experience during the second stage of labour

It is claimed that physiologically, warm water should relieve pain and relax muscles (Zimmermann, et al. 1993:7), and that it also provides mental relaxation by breaking the vicious circle of tension → anxiety → increased pain → increase tension (Eldering & Selke, 1996:26). Burns and Greenish (1993:315) reported that most women commented on how relaxed they felt on first entering the water. Cammu, et al. (1994:470) noted similar observations, where 80% of women who used the water during the first stage of labour found it very soothing and all except one claimed that water relaxed their body.

More women who used water during labour and / or birth, rate their overall birth experience as excellent (w87%) compared to those who chose an epidural for

pain relief (c70%) (Haddad, 1996:107). We requested the women to describe how they felt during the pushing stage of labour. Our results do not support the concept of intense relaxation when immersed in water during the second stage of labour. The results showed that nearly half of the women who delivered in the water felt moderately to very tense (w49% vs c46%). It is acknowledge that the use of immersion in water was a foreign idea for most of the women in our study. Women in the trial were only allowed to enter the bath once they were fully dilated. The fear of the unknown bathing environment together with the fear of pushing may have contributed to the fact that the women in our trial were not relaxed on entering the bath.

It is reported that women, who have given birth before, experience more pain during the second stage of labour than primiparous women (Haddad, 1996:103). This could be due to the fact that more primiparous woman in their survey requested analgesia during the first stage of labour. None of the women in our trial had epidural analgesia. We found that slightly fewer multiparous women in the immersion group, found this birth to be more difficult compared to their previous birthing experienced (w20% vs c25%). The majority of

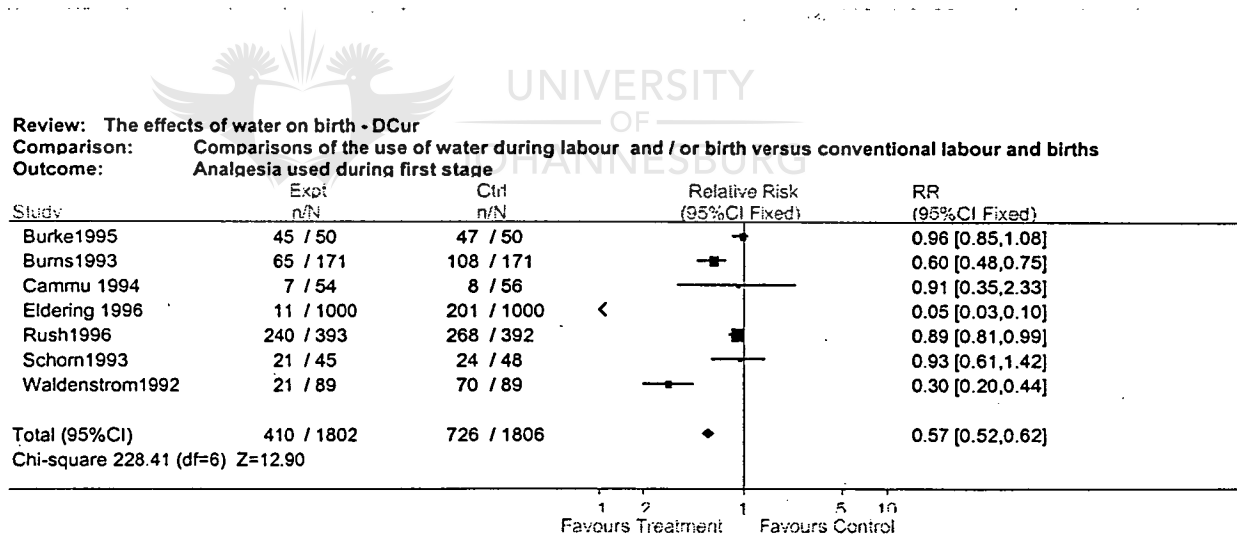
them expressed that if they would be given the opportunity they would like to deliver their next baby in a bath tub (w90% vs c82%).

Haddad (1996:103) claims that approximately 66% of women found that water is an effective pain relief method. Nightingale (1996:66) reported that most women who deliver in water experience less perineal pain during the second stage of labour and that is why the deliveries are more controlled. There were no significant differences in our trial when women were asked to describe the pain they experienced during the pushing stage of labour. Similar proportions experienced very painful or unbearable pain during the pushing stage of labour (w50% vs c48%).

Immersion in water may provide a temporary pain stabilising effect (Cammu, et al. 1994:470), which may be a very effective form of pain relief as fewer women made use of pharmacological analgesia when they used a water tub during labour (Milner, 1988:39). Eldering and Selke (1996:26) found a significant difference regarding the need for analgesia during the first stage of labour when women were immersed in water or not (w1.1% vs c 20.1%). The meta-analyses

of seven studies comparing the use of water during labour with conventional labours showed a statistically significant decrease in the use of analgesia during the first stage of labour (Figure 5.1). This could partly be due to many units who do not offer women a choice of analgesia when they do use water as a method of pain relief. The women in our trial were only randomised at the onset of the second stage of labour. Slightly more women in the water group received analgesia (Pethidine) during the first stage of labour, but this difference was not statistically significant (w32% vs c25%).

Figure 5.1 Analgesia used during the first stage of labour



Paech (1991:395) evaluated women's opinions of various pain relief methods during labour and birth. The use of water as a pain relieving method was not an option in this survey. Significantly more primigravidae reported that the pain they experienced was more than they expected it to be. Women who had epidural analgesia reported that they experienced less pain than they expected.

Significantly more women in our trial experienced their pain to be less painful than they had expected it to be when they were immersed in water (w57% vs c28%). This is in agreement with the results of Haddad (1996:100) where they found that the majority of women who used water during labour and / or birth found their pain to be less painful than they expected it to be.

Half of the women expressed dissatisfaction with their birthing experiencing in a survey done on 1 000 women who delivered at the King Edward Memorial Hospital in Australia (Paech, 1991:395). There were no differences in the rate of dissatisfaction between those women who received epidural analgesia and those who received other methods of analgesia.

There is a significant association between assisted deliveries and maternal dissatisfaction, in those women who had assisted deliveries versus those who had spontaneous deliveries (Paech, 1991:395; Ranta, Spalding, Kangas-Saarela, Jokela, Hollmen, Jouppila and Jouppila, 1995:64).

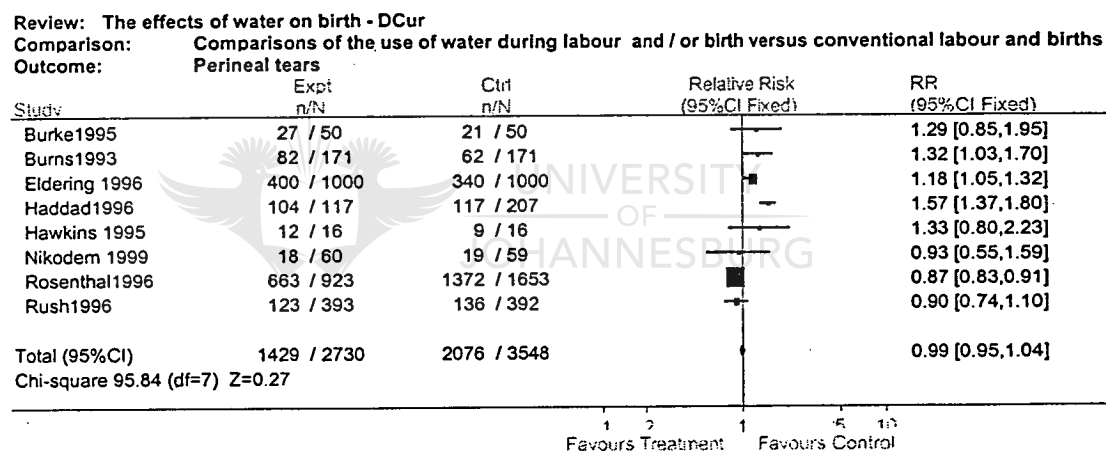
Women who chose to deliver in water were more likely to be satisfied with their births than those who had an epidural (Haddad, 1996:108). Women who delivered in water in our trial were significantly more satisfied with the way they felt they had coped with their birth (w78% vs c58%), but similar proportions found pushing to be very difficult (w15% vs c16%). Interventions such as episiotomies (w5% vs c6.7%) and assisted deliveries (one in each group) were low during our trial.

5.3 Perineal trauma to the birth canal

Our second primary outcome was to observe trauma to the birth canal. Proponents for water births claim that water softens the perineal muscles allowing more stretch by increasing the elasticity to the perineum and therefore decreases perineal injury. This statement is

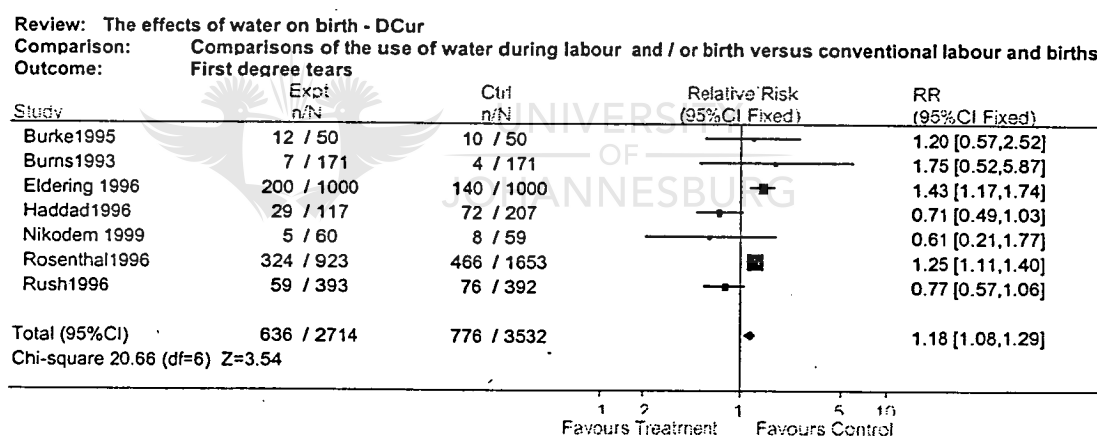
not supported by the meta-analyses of eight studies, which show that there are no significant differences in the overall incidence of perineal tears with a tendency for fewer tears when women use water (Figure 5.2). Our results show little difference in perineal trauma between the two groups (w30% vs c32%).

Figure 5.2 Perineal tears



First degree tears are reported to occur in between 13% - 19% of women (Nodine & Roberts, 1987:123, Figure 5.3). First degree tears occurred significantly less when women gave birth in the conventional manner (Figure 5.3). The overall occurrence of first degree tears was slightly less in our trial (10.9%) with fewer first degree tears in the group of women who were immersed in water (w8.3% vs c13.5%).

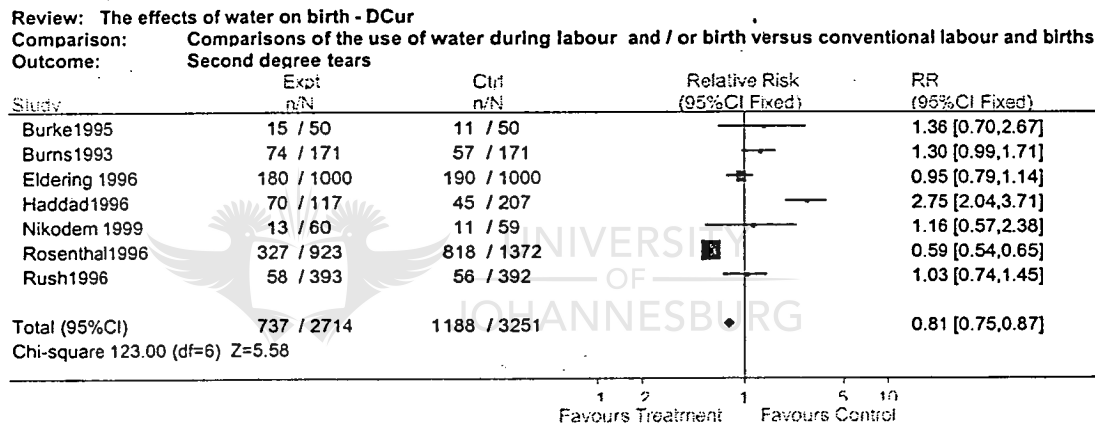
Figure 5.3 First degree tears



Second degree tears are usually observed in less than 20% of women (Nodine & Roberts, 1987:123; Figure 5.4). The results from our trial showed a similar incidence (w21.6% vs c18.6%). Meta- analyses of

seven studies showed a significant decrease in the occurrence of second degree tears when women used water during labour or birth, but it must be noted that one comparative study (Rosenthal) carried 64% of the weight in the analysis (Figure 5.4).

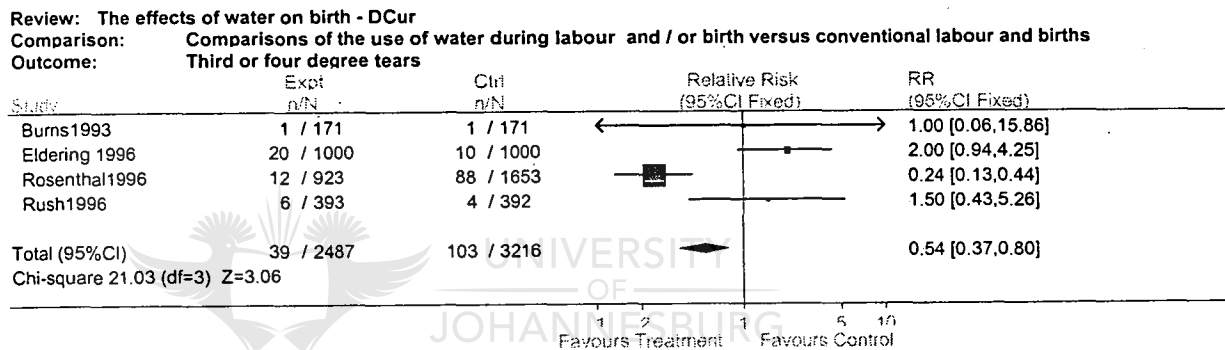
Figure 5.4 Second degree tears



Extension of episiotomies into third and fourth degree tears may occur in up to 15% of primiparous women (Klein, *et al.* 1992:403). Not one woman in our trial experienced a third or a fourth degree tear. Four trials comparing the use of water during labour or birth reported on the incidence of third or fourth degree tears. The risk of women sustaining a third or fourth degree tear is nearly three times greater if they

delivered in the conventional way (Figure 5.5). The comparative study of Rosenthal contributes 80.8% to the weight of the outcome in the meta-analysis, but the incidence in their conventional group was still overall low (5%).

Figure 5.5 Third and fourth degree tears

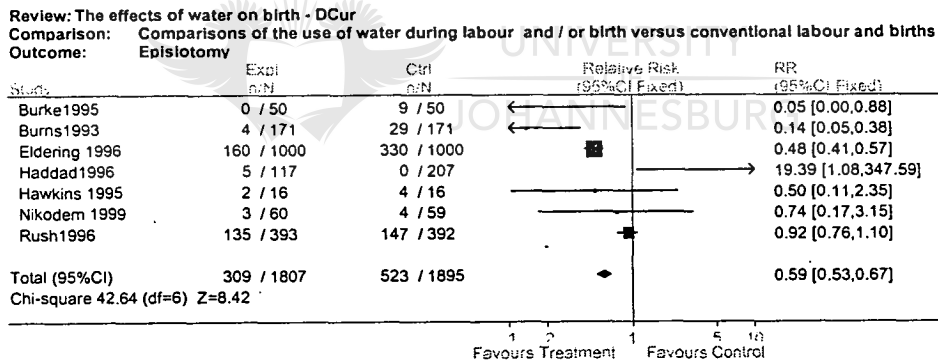


The research midwives followed a strict regime for the performance of episiotomies during the second stage of labour and their overall episiotomy rate was low, with no differences between the groups in episiotomy rates (w5% vs c6.7%). When we look at the meta-analyses of seven studies, we found that the relative risk of a woman receiving an episiotomy when labouring or birthing in the conventional way is nearly double what it would be if she would labour or deliver in water. The meta-analyses showed a statistically

significant decrease in the episiotomy rate when women laboured or birthed in water compared to conventional labours and births (Figure 5.6).

This finding may support the hypothesis that fewer interventions are used when women make use of water immersion during labour and / or birth.

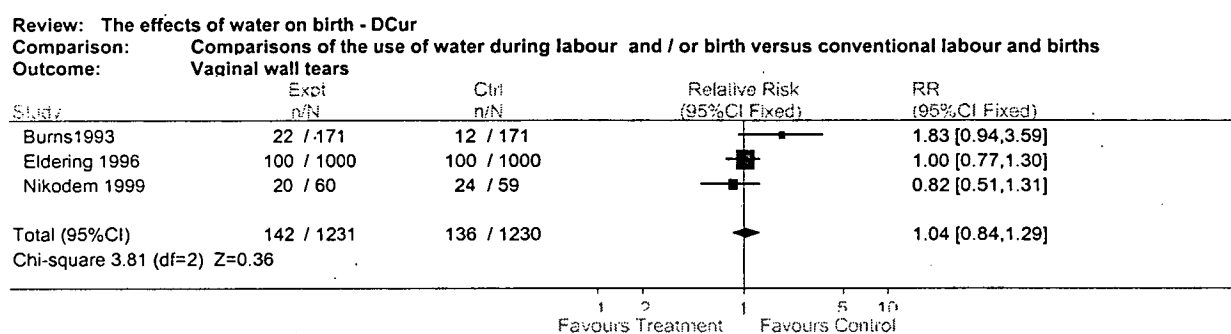
Figure 5.6 Episiotomies



Meta-analyses of three studies showed no statistically significant differences in the frequency of vaginal wall lacerations (Figure 5.7). The overall incidence of vaginal tears was higher in our trial, with slightly fewer

women in the water group experiencing vaginal wall lacerations (w33% vs c40.6%), but this difference was not statistically significant.

Figure 5.7 Vaginal wall lacerations



Klein, et al. (1992:403) reported that labial tears occur in 30% and para-urethral tears in 22% of women who give birth vaginally. Women in our trial were encouraged to use an upright posture when birthing, and this could have contributed to the slightly higher overall incidence in labial (w40% vs c37.2%) and para-urethral tears (w40% vs c45.7%), but there was no statistical difference between the two groups.

Perineal trauma that needs suturing is as low as 17.3% in some countries (Doherty & Cohen, 1993:532). Adam (1996:86) compared the need for

perineal suturing when women were allowed to use water immersion or not, and found that those who delivered in water needed less suturing of perineal lacerations (w48% vs c69%). The proportions of women who needed suturing in our trial were the same (w22% vs c22%), but the overall incidence was lower than that of Adam (1996:86).

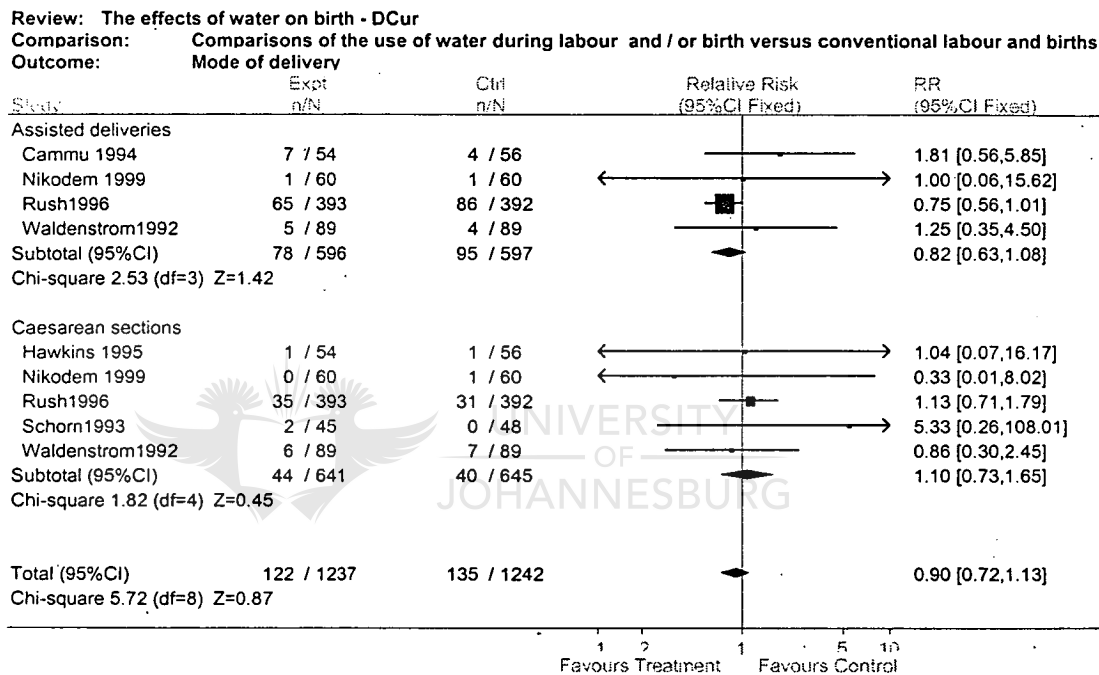
Post partum perineal pain was evident in 15% of women who had a second degree tear and in 38% of women who had an episiotomy when they used water immersion during labour and / or birth (Haddad, 1996:105). When we asked the women in our trial to rate their perineal pain within 24 hours after their delivery we found that fewer women in the water group said that their pain was unbearable (w3% vs c5%) or a lot (w11% vs c19%), but these differences were not statistically significant.

5.4 Additional maternal and neonatal outcomes

Meta-analyses showed no statistically significant difference in the need for assisted deliveries or the rate of caesarean sections in the comparative studies (Figure 5.8). One woman in each group of our trial

needed a vacuum assisted delivery and one woman in the control group needed a caesarean section.

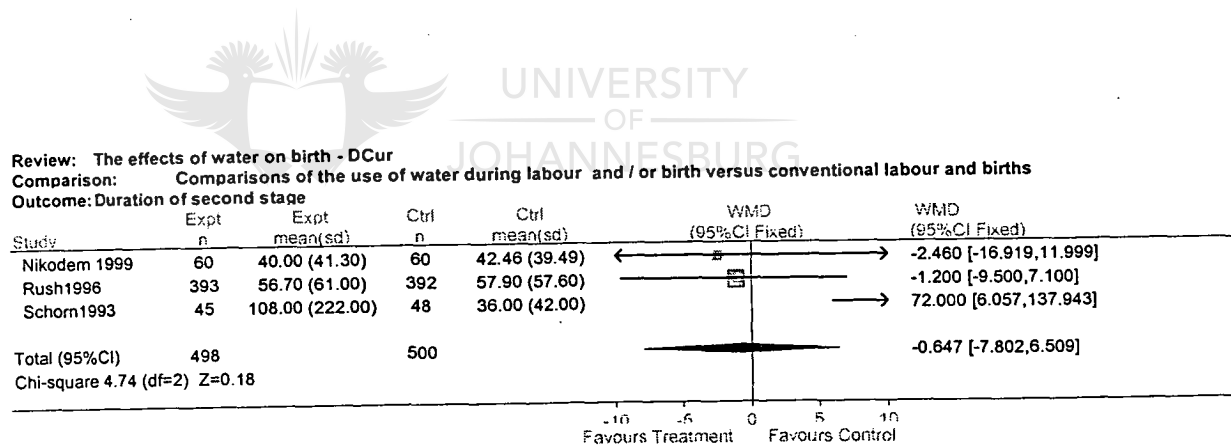
Figure 5.8 Assisted deliveries or caesarean sections



In contrast with other references in which the duration of the second stage of labour was reported to be significantly longer (Schorn, *et al.* 1993:339) or shorter (Lenstrup, *et al.* 1987:709) when women used water during labour or birth, compared to a conventional birth, our results showed no statistically significant difference in the median duration of the second stage

of labour (w28 vs c30 minutes). Rush, *et al.* (1996:141), also did not find any differences between the duration of the second stage of labour when women used water during labour or not. A meta-analysis of three studies comparing women who used water during labour and / or birth with conventional labour and birth showed that the duration of second stage of labour was similar between the two groups (Figure 5.9).

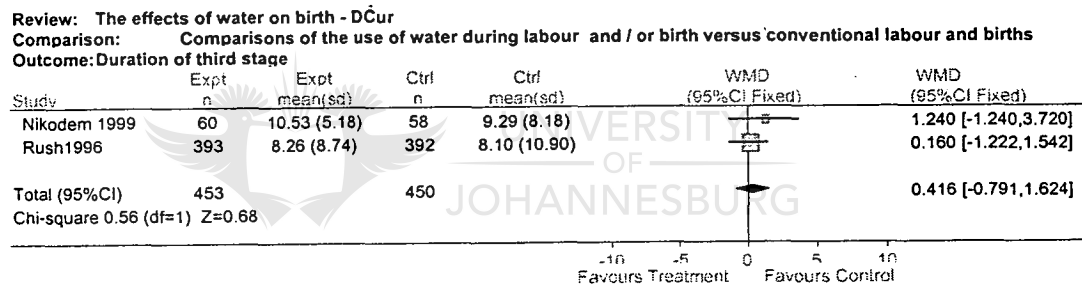
Figure 5.9 Duration of the second stage of labour



Women who delivered in water in our trial stayed sitting upright in the bath, but the bath was emptied before the placentas were expelled. Women in the control group were also encouraged to stay upright during delivery of the placenta. All women received 10IU of Syntocinon IMI after delivery of the infant. The fact that the median duration of the third stage of

labour in the women who delivered in the bath was significantly longer than in the conventional group (w10 vs c7 minutes) may be due to the influence of warm water still having an atony effect on the uterus. The meta-analyses of two trails comparing the use of water in labour and / or birth showed no differences in the duration of the third stage of labour (Figure 5.10).

Figure 5.10 Duration of the third stage of labour



The median time in minutes from randomisation to delivery was very similar between the two groups (w30.5 vs c30). From this we know that women who were submerged in the water spent a median time of 30 minutes in the water. The range was from three minutes to 210 minutes. No other study examined the duration in water during the second stage of labour, but most women do not prefer to stay in the water for

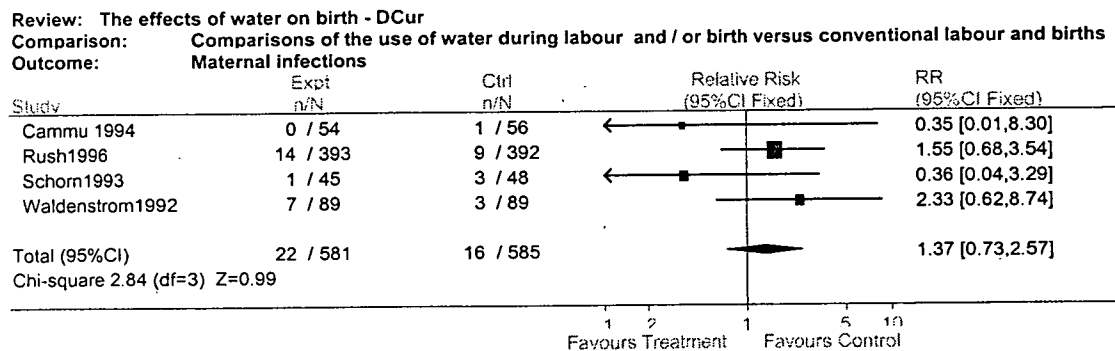
longer than two hours (Eldering & Selke, 1996:261; Schorn et.al., 1993:338; Uller, 1996:126).

Post partum haemorrhage is a major cause of morbidity and mortality even in countries where the active management of the third stage of labour is practised (use of uterotonics). The severe post partum haemorrhage rate (>1000mls) with routine oxytocic use varies between 2-3% (Prendiville, Elbourne & Mc Donald, 1999).

Our results did not confirm the fear that warm water may induce hyperaemia and relaxation of smooth muscles resulting in atony of the uterus, with an increase in post partum haemorrhage. Only three women in the control group had a measured blood loss of more than 500 mls. Eldering and Selke, (1996:29) showed that similar proportions of women had a blood loss of more than 300 mls (w12% vs c12%) and Nightingale (1996:68) reported only a 0.3% incidence of post partum haemorrhage more than 1000 mls when women used water during labour or birth.

Only a few complications occurred during the second and third stage of labour in our trial. We did not evaluate maternal infections in the post partum period as the women in our trial went home soon after delivery and would visit their health clinics in their suburbs for post natal complications. Meta-analyses of maternal infections in the post partum period did not show a statistical difference between the two groups but there is a tendency towards more maternal infections in those who delivered in water (Figure 5.11).

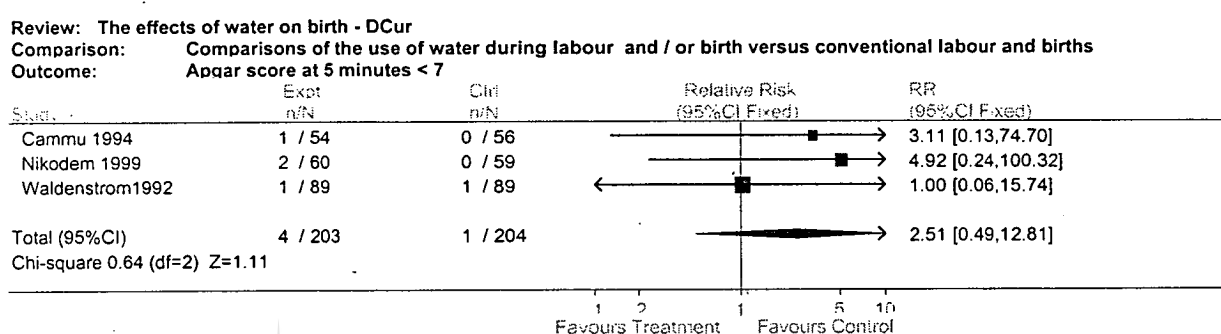
Figure 5.11 Maternal infections



Although the difference in the meta-analyses is not significant, there is a tendency towards an increase in frequency for Apgar scores of less than seven, at five minutes post delivery if women use water immersion during labour and / or birth (Figure 5.12). Our results

are in agreement with the meta-analyses (w3% vs c0%). Eldering and Selke (1996:28) and Nigtingale (1996:68) found no differences in the frequency of infants who presented with low Apgars scores.

Figure 5.12 Apgar score



Only a few infants needed resuscitation (w6% vs c 3%) or admission to special care units (w5% vs c 8%). Neither our results nor those of the meta-analyses showed statistically differences in the need for resuscitation or admission to neonatal units (Figures 5.13 & 14).

Figure 5.13 Infants resuscitated

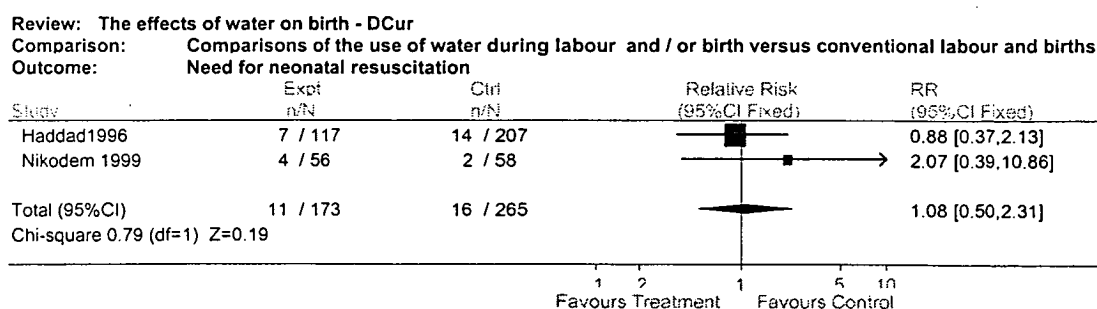
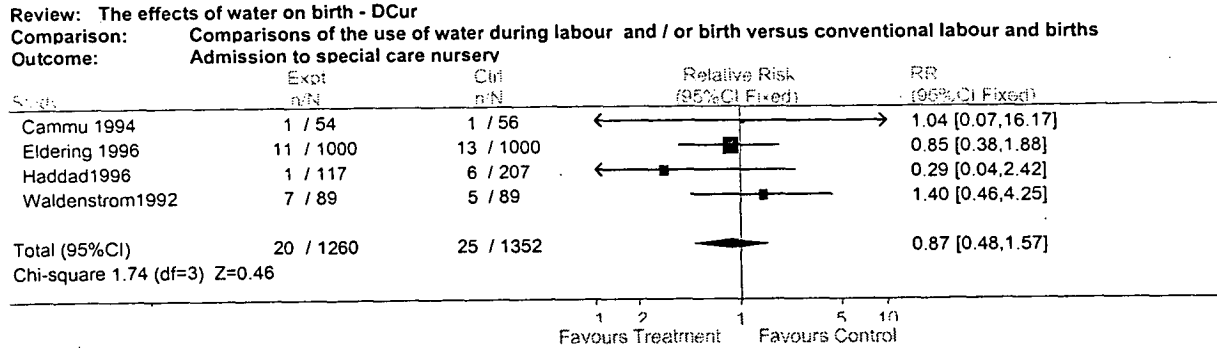


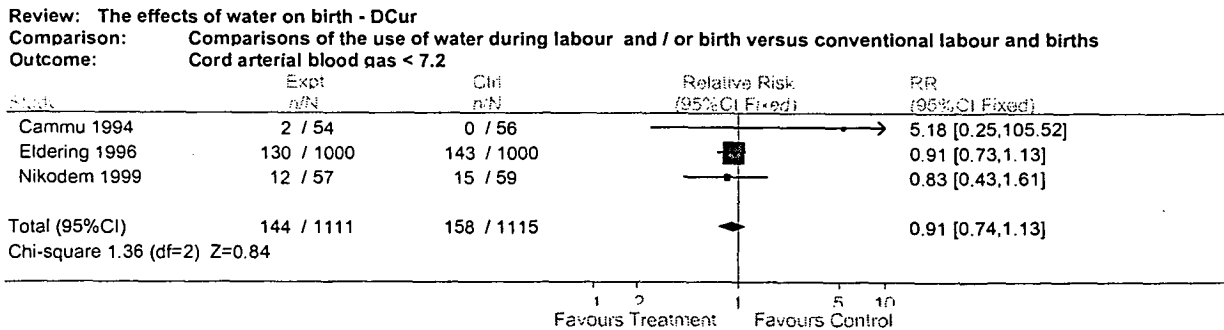
Figure 5.14 Admission to neonatal unit



Meta analyses showed that slightly fewer infants had an arterial cord blood gas pH of less than 7.2 when women laboured and / or delivered in water (Figure 5.15). Our trial showed the same tendency (w21% vs c24%).



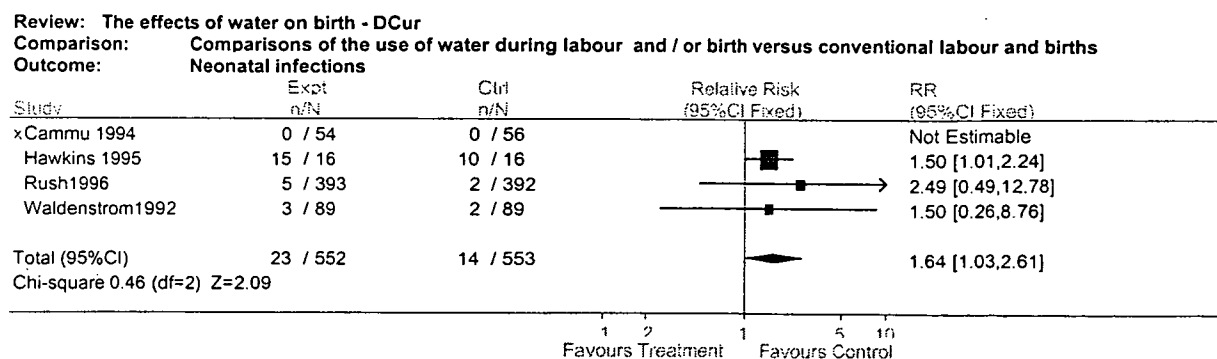
Figure 5.15 Cord arterial blood gas pH



In our trial all women delivered in an upright posture. The position women used when they gave birth in the conventional way was not mentioned in the studies used in the meta-analyses. It may well be that women were not in an upright posture during the second stage of labour when they delivered and they may have experienced decreased placental flow due to aortic pressure in the recumbent position during the second stage of labour.

Neonatal morbidity and mortality are major concerns for those opposed to delivering women in water. Meta-analyses of four studies showed that newborns have a significantly higher risk of becoming infected after being born in water (Figure 5.16).

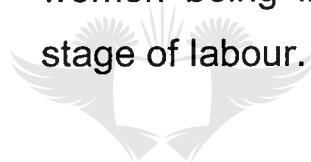
Figure 5.16 Neonatal infections



We reported on one neonatal death that occurred after the woman delivered in water. The reported perinatal deaths in the UK of 12 babies associated with water births is unacceptably high for a population assumed to be at low risk for perinatal infant mortality (Alderdice *et.al.* 1995:837).

5.5 Implications for research

There is no clear evidence available to help us make a clear decision on whether to promote or discourage women being immersed in water during the second stage of labour.

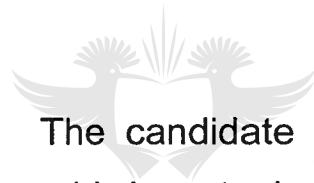


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The greatest concern is still around the possible disadvantages for the fetus or neonate. We therefore recommend the need for collaboration in a large randomised control trial comparing the effect of immersion in water during the second stage of labour comparing between the use of saline and normal tap water to evaluate the effect of possible fresh water inhalation on infant morbidity and mortality rates.

5.6 Implications for midwifery practice

The question arises whether there is a place for warm water births in modern midwifery practice? If there were a place, what would the midwives' role be? To answer this question midwives need evidence based medicine to make informed decisions about their practice. At this stage there is no evidence available to accept or disprove the value of immersion in water during the second stage of labour. We still do not know what are the possible effects that may cause injury to the mother or her infant.



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The candidate has compiled a set of guidelines for midwives to help women make an informed choice concerning the use of immersion in water during the second stage of labour, based on the best available evidence at present.

5.7 Guidelines for birthing in water, based on the best available evidence at present

Pre natal education.

Women should be informed that the use of a water bath is available on a first come first serve basis if the hospital has only one bath for delivering. They should also be informed that only low risk women will be allowed to use the bath and that they will be asked to get out of the bath at any stage during their birth if complications occur. The available possible maternal, fetal and neonatal benefits (chapter two) must be discussed with the woman and her partner or support person.

Exclusion criteria.

Women who are at a high risk of experiencing complications at birth should not be allowed to deliver in water. The exclusion criteria for midwifery care identified are:

grande multiparae

poor obstetric history (perinatal loss or handicapped child).

major medical complications eg. anaemia (Hb < 9mg%), cardiorespiratory disease, renal disease, diabetes

rhesus and other antibody sensitisation

moderate to severe pre-eclampsia

trial of pelvis

rupture of membranes > 24 hours

significant antepartum haemorrhage

multiple pregnancy

preterm labour (< 37 completed weeks)

postterm labour (> 42 completed weeks)

severe impaired fetal growth

macrosomia (estimated weight > 4000g)

abnormal presentation or lie

suspected fetal compromise e.g. poor fetal movements, fetal heart decelerations on cardiotocograph or on auscultation.

pyrexia > 37,9°C

thick meconium stained liquor


prolonged labour or poor progress during first stage of labour or any doubt regarding normal vaginal delivery

elderly primigravidae, women who had a previous caesarean section and heavily sedated women may be allowed to use the bath if an obstetrician is present in the delivery room.

Qualifications and protection of personnel

Birth attendants should be registered midwives or, medical doctors experienced in delivering infants while women are immersed in water. Any other person e.g. recently qualified midwives, midwifery students or partners should only be allowed to assist with the delivery under direct supervision of an experienced birth attendant. Birth attendants should not be allowed in the tub with the parturient and should wear long water tight gloves while conducting the delivery.

Birth room

The logo of the University of Johannesburg, featuring two stylized birds facing each other with a shield between them, and the text 'UNIVERSITY OF JOHANNESBURG' in a light grey font.

The birth room should be kept at about 23°C. Emergency equipment must be available in the room and checked to be in functional order. A step should be available for the woman to get in and out the bath and a light directed at the introitus to enable the birth attendant to observe the emergence of the infant. Warm towels to cover the mother and the infant and a sieve to remove faeces or debris from the tub should also be available.

Specifications for Water Tubs

Bath tubs should be made of durable, nonporous material and should not have water jets, with a quick outlet draining facility. The bath should be deep and wide enough so that the woman can be submerged at least up to her breasts when she is in a sitting position. At present salt should be added to the bath water to obtain a normal saline solution, which is in theory physiologically less harmful to the infant in case of water inhalation.

Cleaning of bath before and after each delivery

Baths should be scrubbed with approved detergents and rinsed with antiseptics before and after every delivery. The bath should be kept dry if not in use. Regular bacterial swabs should be taken from the inlet taps, the side and bottom of the tub and the drains, and sent for analysis.

Water temperature

The temperature of the water should be kept between 33°C and 37°C depending on the ambient temperature of the delivery room. The temperature of the water must be taken at least 12 cm from the surface.

Maternal and fetal vital signs

Maternal blood pressure, pulse and temperature should be monitored at least half-hourly during the second stage of labour. Hydration and urine output could be monitored hourly. Fetal heart rates should be monitored intermittently, before, during and after each bearing down effort during the second stage of labour.

Position and bearing down efforts during the second stage of labour.

Women should be allowed to find a comfortable birthing position. Her own instinctual bearing down efforts should be reinforced and encouraged.

Delivering of the infant.

Support to the perineum or flexion on the fetal head is not encouraged. The infant is brought to the surface directly after birth and the cord is clamped and cut. Nuchal cords can be managed with reduction over the fetal head, or with double clamping and cutting while in the water by a skilled birth attendant. If the cord appears to be short, do not pull on it when lifting the

baby out of the water. The mother could be asked to hold the infant with its head above the surface while the cord is double clamped and cut or she can be asked to stand up out of the water. The infant is not allowed to be submerged with its face under the water once it has surfaced.

If meconium stained liquor is noted at the time of delivery the infant is brought to the surface but not stimulated to breathe until the mouth and oropharynx have been suctioned. The mother can assume any position as long as the baby is out of the water for the rest of the delivery. The baby should be dried in a warm towel if it is lifted completely out of the water or while the placenta is delivered.

Third stage of labour

It is recommended that the water is let out and the woman is covered with a warm towel before the placenta is expelled. The blood loss should be measured, and the women should be observed for any possible signs of an amniotic fluid embolus.

Record keeping and medical legal hazards

Accurate records should be kept as part of the normal audit process. If any problems are anticipated the woman should be lifted out of the water and a medical officer should be called to assist.

5.8 Summary

Warm water does not appear to help women relax or to decrease their experience of pain if they only enter the bath during the second stage of labour. The use of water during the second stage of labour may decrease the use of interventions such as episiotomies. Women who delivered in water are significantly more satisfied with their birthing experience. Meta-analyses of this study and previous non-randomised studies showed a significant decrease in the incidence of episiotomies, second, third and fourth degree tears if women delivered in water, although more women may experience first degree tears.

Maternal and neonatal morbidity is increased when women deliver in water. The possible harmful effect of inhalation of fresh water by an infant is not resolved and a large collaborative randomised controlled trial is recommended.

It is recommended that the routine use of immersion in water during the second stage of labour should only be offered to women by competent birth attendants, who follow the proposed guidelines set out above, until clear evidence is available on the possible beneficial or harmful effects of immersion in water during the second stage of labour on the mother and her infant.

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ANNEXURE

**Annexure 1a Application to committee for research on
human subjects (CRHS)**

TO: COMMITTEE FOR RESEARCH ON HUMAN SUBJECTS

12 November 1993

Dear Sir/Madam,

Please receive herewith a copy of ethics approval form.
Application to P & T Committee has been made and we are waiting for the
answer.

With kind regards,

Yours Sincerely,



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CHERYL NIKODEM
pp PROF GJ HOFMEYR

Annexure 1c Revised information sheet

TO: COMMITTEE FOR RESEARCH ON HUMAN SUBJECTS

29 March 1994

Dear Prof. Cleaton-Jones

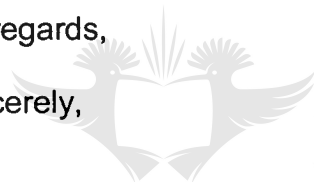
RE Protocol number M940214

The effects of water on labour and birth.

Please receive herewith a copy of revised information sheet as requested by the CRHS as well as consent from P & T Committee.

With kind regards,

Yours Sincerely,



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CHERYL NIKODEM

**Annexure 2a Application for clearance from the
Pharmaceutics and Therapeutics Committee**

Dept. of Obstetrics & Gynaecology
Coronation and J G Strijdom Hospitals
and University of the Witwatersrand

Coronation:

Private Bag, Newclare 2112
FAX (011) 477 4117; TEL (011) 673 4200

J G Strijdom:

Private Bag X47, Auckland Park 2006
FAX 726 5425; TEL 489 0761

Dr S Levin
P & T Committee
J G Strijdom Hospital

THE EFFECTS OF WATER ON LABOUR AND BIRTH;
A RANDOMISED CONTROLLED TRIAL

We would like to apply for a clearance certificate from the
Pharmaceutics and Therapeutics Committee of J G Strijdom Hospital and
Coronation hospital for doing a randomised controlled trial on the effects of
water on labour and birth.

The committee of research on human subjects (medical) requests P & T
Committee clearance to be submitted with ethics application.

Please receive herewith a copy of the proposal for the
randomized controlled trial.

Yours sincerely

G.J. HOFMEYR
Professor and Head
Dept. of Obstetrics & Gynaecology
Coronation and J G Strijdom Hospitals
and University of the Witwatersrand
1994-02-09.

V.C. Nikodem
Research Midwife / Lecturer

Annexure 3a Application for hospital consent

Dept. of Obstetrics & Gynaecology
Coronation and J G Strijdom Hospitals
and University of the Witwatersrand

Coronation:

Private Bag, Newclare 2112
FAX (011) 477 4117; TEL (011) 673 4200

J G Strijdom:

Private Bag X47, Auckland Park 2006
FAX 726 5425; TEL 489 0761

Dr Richter
Superintendent
CORONATION HOSPITAL

The effects of water on labour and birth:
A randomized controlled trial

I would like to apply for permission to do the above mentioned study at J G Strijdom Hospital and Coronation hospital after it has been cleared by the P & T Committee and the University Ethics Committee.

Please receive herewith a copy of the protocol for the trial.

Yours sincerely

G.J. HOFMEYR
Professor and Head
Dept. of Obstetrics & Gynaecology
Coronation and J G Strijdom Hospitals
and University of the Witwatersrand
1994-02-09.

Cheryl Nikodem
Research Midwife

Annexure 4 Patient information and consent from

J G STRIJDOM HOSPITAL, RAND AFRIKAANS UNIVERSITY DEPARTMENT OF NURSING AND UNIVERSITY OF THE WITWATERSRAND DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY

THE EFFECTS OF WATER ON LABOUR AND BIRTH;
A RANDOMISED CONTROLLED TRIAL

SUBJECT INFORMATION SHEET

Dear Patient

Water bath as a method of pain relief for labour and delivery is available in many countries and has been used for more than two decades.

Several authorities have claimed that the use of a water bath is safe and makes labour and birth easier, but these claims have not been proved scientifically.

We are conducting a study to find out whether birthing can be made easier by allowing women to use the water bath during the delivery. Please will you help us by agreeing to take part in this study. Some of those who take part will have the opportunity to use the water bath during delivery, and others will not. We will ask you to answer a questionnaire one day after the birth of your baby and again 6-weeks after the delivery.

By agreeing to take part in this study, you will help us to be able to determine whether there are alternative ways of pain relieve during labour and delivery, but it may not necessarily be of benefit to you at this time: We will continue to give you the best care we are able to whether or not you agree to take part in this study. If you do agree, you will be free to withdraw from the study at any time if you wish to do so.

We hope you will be able to help us. If you have any questions, please ask.

Consent

I _____ hereby agree

to take part in the water bath study, which has been explained to me by

_____. I fully understand what the study entails, and that I

may withdraw my consent at any time.

Signed: _____

Witness:

Date: _____

Annexure 5 Baseline data collection sheet

The effects of water on birth: A randomised controlled trial.

Baseline questionnaire

University of the Witwatersrand Obstetrics
and Gynaecology Department
Rand Afrikaans University Baseline Questionnaire

Study number

p	m		
---	---	--	--

Researcher's name	Subject's name
-------------------	----------------

Birth date	D	D	M	M	Y	Y	Age		Gest	
------------	---	---	---	---	---	---	-----	--	------	--

Employment when you fell pregnant	Home language
Employed	Unemployed

Present marital status					
Married	Living with boyfriend	Single	Divorced	Widowed	Other

Onset of active labour	MSL									
D	D	M	M	Y	Y		h	None	With AROM	Later

Blood pressure	Puls	Temp	FHR
		°C	

Analgesia								
Peth	Y	N	h	Ate	Y	N	h	

Cervical dilatation	Randomisation						
	D	D	M	M	Y	Y	h

Deliver	Placenta					
D	D	M	M	Y	Y	h

Blood loss

--	--	--

Cord around neck

Y	N
---	---

Cut

Y	N
---	---

Perineum

1	1	2	3	4	E	cs
---	---	---	---	---	---	----

Sut

Y	N
---	---

Vaginal

Y	N
---	---

Sut

Y	N
---	---

Labial

Y	N
---	---

Sut

Y	N
---	---

Cervix

Y	N
---	---

Gender

M	F
---	---

Weight

				g
--	--	--	--	---

Apgar¹

--	--

Apgar⁵

--	--

Apgar¹⁰

--	--

Temp^c

--	--	--

Resus

Y	N
---	---

O₂

Y	N
---	---

Intubate

Y	N
---	---

ABG pH

1	2	3	4
---	---	---	---

Time

1	2	h	1	2
---	---	---	---	---

Nursery days

Y	N	
---	---	--

Maternal complications during the second stage of labour

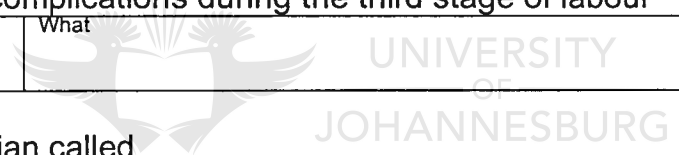
Y	N	What
---	---	------

Maternal complications during the third stage of labour

Y	N	What
---	---	------

Paediatrician called

Y	N	Why
---	---	-----



Annexure 6 Self-administered questionnaire

The effects of water on birth: A randomised controlled trial.

Self-administered questionnaire

University of the Witwatersrand Obstetrics and Gynaecology Department
 Rand Afrikaans University Baseline Questionnaire

Study number

p	m		
---	---	--	--

Researcher's name	Subject's name
-------------------	----------------

How did you feel during the pushing stage of your labour?

Very relaxed	A little tense	Moderately tense	Very tense
--------------	----------------	------------------	------------

The pain that you experienced during the pushing was?

None	Very little	In between	Very painful	Unbearable
------	-------------	------------	--------------	------------

How did you find the pain during the pushing compared to what you expected it to be?

Less painful	The same	More painful
--------------	----------	--------------

How satisfied do you feel with the way you coped during the pushing part of your delivery?

Not satisfied	A little satisfied	Moderately satisfied	Very satisfied
---------------	--------------------	----------------------	----------------

How would you describe the pushing stage of your labour?

Very easy	In-between	Very difficult
-----------	------------	----------------

Please rate the perineal pain you may experience at present. (The pain at the bottom where the baby came out)

None	A little	Moderate	A lot	Unbearable
------	----------	----------	-------	------------

If you have another, would you like to birth...

in water	out of water
----------	--------------

If you experience giving birth before, was this birth ...

Easier	The same	More difficult
--------	----------	----------------

Maternal complications

Neonatal complications

Y	N	What	Y	N	What



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