Immersion in water in labour and birth (Review)

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[Intervention Review]

Immersion in water in labour and birth

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ABSTRACT

Background

Enthusiasts suggest that labouring in water and waterbirth increase maternal relaxation, reduce analgesia requirements and promote a midwifery model of care. Sceptics cite the possibility of neonatal water inhalation and maternal/neonatal infection.

Objectives

To assess the evidence from randomised controlled trials about immersion in water during labour and waterbirth on maternal, fetal, neonatal and caregiver outcomes.

Search strategy

We searched the Cochrane Pregnancy and Childbirth Group's Trials Register (October 2008).

Selection criteria

Randomised controlled trials comparing any bath tub/pool with no immersion during labour and/or birth.

Data collection and analysis

We assessed trial eligibility and quality and extracted data independently. One review author entered data and another checked for accuracy.

Main results

This review includes 11 trials (3146 women); eight related to the first stage of labour, one to the first and second stages, one to early versus late immersion in the first stage of labour, and another to the second stage. We identified no trials evaluating different baths/pools, or the management of third stage of labour.

Results for the first stage of labour showed there was a significant reduction in the epidural/spinal/paracervical analgesia/anaesthesia rate amongst women allocated to water immersion compared to controls (478/1254 versus 529/1245; odds ratio (OR) 0.82, 95% confidence interval (CI) 0.70 to 0.98, six trials). There was no difference in assisted vaginal deliveries (OR 0.84, 95% CI 0.66 to 1.06, seven trials), caesarean sections (OR 1.23, 95% CI 0.86 to 1.75, eight trials), perineal trauma or maternal infection. There were no differences for Apgar score less than seven at five minutes (OR 1.59, 95% CI 0.63 to 4.01, five trials), neonatal unit admissions (OR 1.06, 95% CI 0.70 to 1.62, three trials), or neonatal infection rates (OR 2.01, 95% CI 0.50 to 8.07, five trials).

A lack of data for some comparisons prevented robust conclusions. Further research is needed.

Authors' conclusions

Evidence suggests that water immersion during the first stage of labour reduces the use of epidural/spinal analgesia. There is limited information for other outcomes related to water use during the first and second stages of labour, due to intervention and outcome variability. There is no evidence of increased adverse effects to the fetus/neonate or woman from labouring in water or waterbirth. The fact that use of water immersion in labour and birth is now a widely available care option for women threatens the feasibility of a large, multicentre randomised controlled trial.

PLAIN LANGUAGE SUMMARY

Immersion in water in labour and birth

Immersion in water during the first stage of labour significantly reduces women's perception of pain and use of epidural/spinal analgesia.

Eleven trials were of an adequate quality to include in this review. Of these, six reported that water immersion during the first stage of labour significantly reduced epidural/spinal analgesia requirements, without adversely affecting labour duration, operative delivery rates, or neonatal wellbeing. One study showed that immersion in water during the second stage of labour increased women's reported satisfaction with pushing. Further research is needed to assess the effect of immersion in water on neonatal and maternal morbidity. No trials could be located that assessed the immersion of women in water during the third stage of labour, or evaluating different types of pool/bath.

BACKGROUND

Throughout this review, 'water immersion' refers to the immersion in water by a pregnant woman during any stage of labour (first, second, third) where the woman's abdomen is completely submerged. This implies the use of a receptacle that may be called a pool, tub or bath, and which is larger than a normal domestic bath. The period of immersion by the woman may be for one or more stages of labour, and for any duration. Labour is understood to be as defined by the woman or clinicians at the time, and includes regular painful uterine contractions, leading to full cervical dilation, expulsion of the fetus, and the placenta and membranes.

History

The use of water immersion as a therapeutic medium is not new. Its exact origins are unknown, but there is evidence of immersion in water being used as a treatment for physical and psychological ill health by the Chinese, Egyptians, Japanese and Assyrians, as well as Greeks and Romans (Reid Champion 1990; Reid-Campion 1997). Warm water immersion during labour, including birth, used for relaxation and pain relief, has a long history in lay and clinical care (Garland 2000). Igor Tjarkovsky, a Russian boat builder, stimulated the foundation of a movement to promote waterbirth in Soviet Russia in the 1970s. He became convinced of the benefits of water immersion as a means of maximising physiological potential. Michel Odent subsequently popularised water immersion in other European countries (Odent 1983). Although considered a fad by some, the use of water during labour and birth appeals to both women and their carers, particularly those striving for a woman-centred, intervention free, 'normal' experience. In 1995, the first international waterbirth conference was held in London, followed by many subsequent study events and international conferences.

Official acceptance of the use of water immersion as a care option during labour came in the UK in 1993, with the publication of the Changing Childbirth report (Department of Health 1993), which recommended that a pool facility should be an option available to women in all UK maternity units. Professional recognition of the use of water during labour and birth came in 1994 when both the Royal College of Midwives (RCM 1994) and the United Kingdom Central Council for Nursing, Midwifery and Health Visiting (UKCC 1994) published position statements, which incorporated water immersion during labour into the role of the midwife. The use of water during labour/birth is now integrated in the UK Midwifery Rules and standards (Nursing and Midwifery Council

2004), and UK policy for maternity services with section 8.4 of the National Service Framework for Children, Young People and Maternity Service (Department of Health 2004).

Research about the use of water immersion has accrued in recent years, although to date the evidence is mostly in the form of observational studies (Garland 1997; Garland 2002; Geissbuehler 2004; Ohlsson 2001). A tension has arisen with regard to the perceived acceptability of randomised controlled trial (RCT) design, as some midwives and women perceive this as obviating maternal choice to what is now a widely available option, while women with strong preferences may decline to participate (Garland 1994). Factors such as depth of water, size of the pool and whether the water is still or aerated/whirlpool water have not been compared, as pool design and practice have tended to be based on local availability and customs.

Water immersion during first stage of labour - what it offers women

The positive physiological effects of hydrotherapy such as buoyancy, hydrostatic pressure, and associated thermal changes, are relevant to women labouring in water, where labour is defined as including the first, second (birth) and third stages. The buoyancy of water enables a woman to move more easily than on land (Edlich 1987). This can facilitate the neuro-hormonal interactions of labour, alleviating pain, and potentially optimising the progress of labour (Ginesi 1998a; Ginesi 1998b). Water immersion may be associated with improved uterine perfusion, less painful contractions, a shorter labour with fewer interventions (Aird 1997; Garland 2000; Geissbuehler 2000; Moneta 2001; Otigbah 2000; Schorn 1993;). In addition, the ease of mobility that water immersion offers women may optimise fetal position by encouraging flexion (Ohlsson 2001).

Hydrotherapy has marked physiological effects on the cardiovascular system (Cefalo 1978). Shoulder-deep warm water immersion reduces blood pressure due to vasodilatation of the peripheral vessels and redistribution of blood flow. It is suggested that water immersion during labour increases maternal satisfaction and sense of control (Hall 1998; Richmond 2003). A woman who feels in control during childbirth experiences greater emotional wellbeing postnatally (Green 1998). The UK is promoting water immersion during labour and waterbirth as a means of empowering women and normalising birth (Maternity Care Working Party 2007).

Although the use of additives such as essential oils to the water appears to be gaining popularity (Calvert 2000), to date no trial has generated reliable evidence to support or refute the use of any additive.

Waterbirth (second stage of labour) - what it offers women

It has been suggested that waterbirth may reduce the uptake of pharmacological pain relief and likelihood of perineal trauma (Burke 1995; Burns 2001; Garland 2000; Geissbuehler 2000; Otigbah 2000). There may also be increased maternal satisfaction with the birth experience.

Water immersion and the fetus/neonate (first and/or second stage)

It could be argued that the fetus benefits from a relaxed mother, as this maximises placental oxygen perfusion. 'Nature's opiates', endogenous endorphins, predominate. When the mother is not fearful, oxytocin is released to stimulate effective contractions. Labouring in water, compared to land, has been found to reduce stress hormones, catecholamines, which inhibit oxytocin and labour progress. The fetus may be more likely to adopt a flexed position, because the mother can easily explore different positions to maximise her pelvic diameters if the pool is sufficiently large (Ohlsson 2001).

There are some concerns about birth in water for the fetus/neonate Pinette 2004. The three key concerns regarding water immersion during labour and birth and fetal/neonatal wellbeing are 1) thermoregulation during labour, 2) infection and 3) onset of respiration at birth.

1. Thermo regulation

As with any labouring woman, it is important to avoid her becoming pyrexial. Therefore, the water temperature of a pool should not exceed the maternal body temperature, as immersing a woman in water above her natural core temperature will result in fetal hyperthermia and associated cardiovascular and metabolic disturbances (Johnson 1996). High temperatures have been identified as a safety issue by several authors as being associated with fetal mortality and morbidity, based on individual case studies and/or theory (Deans 1995; Johnson 1996; Rosevear 1993). The theory underpinning this was originally based on a study on pregnant ewes (Cefalo 1978). The fetus responded to an increase in maternal temperature by becoming tachycardiac, reducing resistance in the placenta bed and thus heat dissipation. As the temperature increased, there was a tendency to exceed the heat that could be dissipated by the placenta, leading to an increased risk of fetal mortality (Cefalo 1978). A review of the literature on temperature control in mammalian fetuses, mainly sheep, primates and to a limited extent human, identified that the fetal metabolic processes produce heat (Power 1989). This heat is transferred to the mother primarily via the circulatory system, the umbilical cord and placenta where the large surface area and constant blood flow facilitate heat transfer. A second pathway for heat transfer is via fetal skin, to amniotic fluid, the uterus and maternal system. To enable this heat transfer, the fetus is 0.5^{o}C warmer than the mother. This difference is apparently constant across species, although the

basal temperatures differ (Power 1989). When maternal temperature increases heat transfer is inhibited and the fetal temperature rises, until transfer is again possible. However there is a concomitant rise in metabolic activity and oxygen demands, which may be seen in fetal heart rate changes, and which may contribute to fetal compromise during labour. Katz 1988, studying pregnant women immersed in water and the effects of exercise in water held at a constant temperature (30^{o}C), found no association with abnormal fetal heart rate patterns or increased mortality, although the sample size was small. Therefore temperature regulation during labour/birth is an important factor in or out of water.

2. Respiration

The diving reflex prevents a healthy baby born in water from drowning. This is an apnoea on expiration (the opposite of an adult who dives having taken a breath), with a closed larynx. The fetal larynx has a myriad of airway chemoreceptors which prevent fluid aspiration. The diving reflex is stimulated via facial skin receptors conveying stimuli along the trigeminal nerve, triggered as these receptors make contact with the water (Johnson 1996).

Fetal breathing is inhibited at the hypo-pharynx. This mechanism is associated with hormonal factors such as prostaglandin and adenosine; sensors in the oral pharynx, including free nerve endings/taste buds, prevent aspiration, and indeed the normal mechanism is that any lung fluid rising into the oro-pharynx is swallowed. Mild hypoxia further inhibits breathing until chronic sub lethal override point, leading to the belief that an uncompromised human neonate will not breathe under water (Johnson 1996). A compromised neonate born underwater has the potential to gasp before the nose and mouth are above the surface, thus inhaling bath water into the lungs. Inhalation of even a small quantity of fresh water can be absorbed quickly into the circulation causing appreciable haemodilution and fluid overload - as seen in fresh water drowning.

There have been five reported cases of respiratory problems (Kassim 2005; Nguyen 2002), and two reports of neonatal death following waterbirth attended by a midwife (Burns 2001; Rosser 1994). These adverse outcomes are very rare, and causality cannot be inferred on evidence to directly link reported case studies of rare adverse outcomes with waterbirth.

3. Infection

It has been suggested that fetal/neonatal infection may occur due to cross-contamination from the water and pool, and from the woman (Hawkins 1995; Rawal 1994). However several repeated comparative studies, cohort studies, and audits report no increase risk of infection for the fetus/neonate (Alderdice 1995; Anderson 1996; Eriksson 1997; Otigbah 2000; Rush 1996; Robertson 1998; Zanetti 2007). As with all maternity provision, it is incumbent upon practitioners to ensure they have appropriate cleaning protocols for labour and birthing pools, and employ universal precautions.

To date, there is no evidence of increased maternal, fetal or neonatal risk associated with water immersion, compared with labouring and giving birth on land. Two UK national surveys were undertaken during the 1990s: Alderdice 1995 included 2885 women and their neonates, while Gilbert 1999 evaluated the neonatal outcomes for 4032 infants. Both surveys indicated that there was no reliable evidence to justify denying the choice of water immersion for labour and/or birth to women at low risk of complications. In addition, multiple cohort studies/audits have suggested the safety of water immersion during labour and birth for women at low risk of complication (Garland 2006; Geissbuehler 2004; Otigbah 2000). RCTs have been conducted which are the focus of this review.

Maternal adverse effects of water immersion during labour have been theorised. These include the possibility that it may promote unrealistic expectations about labour, restrict choice of analgesia, restrict mobility, reduce contraction effectiveness, and increase perineal trauma (McCandlish 1993). Increased risk to the mother of infection caused by water entering the uterus has been proposed (Rosevear 1993). If warmth has a relaxing effect on the uterine muscles, the uterus may contract less efficiently postpartum (Church 1989; Deans 1995). A theoretical risk of water embolism has been hypothesised (Odent 1983). The logic of this hypothesis has been challenged (Wickham 2005). To date no studies have reported an association between water immersion during labour/birth with this adverse event.

Third stage of labour

We are not aware of any studies which have compared different approaches to third stage care under water.

Water immersion during labour and birth: what it offers caregivers

Labour and birth is a complex, multifaceted and major life event encompassing physiological, emotional, psychological and social elements. It is therefore, highly individualised, and its features and outcome cannot be predicted with certainty. Although much of health care is based on understanding pathology and ill health, and while that may be appropriate for some, in maternity care, women are experiencing a normal physiological process. Midwives Downe and McCourt (Downe 2004) advocate that midwifery care should be set in the context of salutogenesis.

The salutogenic theory originated from interviews conducted with Israeli women who had survived the Holocaust, about their time in concentration camps during the Second World War. It was noted that some stayed healthy despite horrendous experiences. This epidemiological study stimulated sociologist Antonovsky to develop

the salutogenic paradigm as a way of focusing on health rather than disease (Antonovsky 1979; Antonovsky 1987). Central to salutogenesis is a person's sense of coherence, which Antonovsky defined as a global orientation that denotes the degree of self-esteem and confidence an individual possesses to enable them to deal with life's vicissitudes. In essence salutogenesis involves fostering a positive outlook and sense of self worth to empower the individual to realize their potential. Empowerment is a key element of woman-centred care and the drive to normalise birth - an international initiative, led in the UK by the Royal College of Midwives (RCM 2008). The development of normal birth care pathways is consistent with these aims (NHS Wales 2004). Another stimulus to normalise birth is the international concern over the rise in caesarean sections in particular, but the medicalisation of labour and birth in general (RCOG 2001). This increase in medicalisation of birth is not restricted to professionals; many women have become socialised into believing that childbirth is inherently dangerous (Green 2007). It can be argued that water as an environment changes the context in which care is provided; it facilitates the paradigm shift, from professional-centred to woman-centred, from pathology dominated to normality expected. The woman is in her own 'world' and access to her is mediated by the water.

Water implies relaxation, warmth, and many would suggest it also conveys femininity and sexuality (Odent 1999). Clarke 2007 report an increase in the use of water immersion during labour and birth as one result of increasing the focus of one maternity unit to normality through the use of a care pathway. A birthing pool therefore, offers midwives an opportunity to develop the skills required to provide woman-centred care, form a therapeutic rapport with women, facilitate their freedom and participation in decision making, and support them in having choice and control over their care (Nursing and Midwifery Council 2004).

OBJECTIVES

To assess the effects of water immersion during labour and/or birth (labour stages 1, 2 and 3) on maternal, fetal, neonatal and caregiver wellbeing. For the purpose of this review wellbeing is defined as outcomes measuring physical and psychological health. This review addresses the benefits and risks of immersion in water versus no immersion during each stage of labour. In addition, the review compares early (cervical dilation less than 5 cm) with late (cervical dilation more than 5 cm) immersion, different pool designs, still versus moving water, and water with or without additives.

METHODS

Criteria for considering studies for this review

Types of studies

All RCTs that included water immersion versus no immersion during any stage of labour, regardless of care setting. We have reported trials that included randomised and non-randomised subjects if the randomised data are presented separately. We have included published, unpublished and ongoing studies with reported data.

Types of participants

Nulliparous or multiparous women in labour (spontaneous or induced); singleton or multiple pregnancy, irrespective of gestation or labour characteristics.

Types of interventions

Any kind of bath/tub/pool that enabled immersion compared with no immersion during any stage of labour.

Types of outcome measures

We chose primary outcomes that we thought would be the most clinically valuable in assessing safety and effectiveness for the woman, fetus/neonate and caregivers. We identified all outcomes that were considered to be of interest from the perspective of the woman, primary care givers and related service providers. These (list below) are analysed within the subgroups of:

- immersion in water versus no immersion during the first stage of labour;
- immersion in water versus no immersion during the second stage of labour;
- comparison of different types of bath/pool;
- additives versus no additives to water used for immersion during labour and/or birth;
- early (cervical dilation less than 5 cm) with late (cervical dilation more than 5 cm) immersion.

Maternal outcomes

- Mortality
- Morbidity

- ○ Blood loss during labour (first, second, third stage, and immediate postnatal period)
  - ○ Infection during labour/postnatal period
  - ○ Perineal trauma
  - ○ Postpartum depression
  - ○ Post-traumatic stress disorder
- Labour

- ○ Augmentation of labour (artificial rupture of membranes and/or oxytoxic administration)

- Pain experience during labour (first and second stage)
- Use of non-pharmacological analgesia
- Use of pharmacological analgesia (including regional and general anaesthesia) duration of any stage of labour
- Mode of delivery (spontaneous birth, assisted vaginal deliveries and caesarean sections)
- Duration of labour (first, second and third stage)

- Wellbeing

- Temperature (first and second stage)
- Pulse and blood pressure (first, second and third stage)
- Maternal satisfaction
- Maternal self-esteem
- Preference for care in subsequent labour

Fetal outcomes

- Abnormal heart rate pattern
- Meconium liquor
- Birth weight
- Gestational age at birth

Neonatal outcomes

- Mortality
- Morbidity

- Apgar score at five minutes
- Cord pH immediately after birth (arterial and or venous cord blood)
- Admission to neonatal care unit or high dependency care unit;
- Respiratory support (oxygen/ventilation required)
- Lung hypoplasia
- Infection, including markers of infection such as pyrexia and raised white cell count
- Neurological pathology, e.g. seizures, cerebral palsy
- Snapped cord
- Birth injury

- Wellbeing markers

- Breastfeeding

Caregiver outcomes

- Satisfaction
- Injuries (any reported physical injury attributed to care of women in water)

Search methods for identification of studies

Electronic searches

We searched the Cochrane Pregnancy and Childbirth Group's Trials Register by contacting the Trials Search Co-ordinator (October 2008).

The Cochrane Pregnancy and Childbirth Group's Trials Register is maintained by the Trials Search Co-ordinator and contains trials identified from:

1. quarterly searches of the Cochrane Central Register of Controlled Trials (CENTRAL);
2. weekly searches of MEDLINE;
3. handsearches of 30 journals and the proceedings of major conferences;
4. weekly current awareness alerts for a further 44 journals plus monthly BioMed Central email alerts.

Details of the search strategies for CENTRAL and MEDLINE, the list of handsearched journals and conference proceedings, and the list of journals reviewed via the current awareness service can be found in the 'Specialized Register' section within the editorial information about the Cochrane Pregnancy and Childbirth Group.

Trials identified through the searching activities described above are each assigned to a review topic (or topics). The Trials Search Co-ordinator searches the register for each review using the topic list rather than keywords.

Searching other resources

We used personal contacts to identify other potential trials (published and unpublished) and we retrieved and assessed relevant references referred to in the reviewed papers for appropriateness for inclusion in this review.

We did not apply any language restrictions.

Data collection and analysis

Data extraction and management

We re-evaluated trials included and excluded within the previous review and confirmed their inclusion or exclusion. For this current review two review authors, Elizabeth Cluett (EC) and Ethel Burns (EB), independently assessed risk of bias for each study using the criteria outlined in the Cochrane Handbook for Systematic Reviews of Interventions (Higgins 2008). We resolved any disagreement through discussion.

We used a data extract template provided by the Cochrane Pregancy and Childbirth Group and modified for the topic for the evaluation and data identification/extraction process. EC entered

data into Review Manager software (RevMan 2008), and EB checked for accuracy.

Assessment of risk of bias in included studies

EC and EB independently assessed risk of bias for each study using the criteria outlined in the Cochrane Handbook for Systematic Reviews of Interventions (Higgins 2008), resolving any disagreement by discussion.

(1) Sequence generation (checking for possible selection bias)

We described for each included study the methods used to generate the allocation sequence in sufficient detail to allow an assessment of whether it produced comparable groups.
We assessed the methods as:

- adequate (any truly random process, e.g. random number table; computer random number generator),
- inadequate (any non random process, e.g. odd or even date of birth; hospital or clinic record number) or
- unclear.

(2) Allocation concealment (checking for possible selection bias)

We described for each included study the method used to conceal the allocation sequence in sufficient detail and determined whether intervention allocation could have been foreseen in advance of or during recruitment, or changed after assignment.
We assessed the methods as:

- adequate (e.g. telephone or central randomisation; consecutively numbered sealed opaque envelopes);
- inadequate (open random allocation; unsealed or non-opaque envelopes, alternation; date of birth);
- unclear.

(3) Blinding (checking for possible performance bias)

Due to the nature of the intervention, water immersion, blinding is not possible and therefore this could not be considered.

(4) Incomplete outcome data (checking for possible attrition bias through withdrawals, dropouts, protocol deviations)

We described for each included study the completeness of data, including attrition and exclusions from the analysis. We noted attrition and exclusions; the numbers included in the analysis at each stage (compared with the total randomised participants); reasons for attrition or exclusion where reported; and whether missing data were balanced across groups or were related to outcomes. Where sufficient information is reported, or can be supplied by the trial authors, we will re-include missing data in the analyses which we undertake. We assessed methods as:

- adequate (less than 20% loss);
- inadequate;
- unclear.

(5) Other sources of bias

We described for each included study any important concerns we had about other possible sources of bias, .
We assessed whether each study was free of other problems that could put it at risk of bias:

- yes;
- no;
- unclear.

(6) Overall risk of bias

We made explicit judgements about whether studies are at high risk of bias, according to the criteria given in the Handbook (Higgins 2008). With reference to (1) to (5) above, we assessed the likely magnitude and direction of the bias and whether we considered it was likely to impact on the findings.

Measures of treatment effect

Dichotomous data

For dichotomous data, we used odds ratio with 95% confidence intervals. We analysed data for this review as presented in original papers, therefore by allocation (intention to treat).

Continuous data

For continuous data, we use the mean difference if outcomes are measured in the same way between trials.

Data synthesis

We carried out statistical analysis using the Review Manager software (RevMan 2008).

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies.

We identified a total of 19 studies for consideration for inclusion in the review. Of the eight additional studies reviewed this time, we excluded five. For more information see 'Characteristics of excluded studies'. We initially excluded da Silva 2006, as a full translation was not provided, but it was subsequently published in English and we have included it (da Silva 2007). We excluded Benfield 2001 because of inadequate allocation concealment, and Malarewicz 2005 because the method of randomisation was not detailed.

We excluded the two studies by Cluett (Cluett 2001; Cluett 2004), primarily because all the women were nulliparous who had been diagnosed as having dystocia in the first stage of labour, and the comparison (control) group all received augmentation of labour. Hence comparison and inclusion in any meta analysis with women at low risk of complications is inappropriate. In addition, Cluett 2001 was a feasibility study and only involved four women in each arm. Cluett 2004 suggested that in nulliparous women who have been classified as having slow progress in the first stage of labour, labouring in water for reduced the incidents of epidural analgesia although this did not reach statistical significance (P = 0.056). The pain scores were significantly lower, but as the comparison group received augmentation of labour, it could be argued that this was to be expected. This further supports the rationale for not including these women in this review, as doing so would not represent the situation when water immersion would be used, namely in a low risk labour and birth.

One pilot study (Calvert 2000) compared the use of essential oil of ginger with the use of essential oil of lemon grass. The data from this pilot are not in an appropriate form for analysis and so the study was excluded from the review. Use of other additives, such as salt, have not yet been evaluated in a RCT.

Of the 11 trials included in this review, eight related to the first stage of labour only; one involved immersion during the first and second stages of labour; one related to early versus late immersion in the first stage of labour; and one involved women in the second stage of labour. There were no studies evaluating the use of different types of baths/pools at any stage of labour or the effects of water immersion on the third stage of labour. We identified no trials that evaluated immersion versus no immersion during pregnancy (i.e. not in labour).

One-to-one care in labour is known to affect labour outcomes (Hodnett 2007). In one trial (Taha 2000) investigating water immersion during the first stage of labour, all women regardless of allocation were cared for by the researcher. Where it was stated that normal/routine/standard care was provided, this was understood to mean that the practitioners who normally provided intrapartum care to women in labour in the study centre provided care for the study participants (da Silva 2007; Eckert 2001; Eriksson 1997; Rush 1996; Nikodem 1999; Schorn 1993; Woodward 2004). Cammu 1994 indicated that care was supervised by obstetric staff. No information is provided as to whether these trials involved one-to-one care or not.

Water temperature is known to be important in the care of women using water immersion during labour. This varied across trials, with some using a temperature up to 37ºC (Cammu 1994; Eckert 2001; Kuusela 1998);others up to 38ºC (da Silva 2007 ; Eriksson 1997; Taha 2000); and still others not stated (Ohlsson 2001; Schorn 1993; Woodward 2004). Rush 1996 refers to a temperature of 38 to 39ºC. The higher temperatures may affect outcomes, but there are no studies comparing outcomes for the use of different water temperatures.

The studies collected a wide range of data, but the specific outcome measures collected were very variable, and collected in different formats. For example, some studies did not consider neonatal wellbeing. Use of Apgar scores was also variable; some used them as continuous data, others as dichotomous, making comparison across studies challenging, and resulting in the reporting of many variables based on the results from one study.

For further details, *see* 'Characteristics of included studies'.

Risk of bias in included studies

See details under 'Characteristics of included studies'.

As an intervention, it is not possible to blind participants or carers to water immersion. Not all participants and/or carers will be in a state of equipoise between immersion or non-immersion, that is being equally comfortable and confident about water immersion. This may positively or negatively influence outcomes such as pain perception and hence subsequent analgesia use, maternal satisfaction, self-esteem and postpartum depression. An example of this is Woodward 2004, which reports that some midwives were apparently not supportive of women using water, suggesting a positive bias within the women, and in this case a negative bias within the midwives. Conversely Rush 1996 reports practitioners as maintaining a interest in low-intervention labour practice, suggesting a positive bias towards water immersion. Water immersion, however, is as much a psychological choice as a physical pain management strategy, and as such pragmatic clinical trials are assessing the effect of the whole package.

The trials adopted a variety of definitions for water immersion, with different size baths/pools containing different volumes of water. To date, there is no evidence as to whether different degrees of immersion, or the amount of mobility possible within the bath/pool, affect outcomes. Schorn 1993 refers to a tub with a moulded seat, which may restrict mobility and the freedom to adopt different positions while immersed. Likewise, Rush 1996 used a pool where the woman could not change position. Schorn 1993 and Rush 1996 used a whirlpool (hot tub with jets) and the effect of moving water during immersion may be different to the effect of still water. Kuusela 1998 refers to a tub that is 70 cm deep and holds 730 litres; da Silva 2007 indicates tub volume as 194 litres; Eckert 2001 and Eriksson 1997 cite tub depths of 54 cm and 40 cm, respectively. Differences as to what constitutes water immersion makes comparisons of outcomes across trials difficult.

Compliance with trial allocation was variable across the trials. Of the seven trials that involved water immersion in the first stage of labour, Rush 1996 reported that 46% of women allocated to water immersion did not actually enter the water, while Woodward 2004 planned a 2:1 ratio allocation to water anticipating that about 50% of women would not use water, but of the 40 allocated to use water, only 24 used the pool. Four (of 58) women in da Silva 2007 did not receive the water intervention due to medical/obstetric reasons. Another five trials (Cammu 1994; Eckert 2001; Eriksson 1997; Ohlsson 2001; Woodward 2004) reported some crossover between groups. Kuusela 1998 did not provide information on this.

None of the trials cite any blinding of outcome assessment, and this is likely to be difficult to achieve, as use of water during labour is usually clearly documented in case records. Rush 1996 and da Silva 2007 referred to any post-randomisation exclusion. For Rush 1996 this was 41 (of 785) women who were ineligible for the trial but recruited and allocated to a trial arm. They indicate that these 41 women were included in the analysis as it was on an intention-to-treat basis, but they also supply subgroup analysis with these women excluded.

Randomisation processes varied; those of the best quality used computer-generated, sequentially numbered opaque envelopes containing the group allocation (Eckert 2001; Schorn 1993; Woodward 2004) or a clear description of concealment (Cammu 1994; Eriksson 1997; Ohlsson 2001; Rush 1996). Others were less transparent, although taken to be adequate (da Silva 2007; Kuusela 1998). Nikodem 1999 and Taha 2000 used blocks of 10, which is not ideal as this has the potential for breaking concealment at the end of the block.

Most of the included trials have small sample sizes and therefore a high risk of bias. These factors limit comparison across trials and the reliability and validity of the trial findings.

Effects of interventions

This section considers the results from the included trials and overall conclusions.

Immersion versus no immersion in the first stage of labour

Maternal outcomes

Six trials (Cammu 1994; Eckert 2001; Kuusela 1998; Ohlsson 2001; Rush 1996; Woodward 2004) provided data on epidural/spinal analgesia/anaesthesia use and there was a significant reduction in the incidence of epidural/spinal/paracervical analgesia/anaesthesia amongst women allocated to immersion in water during the first stage of labour compared to controls (478/1254 versus 529/1245; odds ratio (OR) 0.82; 95% confidence interval (CI) 0.70 to 0.98). Of these trials, Rush 1996 and Woodward 2004 reported women allocated to water immersion who did not use water. In Rush 1996, 183 (46%) of the water group did not immerse, but none of the control group immersed. Based on clinical experience, Woodward 2004 anticipated that up to 50% of women allocated to labour in water, would not do so, and this was planned into the recruitment strategy, where the water to control recruitment ratio was 2:1. The other maternal outcomes that reach statistical significance are the reported experience of pain, the wish to use water again, and lower blood pressure readings, all of which were only reported by Taha 2000.

Seven studies provide data on mode of birth (Cammu 1994; Eckert 2001; Kuusela 1998; Ohlsson 2001; Rush 1996; Taha 2000; Woodward 2004). These showed no significant difference for either the assisted delivery rate (water/land 156/1313 versus 181/1315, OR 0.84 (95% CI 0.66 to 1.06)) or caesarean section (water/land 72/1358 versus 58/1354, OR 1.23 (95%CI 0.86 to 1.75)).

There was no significant difference in narcotic/pethidine use from the four trials that provide this data (OR 0.97; 95%CI 0.65 to 1.44)(Eckert 2001; Rush 1996; Taha 2000; Woodward 2004); or for the overall analgesia outcome of 'any analgesia used' (OR 0.95; 95%CI 0.63 to 1.43)(Eckert 2001; Schorn 1993; Taha 2000; Woodward 2004).

There has been some concern that water immersion may slow labour, therefore we analysed data on augmentation. There were no differences in the incidence of amniotomy (240/465 versus 233/461; OR 1.04 95%CI 0.80 to 1.36) (da Silva 2007; Kuusela 1998; Rush 1996), or of the use of oxytocin infusion (101/501 versus 111/509; OR 0.88 95%CI 0.65 to 1.20)(da Silva 2007; Kuusela 1998; Rush 1996; Schorn 1993).

Six trials (Cammu 1994; Eckert 2001; Kuusela 1998; Rush 1996; Schorn 1993; Woodward 2004) provided data on duration of the first stages of labour, and there was no significant difference (mean difference -10.18 minutes, 95% CI -43.06 minutes to 22.70 minutes). Six trials (Cammu 1994; da Silva 2007; Eckert 2001; Kuusela 1998; Rush 1996; Schorn 1993; Woodward 2004) reported on the duration of the second stage of labour; again there was no statistical difference (MD 0.52 minutes; 95% CI -3.95 minutes to 4.99 minutes).

There were no significant differences between the benefits and risks associated with the use of water immersion during labour on outcomes such as perineal trauma: intact perineum (236/678 versus 200/659; OR 1.25 95%CI 0.99 to 1.58) (da Silva 2007; Eckert 2001; Rush 1996; Taha 2000; Woodward 2004); episiotomy (207/644 versus 219/628; OR 0.89, 95%CI 0.70 to 1.13), second degree tears (110/658 versus 112/628; OR 0.93, 95% CI 0.69 to 1.25) and third/fourth degree tears (40/1202 versus 29/1199; OR 1.38, 95% CI 0.85 to 2.23) (Eckert 2001; Ohlsson 2001; Rush 1996; Taha 2000; Woodward 2004).

There were no significant differences in the incidence of maternal infection (Cammu 1994; Eckert 2001; Kuusela 1998; Rush 1996;

Schorn 1993), (15/647 versus 15/648; OR 0.99, 95%CI 0.49 to 2.00).

Other outcomes were based on data from only one or two studies. For example Taha 2000 reported maternal pain and women who used water immersion during the first stage of labour reported significantly less pain (using ordinal descriptors) than those not labouring in water (40/59 versus 55/61; OR 0.23, 95% CI 0.08 to 0.63). The same study (Taha 2000) reported the biophysiological effect of immersion in water on the effect of blood pressure changes: systolic (mean 120.3 mmHg versus 127.5 mmHg; mean difference (MD) -7.20, 95% CI -13.12 to -1.28), diastolic (mean 62.8 mmHg versus 73 mmHg; MD -10.20, 95% CI -13.70 to -6.70); and mean arterial pressure (mean 83.7 versus 94.2; MD -10.50, 95% CI -14.68 to -6.32) were statistically significantly reduced in the immersion group.

Neonatal outcomes

There were no differences in gestational age at birth (MD -0.01; 95% CI -0.82 to 0.80) or birth weight (MD -22.74 95%CI -66.44 to 20.96)(Cammu 1994; da Silva 2007; Eckert 2001; Kuusela 1998; Ohlsson 2001; Rush 1996; Schorn 1993; Taha 2000; Woodward 2004).

Five trials reported when the Apgar score was less than 7 at five minutes (Cammu 1994; Eckert 2001; Ohlsson 2001; Schorn 1993; Taha 2000), and there was no significant difference (10/907 versus 6/927; OR 1.59; 95%CI 0.63 to 4.01). Another two studies provided the mean Apgar score at five minutes (da Silva 2007; Rush 1996) and again there was no difference (MD -0.03 95%CI -0.11 to 0.06). There was no significant difference in the three trials that reported admissions to the neonatal intensive care unit (48/789 versus 45/782; OR 1.06, 95% CI 0.70 to 1.62) (Eckert 2001; Ohlsson 2001; Woodward 2004). Infection rates were very low (6/647 versus 3/648) and reported in five trials (OR 2.01, 95% CI 0.50 to 8.07) (Cammu 1994; Eckert 2001; Kuusela 1998; Rush 1996; Schorn 1993), although in three trials there were no infections in either group (Cammu 1994; Kuusela 1998; Schorn 1993), as might be hoped, as all three had small sample sizes.

Caregiver outcomes

No trial describes any injuries or satisfaction outcomes for care givers.

Immersion versus no immersion in the second stage of labour

Maternal outcomes

One trial evaluated immersion during the second stage of labour (Nikodem 1999) and one trial measured outcomes across the first and second stages (Woodward 2004). We have entered data for this latter study in both the first and second stage sections of this review, although it should be noted that only 10 (25%) of the 40 women allocated to birth in water actually did so. There were no significant differences in the mode of delivery; assisted vaginal birth (OR 0.71, 95%CI 0.18 to 2.86); Caesarean section rate (OR 0.31, 95%CI 0.06 to 1.57) (Nikodem 1999; Woodward 2004). Likewise there were no significant differences in incidence of trauma to the perineum; episiotomy (12/100 versus 10/79, OR 0.70, 95%CI 0.27 to 1.80) and second-degree tears (21/100 versus 14/79, OR 1.26, 95%CI 0.59 to 2.71) (Nikodem 1999; Woodward 2004). Nikodem 1999 demonstrated a significantly higher level of satisfaction with the birth experience (OR 0.20, 95% CI 0.05 to 0.74), with fewer women in the immersion group feeling that they did not cope satisfactorily with their pushing efforts (3/60 versus 12/57).

Neonatal outcomes

For outcomes for which there were data from both trials (Nikodem 1999; Woodward 2004), there were no significant differences in the incidence of meconium (OR 1.40, 95%CI 0.57 to 3.39), or admission to the neonatal unit (OR 0.78, 95%CI 0.23 to 2.59). Neither Nikodem 1999 nor Woodward 2004 found any significant difference in the incidence of low Apgar scores or cord arterial blood pH, although each used slightly different parameters. Nikodem 1999 found no significant difference in the incidence of raised neonatal temperature at birth greater than 37.5º C (8/55 versus 3/54).

Early versus late immersion

One trial compared early versus late immersion during the first stage of labour (Eriksson 1997) and found significantly higher epidural analgesia rates in the early group (42/100 versus 19/100; OR 3.09, 95% CI 1.63 to 5.84) and an increased incidence of augmentation of labour (57/100 versus 30/100; OR 3.09, 95% CI 1.73 to 5.54).

DISCUSSION

This review showed that immersion in water during labour significantly reduced the epidural/spinal analgesia rate based on data from six trials. The only other statistically significant results were for experience of moderate to severe pain, wish to use water for a subsequent labour, and a reduction in blood pressure, all of which were measured in one trial (Taha 2000). However, these conclusions need to be considered in the context of small sample sizes (range 33 to 1237); only two trials achieved a total sample size of greater than 300; blinding to the intervention is not possible; and many outcomes were only considered in one or two trials. These factors limit the interpretation of the results. What is needed is an

equivalence study to explore whether or not labour and/or birth in water is as safe as labour/birth without immersion in water, in a comparable group of women. It is recognised, however, that as use of water in labour and birth is now widely considered a matter of maternal choice, it is increasingly unlikely that conducting a large, multicentered, RCT needed to gain the required evidence will be feasible or acceptable. Large audits and cohort studies should be undertaken in units which provide a pool facility to provide evidence for practice (Geissbuehler 2000; Zanetti 2007).

The trials reported using different sized pools (only five trials provide information on bath/pool size: Cammu 1994; da Silva 2007; Eckert 2001; Eriksson 1997; Kuusela 1998); various durations in the water; and still or moving water, each of which had an impact on the outcomes. These factors limit the validity of the findings.

Rush 1996 and Woodward 2004 reported respectively that 46% (n = 183) and 40% (n = 16) of women allocated to water immersion did not actually use water, although in the case of Woodward 2004 this was expected and a recruitment ratio of 2:1 had been adopted. In both studies, analysis was by intention to treat, and they did not report outcomes by actual use. It is possible that subgroup analysis excluding women who did not use the water might have increased the difference between water users and non-users, in favour of less epidural analgesia for those who used water immersion. This is pertinent, as the authors reported that the main reasons for non-use of the water included early request for epidural, identification of complication precluding water use, as well as non-availability of the pool and change of mind (numbers for each are provided by Woodward 2004 but not by Rush 1996).

Another confounding factor is that the gestational age at which water immersion is permissible varies across the trials, from greater than 34 weeks' gestation (Eriksson 1997) through 35 weeks (Ohlsson 2001) and 36 weeks (Schorn 1993; Taha 2000; Woodward 2004) to greater than 37 weeks (Cammu 1994; da Silva 2007; Eckert 2001; Kuusela 1998; Rush 1996). This is due to variations in the definition of 'preterm' adopted by different countries. However the baseline characteristics of participants in the included studies showed no difference (*see* 'Effects of interventions', Neonatal outcomes for immersion during the first stage of labour).

Although all the trials involved women defined as 'in labour', this was interpreted differently, from trials including all women with contractions, or about to have labour induced with a cervical dilatation of as little as 1 cm (Eckert 2001), to trials including only women in active labour with a cervical dilatation of greater than 6 cm (da Silva 2007). This variability makes comparisons across trials problematic.

Another variation is that the length of the first stage of labour for women in the trial by Cammu 1994 was shorter (mean of 244 minutes) and less variable (small standard deviation of 139 minutes), compared to a first stage length of 846 minutes (SD 432 minutes) in the trial by Schorn 1993. This suggests that the samples may have met different inclusion criteria or experienced a different management protocol during labour, although this was not explicit in the papers. The length of the second stage of labour for the women in the immersion group is much longer than might be expected in the trial by Schorn 1993, which involved nulliparae only, compared to Kuusela 1998 where the second stage duration was reported as 21 minutes. This may again relate to different management strategies, in particular definition of the onset of the second stage and the use or not of directed pushing, but again this is not detailed within the paper.

Only one trial investigated early (before a cervical dilatation of 5 cm) versus late (after a cervical dilatation of 5 cm) immersion in water during the first stage of labour (Eriksson 1997). The main issue arising from this trial is whether or not women in the trial were actually in active labour, and therefore could reasonably be expected to progress spontaneously. Alternatively women may have been in the latent phase, which might have been augmented by mobilisation and other activity within a labour room, compared to relaxation and latent phase contractions ceasing in the water group. The issue then arises as to whether this constitutes slow progress in labour requiring intervention, or whether it may be more appropriate to manage this conservatively, providing mother and fetus are well, in the anticipation that labour would occur spontaneously at some later time. The trial did not consider this possibility.

Although all participants across the included trials were considered at low risk of complications, and trials where this was not so were excluded (Cluett 2001; Cluett 2004), Eckert 2001 reported the inclusion of women whose labour was induced. Rush 1996 indicated that 41 women who did not meet the inclusion criteria had been randomised. When these women were removed from the analysis the P value for epidural analgesia use changes to 0.044 from 0.069, while that for instrumental vaginal delivery becomes 0.011 from 0.055. Therefore, when ineligible women are excluded the results indicate that, for women at low risk of complications, labouring in water reduced the likelihood of epidural/narcotic use and of needing an instrumental vaginal delivery (Rush 1996). The definitions adopted for 'labour' were varied and may have influenced outcomes. In particular, Cammu 1994 required that the amniotic membranes were ruptured, although there is no indication as to whether this was spontaneous rupture or not. In contrast the membranes were intact in all participants in the trial by Schorn 1993. Participants in other trials had a mixture of intact and ruptured membranes (Ohlsson 2001; Rush 1996; Taha 2000; Woodward 2004). These differences might be anticipated to affect pain perception, and hence influence analgesia uptake, maternal satisfaction, and possibly labour progress, which makes comparison across trials difficult. There is little or no information about the presence of one-to-one care or not in the trials evaluating first stage of labour outcomes, although Rush 1996 indicated that

caregivers tended to be more continuously present with the water immersion participants. As one-to-one care in labour is known to affect outcomes (Hodnett 2007), if this was not balanced across trial arms, this could account for any differences found.

Only one trial investigated early (before a cervical dilatation of 5 cm) versus late (after a cervical dilatation of 5 cm) immersion in water during the first stage of labour (Eriksson 1997). The main issue arising from this trial is whether or not study participants were actually in active labour, and therefore could reasonably be expected to progress spontaneously, or whether they were in the latent phase, which might have been augmented by mobilisation and other activity within a labour room, compared to relaxation and latent phase contractions ceasing in the water group. The issue then arises as to whether this constitutes slow progress in labour requiring intervention, or whether it may be more appropriate to manage this conservatively, providing mother and fetus are well, in the anticipation that labour would occur spontaneously at some later time. The trial did not consider this possibility.

The main conclusion of this review is that labouring in water significantly reduces the incidence of epidural/spinal analgesia. It is not possible to conclude whether the differences identified, in particular the reduction in epidural/spinal analgesia, are due to water alone, or the water/pool environment. Water immersion is a care package which includes the actual water and the associated environment, together with the interactions of the woman and her caregivers. It may be that this last factor, linking midwives/caregivers who support the tranquil, no-obstetric-intervention, salutogenic philosophy espoused by labour and birth in water with like-minded women is the most important component. This would be consistent with the evidence on one-to-one care in labour (Hodnett 2007). It could be argued that, if water immersion facilitates the adoption of a woman-centred approach to care, facilitating normalisation of labour and birth, as many now seek (Maternity Care Working Party 2007; RCM 2008), then immersion in water should be promoted.

AUTHORS' CONCLUSIONS

Implications for practice

Despite limitations in the validity and reliability of the RCT evidence to date due to trial design, the statistically significant reduction in rate of epidural/spinal/paracervical analgesia suggests that water immersion during the first stage of labour reduces the need for this invasive, pharmacological pain mode of analgesia, which disturbs the physiology of labour and is associated with iatrogenic interventions. We found no evidence that this was associated with poorer outcomes for neonates, longer labours or more complex births. The other significant findings come from data from one study only and therefore have to be read with caution. Women can be advised that the use of water immersion in the first stage of labour may reduce the incidence of epidural/spinal/paracervical analgesia, and midwives and other birth attendants can suggest water immersion as part of labour pain management strategy.

There is insufficient evidence about the use of water immersion during second stage of labour and therefore clear implications cannot be stated.

Overall, the evidence indicates that immersion in water during the first stage decreases maternal uptake of epidural/spinal analgesia, and that water immersion during the first stage of labour can be supported for women at low risk of complications.

Immersion during the second stage of labour needs further investigation, but at present there is no clear evidence to support or not to support a woman's decision to give birth in water.

Implications for research

There is some evidence that immersion in water during the first stage of labour reduces the need for epidural/spinal analgesia, but the limited reliability and validity of the studies means that this would benefit from further research, in particular from a study of an appropriate size to assess equivalence. There is a lack of clarity as to what constitutes water immersion, and further evaluation of the relative merits of different shaped/sized pools is required, and of still versus moving water, and the relative merits of water immersion during early labour (latent phase). There is insufficient information to support or not to support the use of immersion during the second stage of labour (birth), or the third stage. The safety regarding infection and neonatal outcomes are not addressed, and large collaborative trials are needed to answer these critical issues. It has been suggested that maternal satisfaction increases with water immersion, although there is a need for a large trial to evaluate this.

There are no data on caregiver outcomes and this warrants investigation.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Cammu 1994

Methods	Randomisation by sealed opaque envelopes containing method indicator card. Methodological qualities: (1) Selection bias: low risk: adequate concealment at time of randomisation. (2) Performance bias: high risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation. (3) Exclusion bias: moderate risk of bias: 57 were randomly allocated to bath, 3 refused to bathe and their results were not included in analyses. (4) Bias conclusion: moderate bias: one or more criteria partially met. May raise some doubt about the results.
Participants	Study group: n = 54. Control group: n = 56. Inclusion criteria: gestation > 36 weeks; low risk; nulliparous; singleton; cephalic presentation; active labour between 4-5 cm cervical dilatation; ruptured membranes with clear liquor on entry; scalp electrodes used for all participants; ambulation and analgesics were allowed.
Interventions	The use of an oval-shaped hot tub during labour. Bath temperature not exceeding 37 degrees celsius. No chemicals added. Control group: no water immersion during labour. First stage of labour study, women in both groups received 'personalised' care but it is not clear if this is one-to-one care or not, although care overseen by obstetricians and all births conducted by house officers (doctors).
Outcomes	Maternal outcomes: *use of analgesia/anaesthesia; *augmentation of labour; cervical dilatation; *duration of labour and birth; *mode of delivery; *maternal infection. Fetal outcomes: abnormal fetal heart rate patterns needing intervention. Neonatal outcomes: *neonatal condition; *admittance to NICU or high dependency care unit; *neonatal infection rates.
Notes	Academic hospital, Brussels, Belgium.

Cammu 1994 (*Continued*)

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Yes	Adequate
Blinding? All outcomes	No	High risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation.

da Silva 2007

Methods	Randomisation was computer generated, and then recorded on a list (paper copy), where the next allocation was concealed from the research until the next woman had provided consent, was recruited and thus being allocated. Methodological qualities: (1) Selection bias: none apparent. (2) Performance bias: high risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation. (3) Exclusion bias: low risk of bias 4 of 58 in water group did not get water as required caesarean section prior to immersion, and 2 of 56 in control group also required caesarean section prior to reaching cervical dilation of 6cm. Analysed according to intention to treat. (4) Bias conclusion: high risk of bias, where one or more criteria are not met may cause plausible bias that seriously weakens confidence in the results.
Participants	Power calculation undertaken. Water n = 58. Control n = 56. Full term, nulliparous, live, cephalic presentation, no complications, cervical dilation of 6cm or less in established labour.
Interventions	Control group received standard care, including cardiotocography on admission, ambulation, amniotomy and oxytocin augmentation if now cervical progress over 3 hours, intermittent auscultation during labour. Intervention group as above with immersion in water when cervix had reached 6-7 cm dilated, for 60 minutes. First stage of labour study, no mention of one-to-one care or not. Pool was 194 litres, equipped with a heater. Water temperature ranged from 27 to 38 degrees Celsius.
Outcomes	Pain score on 5-point behavioural scale and numerical pain score from 0 to 10, at 6-7 cm dilated and again 1 hour later. In addition the following data were collected: use of augmentation, amniotic liquor conditions, duration of labour, perineal condition, gestational age, Apgar score at 1 and 5 minutes, maternal and water temperature.
Notes	Study done in Sao Paulo, Brazil.
Risk of bias	

da Silva 2007 (*Continued*)

Item	Authors' judgement	Description
Allocation concealment?	Yes	However description suggests the process could be open to tampering.
Blinding? All outcomes	No	High risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation.

Eckert 2001

Methods	Randomisation by sealed opaque, sequentially numbered envelopes that were kept in the admission ward. Prepared in random blocks of ten, stratified for parity. Methodological qualities: (1) Selection bias: none. (2) Performance bias: high risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation. (3) Exclusion bias: high risk of bias 37/134 of women allocated to bath group did not bathe and 34/134 of women allocated to the control group did bathe. Analysed according to intention to treat. (4) Bias conclusion: high risk of bias, where one or more criteria are not met may cause plausible bias that seriously weakens confidence in the results.
Participants	Study group n = 137. Control group n = 137. Inclusion criteria: gestation > 36 weeks; low risk; singleton; cephalic presentation. Exclusion criteria: planned CS; history of Group B streptococcal infection; epidural anaesthesia; continuous FHR monitoring needed.
Interventions	Women were allocated to a delivery suite with a bath or to a general delivery suite without a bath. The bath group was allowed to use the bath as long as each woman wished, but they had to get out during second stage of labour (first stage only). The bath tub was 120 cm x 160 cm x 54 cm and the maximum water temperature was 37 degrees celsius. Control group was allowed to use a shower. First stage only study women received care from same midwives but no mention of one-to-one second care or not.
Outcomes	Maternal outcomes: *maternal experience and satisfaction of labour; *use of analgesia/anaesthesia; *augmentation of labour; *presence of meconium stained liquor; *duration of labour and birth; *mode of delivery; *trauma to the birth canal requiring suturing; *blood loss;

Eckert 2001 (*Continued*)

	*postpartum depression; breastfeeding. Fetal outcomes: *abnormal fetal heart rate patterns, needing intervention. Neonatal outcomes: *neonatal condition; *admittance to NICU or high dependency care unit; * temperature at birth; *neonatal infection rates.
Notes	Tertiary referral hospital in Adelaide, Australia. Some of the results are not in an appropriate format. Further information needed.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	Adequate.
Blinding? All outcomes	No	High risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation.

Eriksson 1997

Methods	Randomisation by sealed opaque, sequentially numbered envelopes containing the code. Methodological qualities: (1) Selection bias: none. (2) Performance bias: high risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation. (3) Exclusion bias: low risk of bias as only 8/200 did not enter bath. Analysed according to intention to treat. (4) Bias conclusion: moderate bias. One or more criteria partially met. May raise some doubt about the results.
Participants	Group one: n = 100: the "early bath group". Group two: n = 100: the "late bath group". Regional referral hospital in the west of Sweden. Inclusion criteria: gestation > 34 weeks; low risk; singleton; cephalic presentation; spontaneous labour; contractions 3/10 minutes and/or ruptured membranes with cervical dilatation less than 3 cm. Normal FHR pattern. Ambulation and analgesics were allowed.

Eriksson 1997 (*Continued*)

Interventions	All women used an oval tub that was 1.5 m long and 40 cm deep. It contained 300 L of waters at a temperature not more than 38 degrees Celsius. Group one: the "early bath group" had a cervical dilatation of less than 5 cm when immersed in water. Group two: the "late bath group" had a cervical dilation of 5 cm or more when immersed in water. No mention of one-to-one care or not.
Outcomes	Maternal outcomes: *use of analgesia/anaesthesia; *augmentation of labour; duration of labour and birth; *mode of delivery; *maternal infection; *abnormal fetal heart rate patterns needing intervention; *neonatal condition; *admittance to NICU or high dependency care unit; *neonatal infection rates (studies that describe additional outcomes that may be of importance will be mentioned in the text); parity; maternal age; birth weight; Bishop score before randomisation.
Notes	Duration of labour not in acceptable format. Early group 9.80 hours and late group 8.48 hours P < 0.004. Primipara: 72/100 in early group and 60/100 in late group. Maternal mean age: 26.3 early group; 27.2 late group. Mean birth weight: 3550 g early group; 3616 g late group. Performance bias: caregivers were not blind to group allocation. Not recorded if results were analysed blind. Exclusion bias: *women did not enter bath - groups not mentioned. Thus moderate rate of bias may be present.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	Adequate.
Blinding? All outcomes	No	High risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation.

Kuusela 1998

Methods	Randomisation stated but only described as 'by lots'. Methodological qualities: (1) Selection bias: no information. (2) Performance bias: high risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation. (3) Exclusion bias: low risk of bias as no drop outs reported. (4) Bias conclusion: moderate bias. One or more criteria partially met. May raise some doubt about the results.
Participants	33 women, 18 water, 15 control. In labour (cervix 4cm dilated). Low risk - term, 1 fetus, no complications in current or any previous pregnancy/birth.
Interventions	Intervention was use of bath for max of 60 minutes. Bath was thermally insulted, oval, size 150cm by 110 cm, by 70cm deep. Volume was 730 litres. Water temperature 37 degree celsius. No pharmacological analgesia available to either control or intervention group during study hour. After use of bath labour care as normal and could access 'usual' pain relief methods, positions. No mention of one-to-one second care or not. First stage only study.
Outcomes	Duration of first and second stage of labour. Pain relief used, pain score before and after study period (1 hour), own assessment in postnatal questionnaire on day 2 postpartum. Blood loss, perineal trauma, Apgars. Maternal pulse, temperature, blood pressure.
Notes	Undertaken in Finland - 1 hospital.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	Described as randomised but lack of detailed translation prohibits how concealed.
Blinding? All outcomes	No	High risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation.

Nikodem 1999

Methods	Randomisation by sealed opaque, sequentially numbered envelopes containing the code. Prepared in random blocks of ten, stratified for parity. Methodological qualities: (1) Selection bias: none. (2) Performance bias: high risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation. (3) Exclusion bias: low risk of bias as all women received their allocated treatment. Analysed according to intention to treat. One lost to follow up. (4) Bias conclusion: moderate bias. One or more criteria partially met. May raise some doubt about the results. Women were randomised at full dilatation of bearing down efforts.
Participants	Study group: n = 60. Control group: n = 60. Academic teaching hospital, Johannesburg, South Africa. Inclusion criteria: gestation > 36 weeks; low risk; singleton; cephalic presentation; active phase of labour; normal FHR pattern; ambulation and analgesics were allowed; able to read and understand English. No immersion of water was used during the first stage of labour.
Interventions	Study group: Allocated to oval bath tub which contained about 220 L of water. Temperature 34-38 degrees celsius. Women were allowed to use different postures in the bath. Control group: care the same as study group but they were not allowed to use a bath for birth. All care was the same. Consent obtained early in labour but randomisation took place at full second stage. Same main caregivers for all women.
Outcomes	Maternal outcomes: *maternal experience and satisfaction of labour; *pain; *use of analgesia/anaesthesia; *augmentation of labour; *blood pressure; *pulse; *duration of labour and birth; *mode of delivery; *trauma to the birth canal requiring suturing; *blood loss; maternal infection; *postpartum depression. Fetal outcomes: *abnormal fetal heart rate patterns needing intervention. Neonatal outcomes:

Nikodem 1999 (*Continued*)

	*neonatal condition; *admittance to NICU or high dependency care unit; *temperature at birth; *perinatal deaths; delivered in OP position; gravida; age; birth weight; duration in bath.
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	Adequate.
Blinding? All outcomes	No	High risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation.

Ohlsson 2001

Methods	Randomised when regular contractions and eligible. Sealed opaque envelopes, location not indicated. Methodological qualities: (1) Selection bias: low risk; adequate concealment at time of randomisation. (2) Performance bias: high risk of bias; could have been introduced because researcher cannot be blind to group allocation after randomisation. (3) Exclusion bias: moderate risk of bias; 46 were excluded and 11.1% (KH) and 4.4% (LH) did not use tub. (4) Bias conclusion: moderate bias; one or more criteria partially met. May raise some doubt about the results.
Participants	Study group: KH: n = 364. OH: n = 95; LH: n = 153; total = 612. Control group: KH: n = 376; OH: n = 97; LH: n =152; total = 625. Inclusion criteria: gestation > 35 weeks; previous caesarean sections included (VBAC); twins included; active labour > 3 cm cervical dilatation; ruptured membranes on entry also eligible. Ambulation, analgesics and anaesthesia were allowed. 42 were withdrawn (15 from OH, 21 from LH and 6 KH) no indication for study/control group split for withdraws.

Ohlsson 2001 (*Continued*)

Interventions	Study group: warm bath; no information on management of care for either group; no information on water temperature or bath size. Control group: shower allowed. Water use in first stage, no mention of one-to-one second care or not.
Outcomes	Maternal outcomes: *use of analgesia/anaesthesia; *mode of delivery; *trauma to the birth canal requiring suturing. Neonatal outcomes: *neonatal condition; *admittance to NICU or high dependency care unit. Additional outcomes: secondary arrest and delivered in OP position.
Notes	Academic hospital, Ontario, Canada.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	Adequate.
Blinding? All outcomes	No	High risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation.

Rush 1996

Methods	Randomisation by consecutively numbered, computer generated random allocation in sealed opaque envelopes. Methodological qualities: (1) Selection bias: low risk; adequate concealment at time of randomisation. (2) Performance bias: high risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation. (3) Exclusion bias: high risk of bias. (4) Bias conclusion: high risk of bias. Where one or more criteria are not met may cause plausible bias that seriously weakens confidence in the results.
Participants	Academic hospital, Ontario, Canada. Inclusion criteria: gestation > 37 weeks; previous caesarean sections included (VBAC); twins included; active labour > 3 cm cervical dilatation; ruptured membranes on entry also eligible. Ambulation, analgesics and anaesthesia were allowed. 800 women were randomised, 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 bath 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. Experimental group adds up to 394.
Interventions	Study group: n = 393. The use of a Parker whirlpool hot tub with jets during labour. Bath temperature between 38-39 degrees celsius. Mean total time in tub was 54 minutes. No births in tub. Control group: n = 392. No water immersion during labour. Refer to care being provided by assigned nurse, and all had be trained to care for women using immersion, but not clear if this is one-to-one second care. First stage only.
Outcomes	Maternal outcomes: *use of analgesia/anaesthesia; *augmentation of labour; *presence of meconium stained liquor; *duration of labour and birth; *mode of delivery. Additional outcomes: maternal age; gravida; cervical dilatation; duration in tub; VBAC.
Notes	Data table 1 incorrect. No response from authors.

Risk of bias

Item	**Authors' judgement**	**Description**
Allocation concealment?	Yes	Adequate.
Blinding? All outcomes	No	High risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation.

Schorn 1993

Methods	Randomisation by packets containing random computer generated codes. Methodological qualities: (1) Selection bias: high risk - the researcher knew group allocation before obtaining informed consent. (2) Performance bias: high risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation. (3) 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. (4) Bias conclusion: moderate bias. One or more criteria partially met. May raise some doubt about the results.
Participants	Study group: n = 45. Control group: n = 48. Inclusion criteria: gestation between 36-41 weeks; no major obstetric or medical complication; active labour between 4-7 cm cervical dilatation; intact membranes on entry; normal fetal heart rate patterns; ambulation and analgesics were allowed.
Interventions	Study group: 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: No water immersion during labour. Showers were allowed. First stage of labour.
Outcomes	Maternal age; gestational age; ethnicity; parity; water temperature; duration in bath; *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; re-admissions to hospital.

Schorn 1993 (*Continued*)

Notes	Academic hospital, Houston, Texas, USA.	
Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	No	Inadequate.
Blinding? All outcomes	No	High risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation.

Taha 2000

Methods	Randomisation by sealed opaque, sequentially numbered sealed opaque envelopes containing the code. Prepared in random blocks of ten, stratified for parity. Randomised when in active birth labour and met inclusion and exclusion criteria. Methodological qualities: (1) Selection bias: none. (2) Performance bias: high risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation. (3) Exclusion bias: low risk of bias all women received their allocated treatment. Analysed according to intention to treat. One lost to follow up. (4) Bias conclusion: moderate bias. One or more criteria partially met. May raise some doubt about the results.
Participants	Study group: n = 59. Control group: n = 61. Inclusion criteria: in active labour; primiparous women with cervical dilatation of 4-7 cm; multiparous women with cervical dilatation of 4-6 cm; low risk women; read/understand English. Exclusion criteria: poor obstetric history; previous CS; medical disorders; pre-eclampsia; multiple pregnancy; intrauterine growth impairment < 36 weeks and > 42 weeks; pyrexia; meconium stained liquor; prolonged ruptured of membranes.
Interventions	Study group: labour in water; water temperature 34-38 degrees Celsius; analgesia as required; exit for second stage; not out of the water for more than 30 minutes. Control group: encouraged ambulation; if lie down use side analgesia as required. Same midwife for all women (so one-to-one second stage care assumed) also same observer/assessor of

Taha 2000 (*Continued*)

	pain for all. First stage study.
Outcomes	Outcomes reported: maternal outcomes; *pain; *use of analgesia/anaesthesia; *augmentation of labour; *blood pressure; *pulse; *duration of labour and birth; *mode of delivery; *trauma to the birth canal requiring suturing; *blood loss; *postpartum depression; *breastfeeding; fetal outcomes; *abnormal fetal heart rate patterns needing intervention. Additional outcomes: studies which describe additional outcomes that may be of importance will be mentioned in the text; gestational age; maternal age; gravida; parity; cervical dilatation; duration in tub; meconium stain liquor.
Notes	Academic hospital, South Africa.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	Adequate.
Blinding? All outcomes	No	High risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation.

Woodward 2004

Methods	Randomisation schedule provided by National Perinatal Epidemiology Unit, Oxford. A person unconnected to study prepared by consecutively numbered, computer-generated random allocation in sealed opaque envelopes. Methodological qualities: (1) Selection bias: low risk; adequate concealment at time of randomisation. (2) Performance bias: high risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation. (3) Exclusion bias: moderate risk as, although expected and 2:1 randomisation undertaken, 16 of 40 women in water arm and 2 of 20 in control arm did not receive their allocated treatment. Analysed according to intention to treat. One woman withdrew. (4) Bias conclusion: Moderate risk of bias. Where one or more criteria are not met may cause plausible bias that seriously weakens confidence in the results.
Participants	2 groups in RCT part of study. Water n = 40. Land n = 20 (2:1 ratio as about local experience was 50% of women choose not to use water). Women recruited through community midwife, posters in clinics, and media promotions and interested women contacted researcher or gave permission to own midwife to pass on information. Aged 18-50. Low risk.
Interventions	Women could use pool in first and second stages of labour - results do not distinguish which of the women allocated to pool, did not use pool (16 of 40 women), used pool for first stage only (13 of 40 women), used pool in second stage but not for birth (1 woman), or gave birth in the pool (10 women) (no subgroup analysis). Data entered into both 'immersion in water versus no immersion during first stage of labour ' AND 'immersion in water versus no immersion during second stage of labour' DATA and ANALYSIS section. Waterbirth pool - dimensions/volume not described, temperature described as recorded but data not provided. No mention of one-to-one second care or not.
Outcomes	Intention to treat analysis done. Maternal: age, social history, pulse, temperature, maternal satisfaction on scale of 0-6 immediately post birth and in 6 week postal questionnaire. Labour: length of first, second stages; analgesia used; augmentation; mode of birth. Fetus/neonate: cord arterial and venous gases, Apgar score at 1, 5 and 10 mins, time to first respiration, rectal temperature at birth, ear swabs, method of feeding, date and time of first feed, admission to neonatal unit (plus any interventions needed) infection, any mortality/morbidity. Water; duration in water, water temperature, microbiological analysis at end of labour/use.
Notes	Non-randomised, preference arm data not included although additional 20 participants in this part of study. 16 (40%) of water women did not use water. UK study.

Risk of bias

Item	Authors' judgement	Description

Woodward 2004 (*Continued*)

Allocation concealment?	Yes	Adequate.
Blinding? All outcomes	No	High risk of bias could have been introduced because researcher cannot be blind to group allocation after randomisation.

*: prespecified outcomes
CS: caesarean section
FHR: fetal heart rate
KH: Karlskrona Hospital
LH: Lund hospital
NICU: neonatal intensive care unit
OH: Osterund Hospital
OP: occipito posterior
VBAC: vaginal birth after caesarean section

Characteristics of excluded studies *[ordered by study ID]*

Bastide 1990	Unpublished data from 1990 available only. Inadequate data for assessment at this time. We contacted the author for further information, but nothing was provided.
Benfield 2001	Inadequate allocation concealment.
Calvert 2000	Results of this pilot study (22 women) are not given in a format that can be used in the review. The aim was to compare the effect of the essential oil of ginger compared to essential oil of lemon grass on the progress of labour. The pilot study showed no differences on frequency of contractions, cervical dilatation or duration of first stage of labour between the two groups.
Cluett 2001	Feasibility study: only 4 women in each of the 3 trial arms. Women had all been diagnosed as having dystocia in the first stage of labour (less than 1 cm/hr progress after established labour).
Cluett 2004	Women had all been diagnosed as having dystocia in the first stage of labour (less than 1 cm/hr progress after established labour) and the comparison group was women receiving augmentation of labour.
Labrecque 1999	The method does not meet the inclusion criteria for this review. It is impossible to disentangle the effects of immersion in water. The aim of the trial was to compare three non-pharmacological approaches to relieve back pain. A total of 34 women were randomly allocated to receive one of three treatments: (1) intracutaneous sterile water injections, (2) transcutaneous electrical nerve stimulation and (3) standard care that included back massage, whirlpool bath and liberal mobilization. The sample size is small and results should be interpreted within the setting only. Women in the ISW group experienced a decrease in the intensity and unpleasantness of their backache, but they would not like to use this method in a future labour.

(*Continued*)

Malarewicz 2005	Randomisation not clear from English abstract, refer to 2005 women of which 100 in control group but allocation to group not detailed. Could be reclassified if full translation becomes available.

ISW: intracutaneous sterile water injection

DATA AND ANALYSES

Comparison 1. Immersion in water versus no immersion during first stage of labour

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Use of epidural/spinal analgesia/ paracervical block	6	2499	Odds Ratio (M-H, Fixed, 95% CI)	0.82 [0.70, 0.98]
2 Pethidine/narcotic used	4	1240	Odds Ratio (M-H, Fixed, 95% CI)	0.97 [0.65, 1.44]
3 Use of transcutaneous nerve stimulation (TENS)	2	845	Odds Ratio (M-H, Fixed, 95% CI)	1.05 [0.36, 3.10]
4 Use of any analgesia	4	547	Odds Ratio (M-H, Fixed, 95% CI)	0.95 [0.63, 1.43]
5 Any pharmacological analgesia	2	394	Odds Ratio (M-H, Fixed, 95% CI)	1.08 [0.71, 1.65]
6 Experience of moderate to severe pain	1		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only
6.1 Ordinal description as moderate to severe	1	120	Odds Ratio (M-H, Fixed, 95% CI)	0.23 [0.08, 0.63]
6.2 Line scale	1	120	Odds Ratio (M-H, Fixed, 95% CI)	0.25 [0.10, 0.63]
7 Instrumental/surgical delivery	8		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only
7.1 Assisted vaginal deliveries	7	2628	Odds Ratio (M-H, Fixed, 95% CI)	0.84 [0.66, 1.06]
7.2 Caesarean section	8	2712	Odds Ratio (M-H, Fixed, 95% CI)	1.23 [0.86, 1.75]
8 Duration of first stage (minutes)	6	1355	Mean Difference (IV, Fixed, 95% CI)	-10.18 [-43.06, 22.70]
9 Duration of second stage (minutes)	7	1463	Mean Difference (IV, Fixed, 95% CI)	0.52 [-3.95, 4.99]
10 Duration of third stage (minutes)	2	1059	Mean Difference (IV, Fixed, 95% CI)	0.25 [-1.10, 1.60]
11 Duration of labour from randomisation till delivery	0	0	Mean Difference (IV, Fixed, 95% CI)	Not estimable
12 Duration of total labour (all three stages)	1	120	Mean Difference (IV, Fixed, 95% CI)	-27.5 [-133.05, 78.05]
13 Postpartum haemorrhage	1	274	Odds Ratio (M-H, Fixed, 95% CI)	1.68 [0.78, 3.61]
14 Blood loss	2	153	Mean Difference (IV, Fixed, 95% CI)	-14.33 [-63.03, 34.37]
15 Perineal trauma after vaginal birth	6		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only
15.1 Intact	5	1337	Odds Ratio (M-H, Fixed, 95% CI)	1.25 [0.99, 1.58]
15.2 Episiotomy	5	1272	Odds Ratio (M-H, Fixed, 95% CI)	0.89 [0.70, 1.13]
15.3 Second degree tear	5	1286	Odds Ratio (M-H, Fixed, 95% CI)	0.93 [0.69, 1.25]
15.4 Third or fourth degree tears	5	2401	Odds Ratio (M-H, Fixed, 95% CI)	1.38 [0.85, 2.23]
16 Satisfication with labour	0	0	Mean Difference (IV, Fixed, 95% CI)	Not estimable
16.1 Labour and delivery satisfaction index	0	0	Mean Difference (IV, Fixed, 95% CI)	Not estimable
16.2 Dissatisfied measured using ordinal scale	0	0	Mean Difference (IV, Fixed, 95% CI)	Not estimable
17 Self reports pain score on visual analogue scale of 0-10	1	216	Mean Difference (IV, Fixed, 95% CI)	-0.51 [-0.92, -0.10]

17.1 Pain score at start of assessment period (time zero)	1	108	Mean Difference (IV, Fixed, 95% CI)	-0.20 [-0.79, 0.39]
17.2 Pain score 30 minutes later	1	108	Mean Difference (IV, Fixed, 95% CI)	-0.80 [-1.37, -0.23]
18 Does not wish to use bath with next labour/delivery	1	119	Odds Ratio (M-H, Fixed, 95% CI)	0.32 [0.11, 0.95]
19 Artificial rupture of membranes	3	926	Odds Ratio (M-H, Fixed, 95% CI)	1.04 [0.80, 1.36]
20 Amniotic fluid index	0	0	Odds Ratio (M-H, Fixed, 95% CI)	Not estimable
21 Presence of meconium stained liquor	5	1260	Odds Ratio (M-H, Fixed, 95% CI)	0.94 [0.71, 1.25]
22 Use of oxytocin for augmentation of labour	4	1019	Odds Ratio (M-H, Fixed, 95% CI)	0.88 [0.65, 1.20]
23 Systolic blood pressure	1	120	Mean Difference (IV, Fixed, 95% CI)	-7.20 [-13.12, -1.28]
24 Diastolic blood pressure	1	120	Mean Difference (IV, Fixed, 95% CI)	-10.20 [-13.70, -6.70]
25 Mean arterial blood pressure	1	120	Mean Difference (IV, Fixed, 95% CI)	-10.5 [-14.68, -6.32]
26 Maternal infection (perineal, systemic, uterine or increase in temperature)	5	1295	Odds Ratio (M-H, Fixed, 95% CI)	0.99 [0.49, 2.00]
27 Low self-esteem	0	0	Odds Ratio (M-H, Fixed, 95% CI)	Not estimable
28 Postpartum depression EPDS more than 11	2	370	Odds Ratio (M-H, Fixed, 95% CI)	1.49 [0.82, 2.71]
29 Not breastfeeding after six weeks postdelivery	2	363	Odds Ratio (M-H, Fixed, 95% CI)	1.20 [0.60, 2.39]
30 Abnormal fetal heart rate patterns	3	487	Odds Ratio (M-H, Fixed, 95% CI)	0.84 [0.54, 1.31]
31 Apgar score less than seven (five minutes)	5	1834	Odds Ratio (M-H, Fixed, 95% CI)	1.59 [0.63, 4.01]
32 Apgar score at five minutes	2	893	Mean Difference (IV, Fixed, 95% CI)	-0.03 [-0.11, 0.06]
33 Umbilical artery pH less than 7.20	1	110	Odds Ratio (M-H, Fixed, 95% CI)	5.38 [0.25, 114.71]
34 Neonate temperature	1		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only
34.1 Temperature less than 36.2 degrees C at birth	0	0	Odds Ratio (M-H, Fixed, 95% CI)	Not estimable
34.2 Temperature greater than 37.5 degrees C at birth	0	0	Odds Ratio (M-H, Fixed, 95% CI)	Not estimable
34.3 Temperature greater than 37.8 degrees C as an indicator for infection	1	274	Odds Ratio (M-H, Fixed, 95% CI)	1.0 [0.06, 16.15]
35 Admission to neonatal intensive care unit	3	1571	Odds Ratio (M-H, Fixed, 95% CI)	1.06 [0.70, 1.62]
36 Neonatal infection	5	1295	Odds Ratio (M-H, Fixed, 95% CI)	2.01 [0.50, 8.07]
37 Lung hypoplasia present	0	0	Odds Ratio (M-H, Fixed, 95% CI)	Not estimable
38 Perinatal deaths	0	0	Odds Ratio (M-H, Fixed, 95% CI)	Not estimable
39 Caregiver injuries	0	0	Odds Ratio (M-H, Fixed, 95% CI)	Not estimable
40 Neonatal gestational age at birth	9	2820	Mean Difference (IV, Fixed, 95% CI)	-0.01 [-0.82, 0.80]
41 Birth weight in grams	9	2820	Mean Difference (IV, Fixed, 95% CI)	-22.74 [-66.44, 20.96]

Comparison 2. Immersion in water versus no immersion during second stage of labour

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Experience of moderate to severe pain	1		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Ordinal description as moderate to severe	1	117	Odds Ratio (M-H, Fixed, 95% CI)	1.11 [0.54, 2.30]
1.2 Labour Agentry scale	0	0	Odds Ratio (M-H, Fixed, 95% CI)	Not estimable
1.3 Line scale	0	0	Odds Ratio (M-H, Fixed, 95% CI)	Not estimable
2 Satisfied with labour	1		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Labour and delivery satisfaction index	0	0	Odds Ratio (M-H, Fixed, 95% CI)	Not estimable
2.2 Little or not satisfied with coping experience	1	117	Odds Ratio (M-H, Fixed, 95% CI)	0.20 [0.05, 0.74]
3 Does not wish to use bath next delivery	1	117	Odds Ratio (M-H, Fixed, 95% CI)	0.52 [0.18, 1.55]
4 Perineal trauma after vaginal birth	2		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Episiotomy	2	179	Odds Ratio (M-H, Fixed, 95% CI)	0.70 [0.27, 1.80]
4.2 Second-degree tear	2	179	Odds Ratio (M-H, Fixed, 95% CI)	1.26 [0.59, 2.71]
4.3 Third-or fourth-degree tears	1	60	Odds Ratio (M-H, Fixed, 95% CI)	1.56 [0.06, 39.95]
5 Duration of second stage (minutes)	2	180	Mean Difference (IV, Fixed, 95% CI)	-4.84 [-17.25, 7.58]
6 Instrumental/surgical delivery	2		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only
6.1 Assisted vaginal deliveries	2	180	Odds Ratio (M-H, Fixed, 95% CI)	0.71 [0.18, 2.86]
6.2 Caesarean section	2	180	Odds Ratio (M-H, Fixed, 95% CI)	0.31 [0.06, 1.57]
7 Postpartum haemorrhage more than 500 ml	1	120	Odds Ratio (M-H, Fixed, 95% CI)	0.14 [0.01, 2.69]
8 Presence of meconium stained liquor	2	180	Odds Ratio (M-H, Fixed, 95% CI)	1.40 [0.57, 3.39]
9 Apgar score less than seven (five minutes)	1	119	Odds Ratio (M-H, Fixed, 95% CI)	5.09 [0.24, 108.22]
10 Apgar less than eight at five minutes	1	60	Odds Ratio (M-H, Fixed, 95% CI)	1.56 [0.06, 39.95]
11 Neonate temperature	1		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only
11.1 Temperature less than 36.2 degrees C at birth	1	109	Odds Ratio (M-H, Fixed, 95% CI)	0.98 [0.27, 3.60]
11.2 Temperature greater than 37.5 degrees C at birth	1	109	Odds Ratio (M-H, Fixed, 95% CI)	2.89 [0.72, 11.56]
11.3 Temperature greater 37.8 degrees C as an indicator for infection	0	0	Odds Ratio (M-H, Fixed, 95% CI)	Not estimable
12 Umbilical artery pH less than 7.20	1	116	Odds Ratio (M-H, Fixed, 95% CI)	0.86 [0.36, 2.06]
13 Cord arterial pH	1	48	Mean Difference (IV, Fixed, 95% CI)	Not estimable
14 Admission to neonatal intensive care unit	2	180	Odds Ratio (M-H, Fixed, 95% CI)	0.78 [0.23, 2.59]
15 Perinatal deaths	1	120	Odds Ratio (M-H, Fixed, 95% CI)	3.05 [0.12, 76.39]

16 Satisfaction with labour and birth on scale of 0-6 where 0 is not at all satisfied	1	60	Mean Difference (IV, Fixed, 95% CI)	0.03 [-0.64, 0.70]
17 Maternal temperature	1	60	Mean Difference (IV, Fixed, 95% CI)	0.20 [-0.18, 0.58]
18 Breast feeding	1	60	Odds Ratio (M-H, Fixed, 95% CI)	0.38 [0.07, 1.97]
19 Antibiotics given to neonate	1	60	Odds Ratio (M-H, Fixed, 95% CI)	1.54 [0.15, 15.83]
20 Positive neonatal swab of ear, mouth or umbilicus	1	154	Odds Ratio (M-H, Fixed, 95% CI)	2.26 [0.91, 5.58]
21 Neonatal gestational age at birth in days	2	180	Mean Difference (IV, Fixed, 95% CI)	-1.0 [-5.13, 3.13]

Comparison 5. Early versus late immersion in water

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Epidural/spinal analgesia/ paracervical block	1	200	Odds Ratio (M-H, Fixed, 95% CI)	3.09 [1.63, 5.84]
2 Use of oxytocin	1	200	Odds Ratio (M-H, Fixed, 95% CI)	3.09 [1.73, 5.54]
3 Instrumental or surgical delivery	0	0	Odds Ratio (M-H, Fixed, 95% CI)	Not estimable
4 Abnormal fetal heart rate patterns	1	200	Odds Ratio (M-H, Fixed, 95% CI)	Not estimable
5 Apgar score less than seven at one minute	1	200	Odds Ratio (M-H, Fixed, 95% CI)	Not estimable
6 Neonatal infection	1	200	Odds Ratio (M-H, Fixed, 95% CI)	3.03 [0.12, 75.28]
7 Admission to neonatal special care unit	0	0	Odds Ratio (M-H, Fixed, 95% CI)	Not estimable
8 Neonatal birth weight in grams	1	200	Mean Difference (IV, Fixed, 95% CI)	-66.0 [-189.34, 57.34]

Analysis 1.1. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 1 Use of epidural/spinal analgesia/paracervical block.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 1 Use of epidural/spinal analgesia/paracervical block

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Cammu 1994	7/54	8/56		2.3 %	0.89 [0.30, 2.66]
Eckert 2001	46/137	49/137		11.0 %	0.91 [0.55, 1.49]
Kuusela 1998	1/18	1/15		0.3 %	0.82 [0.05, 14.39]
Ohlsson 2001	183/612	205/625		48.2 %	0.87 [0.69, 1.11]
Rush 1996	235/393	259/392		35.4 %	0.76 [0.57, 1.02]
Woodward 2004	6/40	7/20		2.7 %	0.33 [0.09, 1.16]
Total (95% CI)	**1254**	**1245**		**100.0 %**	**0.82 [0.70, 0.98]**

Total events: 478 (Immersion), 529 (No immersion)

Heterogeneity: Chi^2 = 2.70, df = 5 (P = 0.75); I^2 =0.0%

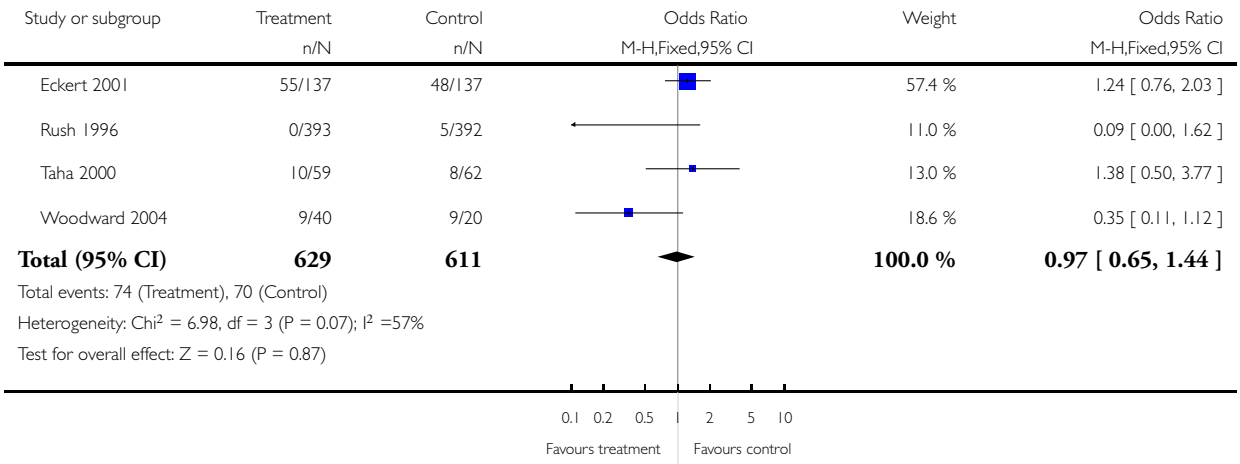
Test for overall effect: Z = 2.23 (P = 0.025)

Analysis 1.2. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 2 Pethidine/narcotic used.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 2 Pethidine/narcotic used

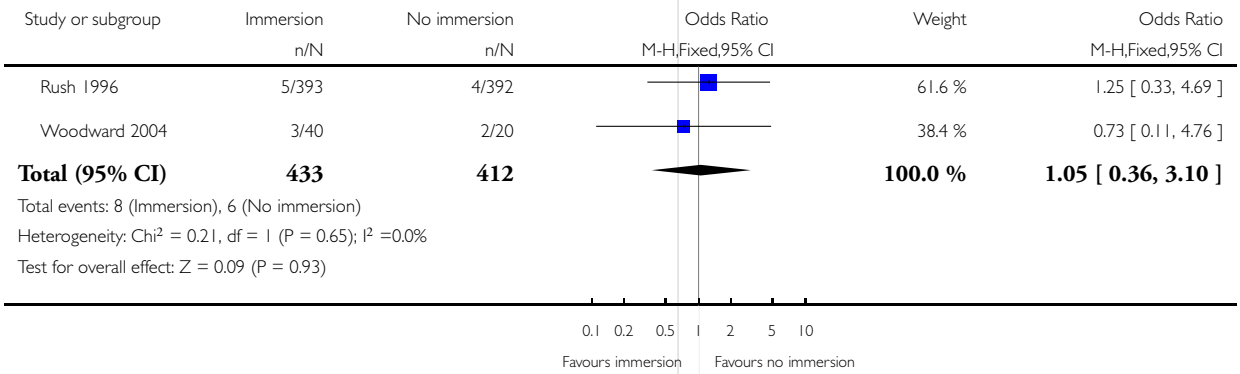


Analysis 1.3. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 3 Use of transcutaneous nerve stimulation (TENS).

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 3 Use of transcutaneous nerve stimulation (TENS)



Analysis 1.4. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 4 Use of any analgesia.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

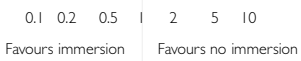
Outcome: 4 Use of any analgesia

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Eckert 2001	114/137	110/137		39.8 %	1.22 [0.66, 2.25]
Schorn 1993	21/45	24/48		26.7 %	0.88 [0.39, 1.98]
Taha 2000	13/59	17/61		28.1 %	0.73 [0.32, 1.68]
Woodward 2004	36/40	19/20		5.5 %	0.47 [0.05, 4.54]
Total (95% CI)	**281**	**266**		**100.0 %**	**0.95 [0.63, 1.43]**

Total events: 184 (Immersion), 170 (No immersion)

Heterogeneity: Chi^2 = 1.40, df = 3 (P = 0.70); I^2 =0.0%

Test for overall effect: Z = 0.25 (P = 0.80)



Analysis 1.5. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 5 Any pharmacological analgesia.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 5 Any pharmacological analgesia

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Eckert 2001	55/137	48/137		68.8 %	1.24 [0.76, 2.03]
Taha 2000	13/59	17/61		31.2 %	0.73 [0.32, 1.68]
Total (95% CI)	**196**	**198**		**100.0 %**	**1.08 [0.71, 1.65]**

Total events: 68 (Immersion), 65 (No immersion)

Heterogeneity: Chi^2 = 1.16, df = 1 (P = 0.28); I^2 =14%

Test for overall effect: Z = 0.38 (P = 0.71)

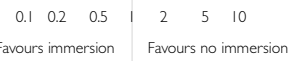
Analysis 1.6. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 6 Experience of moderate to severe pain.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 6 Experience of moderate to severe pain

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
1 Ordinal description as moderate to severe					
Taha 2000	40/59	55/61		100.0 %	0.23 [0.08, 0.63]
Subtotal (95% CI)	**59**	**61**		**100.0 %**	**0.23 [0.08, 0.63]**
Total events: 40 (Immersion), 55 (No immersion)					
Heterogeneity: not applicable					
Test for overall effect: Z = 2.87 (P = 0.0041)					
2 Line scale					
Taha 2000	37/59	53/61		100.0 %	0.25 [0.10, 0.63]
Subtotal (95% CI)	**59**	**61**		**100.0 %**	**0.25 [0.10, 0.63]**
Total events: 37 (Immersion), 53 (No immersion)					
Heterogeneity: not applicable					
Test for overall effect: Z = 2.95 (P = 0.0032)					

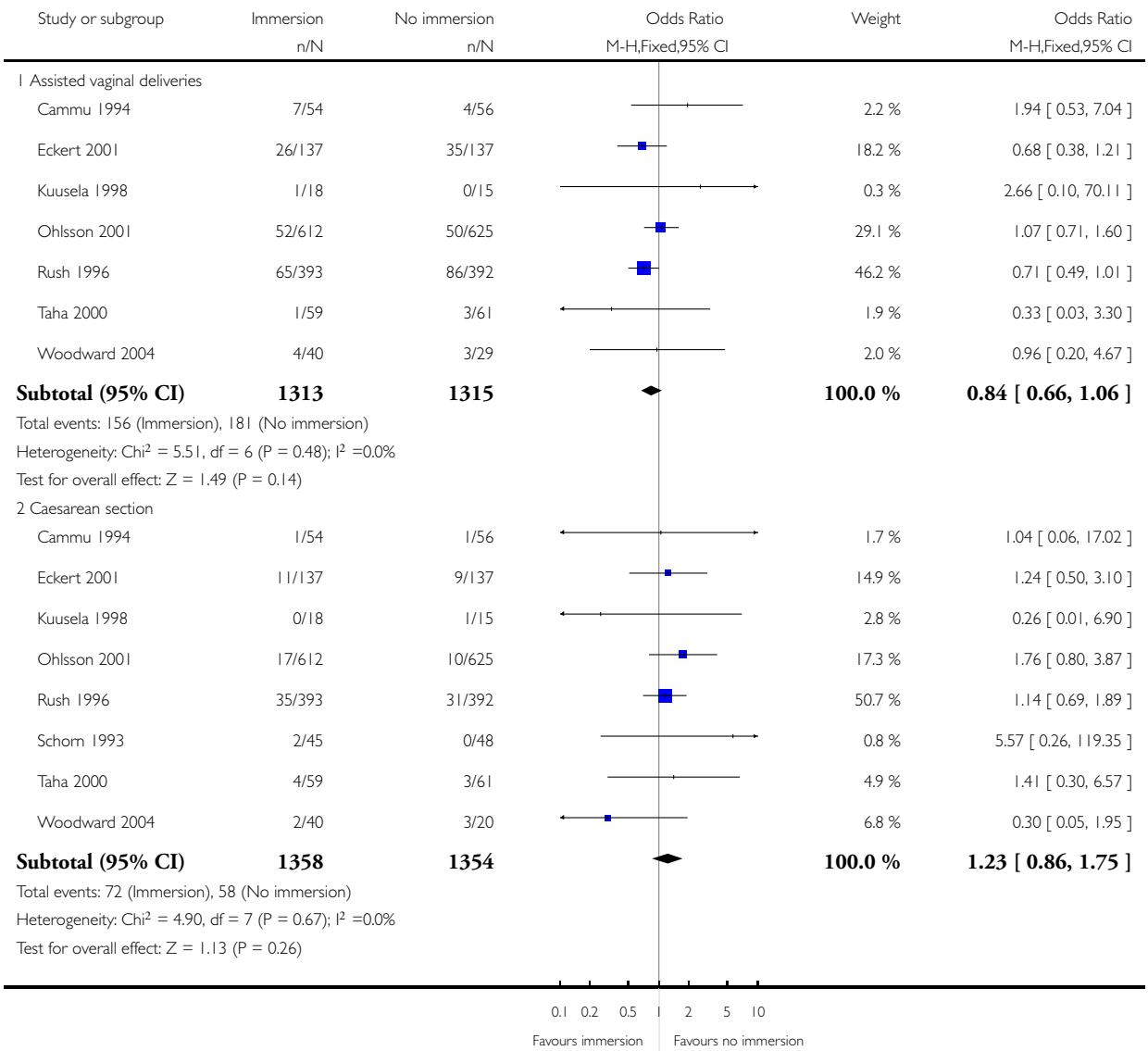


Analysis 1.7. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 7 Instrumental/surgical delivery.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 7 Instrumental/surgical delivery



Analysis 1.8. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 8 Duration of first stage (minutes).

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 8 Duration of first stage (minutes)

Study or subgroup	Immersion		No immersion		Mean Difference	Weight	Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Fixed,95% CI		IV,Fixed,95% CI
Cammu 1994	54	244 (139)	56	264 (170)		32.2 %	-20.00 [-77.94, 37.94]
Eckert 2001	137	404.23 (225.23)	137	407.21 (222.56)		38.5 %	-2.98 [-56.00, 50.04]
Kuusela 1998	18	528 (216)	15	642 (354)		2.6 %	-114.00 [-319.06, 91.06]
Rush 1996	393	403 (596)	392	405 (555)		16.7 %	-2.00 [-82.56, 78.56]
Schorn 1993	45	846 (432)	48	846 (348)		4.2 %	0.0 [-160.07, 160.07]
Woodward 2004	40	420.8 (225.4)	20	409.4 (265)		5.9 %	11.40 [-124.13, 146.93]
Total (95% CI)	**687**		**668**			**100.0 %**	**-10.18 [-43.06, 22.70]**

Heterogeneity: Chi^2 = 1.32, df = 5 (P = 0.93); I^2 =0.0%

Test for overall effect: Z = 0.61 (P = 0.54)

Analysis 1.9. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 9 Duration of second stage (minutes).

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 9 Duration of second stage (minutes)

Study or subgroup	Immersion N	Mean(SD)	No immersion N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Cammu 1994	54	33 (20)	56	34 (22)		-1.00 [-8.85, 6.85]
da Silva 2007	54	37.5 (25.9)	54	31.8 (19.1)		5.70 [-2.88, 14.28]
Eckert 2001	137	64.94 (66.25)	137	68.8 (69.8)		-3.86 [-19.97, 12.25]
Kuusela 1998	18	21 (0)	15	20 (0)		0.0 [0.0, 0.0]
Rush 1996	393	56.7 (61)	392	57.9 (57.6)		-1.20 [-9.50, 7.10]
Schorn 1993	45	108 (222)	48	36 (42)		72.00 [6.06, 137.94]
Woodward 2004	40	47.3 (46.8)	20	58.7 (44.3)		-11.40 [-35.63, 12.83]
Total (95% CI)	**741**		**722**			**0.52 [-3.95, 4.99]**

Heterogeneity: Chi² = 7.44, df = 5 (P = 0.19); I² =33%

Test for overall effect: Z = 0.23 (P = 0.82)

Analysis 1.10. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 10 Duration of third stage (minutes).

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 10 Duration of third stage (minutes)

Study or subgroup	Immersion N	Mean(SD)	No immersion N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Eckert 2001	137	15.58 (33.36)	137	13.42 (17.74)		4.6 %	2.16 [-4.17, 8.49]
Rush 1996	393	8.26 (8.74)	392	8.1 (10.9)		95.4 %	0.16 [-1.22, 1.54]
Total (95% CI)	**530**		**529**			**100.0 %**	**0.25 [-1.10, 1.60]**

Heterogeneity: Chi² = 0.37, df = 1 (P = 0.54); I² =0.0%

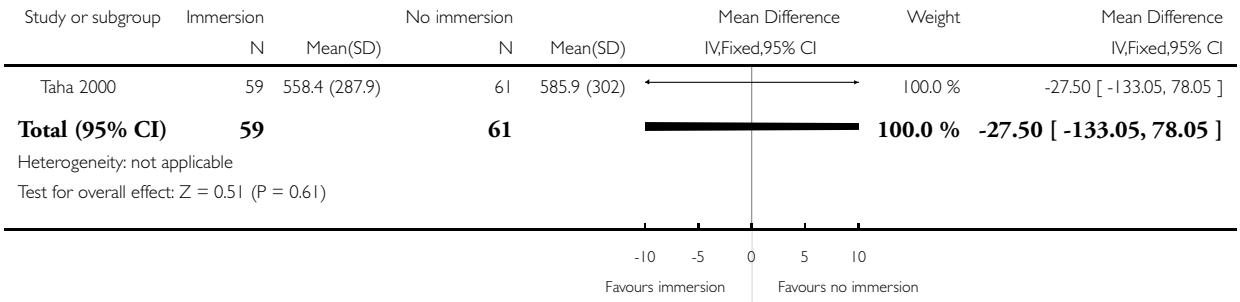
Test for overall effect: Z = 0.36 (P = 0.72)

Analysis 1.12. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 12 Duration of total labour (all three stages).

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 12 Duration of total labour (all three stages)

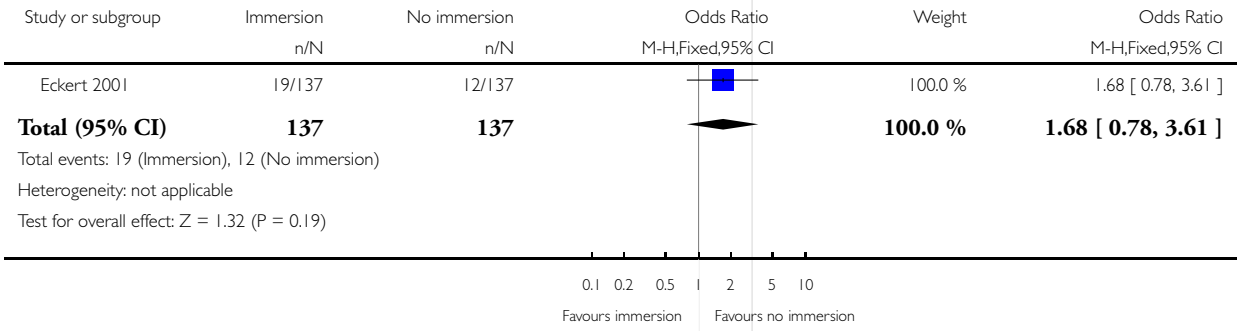


Analysis 1.13. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 13 Postpartum haemorrhage.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 13 Postpartum haemorrhage

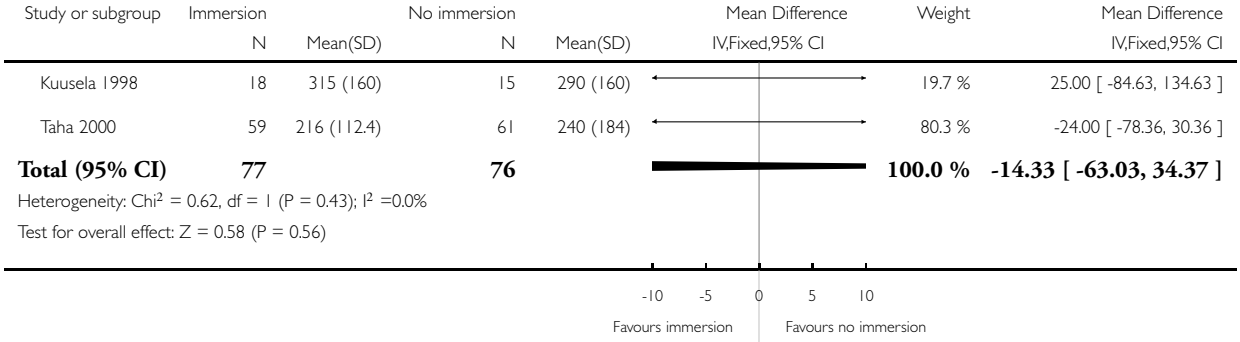


Analysis 1.14. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 14 Blood loss.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 14 Blood loss

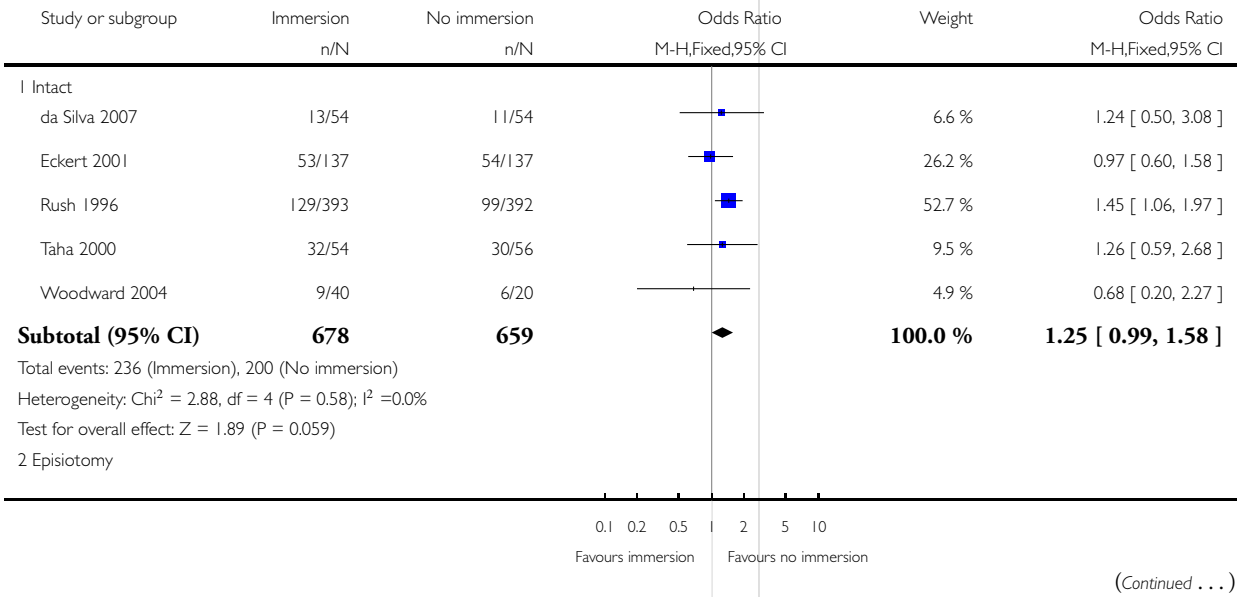


Analysis 1.15. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 15 Perineal trauma after vaginal birth.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 15 Perineal trauma after vaginal birth



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Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
da Silva 2007	27/54	27/54		9.5 %	1.00 [0.47, 2.13]
Eckert 2001	35/137	32/137		16.8 %	1.13 [0.65, 1.95]
Rush 1996	135/358	147/361		64.4 %	0.88 [0.65, 1.19]
Taha 2000	1/55	7/56		4.8 %	0.13 [0.02, 1.09]
Woodward 2004	9/40	6/20		4.4 %	0.68 [0.20, 2.27]
Subtotal (95% CI)	**644**	**628**		**100.0 %**	**0.89 [0.70, 1.13]**
Total events: 207 (Immersion), 219 (No immersion)					
Heterogeneity: Chi^2 = 4.13, df = 4 (P = 0.39); I^2 =3%					
Test for overall effect: Z = 0.96 (P = 0.34)					
3 Second degree tear					
da Silva 2007	7/54	5/54		4.7 %	1.46 [0.43, 4.92]
Eckert 2001	32/137	43/137		35.7 %	0.67 [0.39, 1.14]
Rush 1996	58/358	56/361		50.6 %	1.05 [0.71, 1.57]
Taha 2000	5/55	5/56		4.9 %	1.02 [0.28, 3.74]
Woodward 2004	8/54	3/20		4.0 %	0.99 [0.23, 4.15]
Subtotal (95% CI)	**658**	**628**		**100.0 %**	**0.93 [0.69, 1.25]**
Total events: 110 (Immersion), 112 (No immersion)					
Heterogeneity: Chi^2 = 2.41, df = 4 (P = 0.66); I^2 =0.0%					
Test for overall effect: Z = 0.49 (P = 0.63)					
4 Third or fourth degree tears					
Eckert 2001	5/137	2/137		6.7 %	2.56 [0.49, 13.41]
Ohlsson 2001	28/612	22/625		72.3 %	1.31 [0.74, 2.32]
Rush 1996	6/358	4/361		13.6 %	1.52 [0.43, 5.44]
Taha 2000	0/55	1/56		5.1 %	0.33 [0.01, 8.36]
Woodward 2004	1/40	0/20		2.2 %	1.56 [0.06, 39.95]
Subtotal (95% CI)	**1202**	**1199**		**100.0 %**	**1.38 [0.85, 2.23]**
Total events: 40 (Immersion), 29 (No immersion)					
Heterogeneity: Chi^2 = 1.33, df = 4 (P = 0.86); I^2 =0.0%					
Test for overall effect: Z = 1.32 (P = 0.19)					

Analysis 1.17. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 17 Self reports pain score on visual analogue scale of 0-10.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 17 Self reports pain score on visual analogue scale of 0-10

Study or subgroup	Immersion N	Mean(SD)	No Immersion N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
1 Pain score at start of assessment period (time zero)							
da Silva 2007	54	8.5 (1.4)	54	8.7 (1.7)		48.2 %	-0.20 [-0.79, 0.39]
Subtotal (95% CI)	**54**		**54**			**48.2 %**	**-0.20 [-0.79, 0.39]**
Heterogeneity: not applicable							
Test for overall effect: Z = 0.67 (P = 0.50)							
2 Pain score 30 minutes later							
da Silva 2007	54	8.5 (1.6)	54	9.3 (1.4)		51.8 %	-0.80 [-1.37, -0.23]
Subtotal (95% CI)	**54**		**54**			**51.8 %**	**-0.80 [-1.37, -0.23]**
Heterogeneity: not applicable							
Test for overall effect: Z = 2.77 (P = 0.0057)							
Total (95% CI)	**108**		**108**			**100.0 %**	**-0.51 [-0.92, -0.10]**
Heterogeneity: Chi^2 = 2.07, df = 1 (P = 0.15); I^2 =52%							
Test for overall effect: Z = 2.45 (P = 0.014)							
Test for subgroup differences: Chi^2 = 2.07, df = 1 (P = 0.15), I^2 =52%							

Analysis 1.18. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 18 Does not wish to use bath with next labour/delivery.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 18 Does not wish to use bath with next labour/delivery

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Taha 2000	5/58	14/61		100.0 %	0.32 [0.11, 0.95]
Total (95% CI)	**58**	**61**		**100.0 %**	**0.32 [0.11, 0.95]**
Total events: 5 (Immersion), 14 (No immersion)					
Heterogeneity: not applicable					
Test for overall effect: Z = 2.06 (P = 0.039)					

Analysis 1.19. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 19 Artificial rupture of membranes.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 19 Artificial rupture of membranes

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
da Silva 2007	42/54	36/54		7.2 %	1.75 [0.74, 4.12]
Kuusela 1998	11/18	7/15		2.7 %	1.80 [0.45, 7.20]
Rush 1996	187/393	190/392		90.1 %	0.97 [0.73, 1.28]
Total (95% CI)	**465**	**461**		**100.0 %**	**1.04 [0.80, 1.36]**

Total events: 240 (Immersion), 233 (No immersion)

Heterogeneity: $Chi^2 = 2.29$, df = 2 (P = 0.32); $I^2 = 13\%$

Test for overall effect: Z = 0.32 (P = 0.75)

Analysis 1.21. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 21 Presence of meconium stained liquor.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 21 Presence of meconium stained liquor

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
da Silva 2007	1/54	6/54		5.8 %	0.15 [0.02, 1.30]
Eckert 2001	33/137	28/137		21.1 %	1.24 [0.70, 2.19]
Kuusela 1998	4/18	6/15		5.0 %	0.43 [0.09, 1.95]
Rush 1996	76/393	80/392		64.1 %	0.94 [0.66, 1.33]
Woodward 2004	10/40	4/20		4.0 %	1.33 [0.36, 4.94]
Total (95% CI)	**642**	**618**		**100.0 %**	**0.94 [0.71, 1.25]**

Total events: 124 (Immersion), 124 (No immersion)

Heterogeneity: Chi² = 4.95, df = 4 (P = 0.29); I² =19%

Test for overall effect: Z = 0.41 (P = 0.68)

Analysis 1.22. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 22 Use of oxytocin for augmentation of labour.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 22 Use of oxytocin for augmentation of labour

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
da Silva 2007	19/54	23/54		17.1 %	0.73 [0.34, 1.59]
Kuusela 1998	3/18	5/15		5.2 %	0.40 [0.08, 2.06]
Rush 1996	71/393	73/392		68.6 %	0.96 [0.67, 1.38]
Schorn 1993	8/45	10/48		9.1 %	0.82 [0.29, 2.31]
Total (95% CI)	**510**	**509**		**100.0 %**	**0.88 [0.65, 1.20]**

Total events: 101 (Immersion), 111 (No immersion)

Heterogeneity: Chi² = 1.36, df = 3 (P = 0.71); I² =0.0%

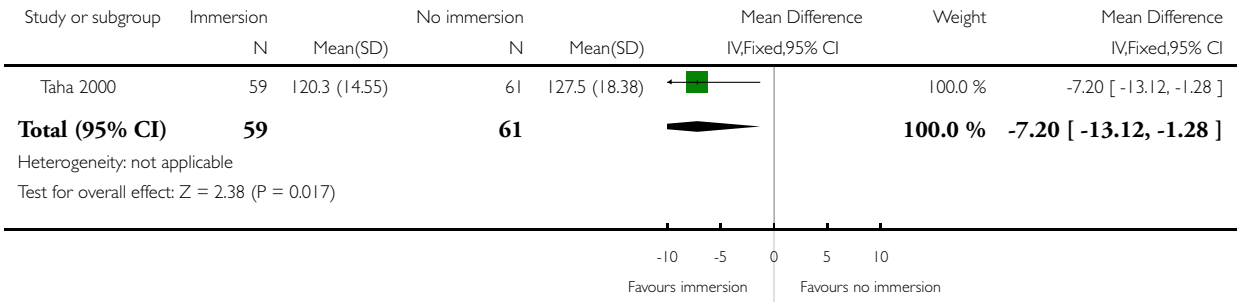
Test for overall effect: Z = 0.81 (P = 0.42)

Analysis 1.23. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 23 Systolic blood pressure.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 23 Systolic blood pressure

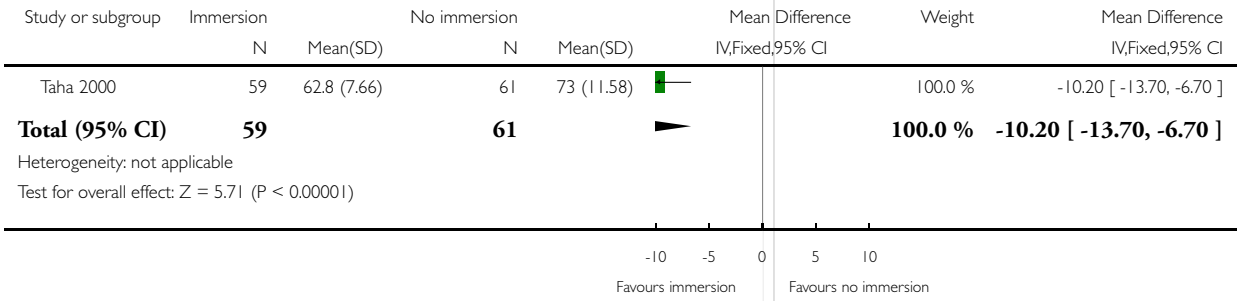


Analysis 1.24. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 24 Diastolic blood pressure.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 24 Diastolic blood pressure



Analysis 1.25. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 25 Mean arterial blood pressure.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 25 Mean arterial blood pressure

Study or subgroup	Immersion N	Mean(SD)	No immersion N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Taha 2000	59	83.7 (8.48)	61	94.2 (14.27)		100.0 %	-10.50 [-14.68, -6.32]
Total (95% CI)	**59**		**61**			**100.0 %**	**-10.50 [-14.68, -6.32]**

Heterogeneity: not applicable

Test for overall effect: Z = 4.92 (P < 0.00001)

Analysis 1.26. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 26 Maternal infection (perineal, systemic, uterine or increase in temperature).

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

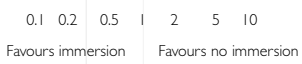
Outcome: 26 Maternal infection (perineal, systemic, uterine or increase in temperature)

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Odds Ratio M-H,Fixed,95% CI
Cammu 1994	0/54	1/56		0.34 [0.01, 8.52]
Eckert 2001	0/137	0/137		0.0 [0.0, 0.0]
Kuusela 1998	0/18	2/15		0.15 [0.01, 3.29]
Rush 1996	14/393	9/392		1.57 [0.67, 3.68]
Schorn 1993	1/45	3/48		0.34 [0.03, 3.40]
Total (95% CI)	**647**	**648**		**0.99 [0.49, 2.00]**

Total events: 15 (Immersion), 15 (No immersion)

Heterogeneity: Chi^2 = 3.83, df = 3 (P = 0.28); I^2 =22%

Test for overall effect: Z = 0.02 (P = 0.98)



Analysis 1.28. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 28 Postpartum depression EPDS more than 11.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 28 Postpartum depression EPDS more than 11

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Eckert 2001	14/137	12/137		61.0 %	1.19 [0.53, 2.67]
Taha 2000	17/47	11/49		39.0 %	1.96 [0.80, 4.80]
Total (95% CI)	**184**	**186**		**100.0 %**	**1.49 [0.82, 2.71]**

Total events: 31 (Immersion), 23 (No immersion)

Heterogeneity: Chi² = 0.66, df = 1 (P = 0.42); I² =0.0%

Test for overall effect: Z = 1.30 (P = 0.19)

Analysis 1.29. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 29 Not breastfeeding after six weeks postdelivery.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 29 Not breastfeeding after six weeks postdelivery

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Eckert 2001	12/137	7/130		44.6 %	1.69 [0.64, 4.43]
Taha 2000	8/47	10/49		55.4 %	0.80 [0.29, 2.24]
Total (95% CI)	**184**	**179**		**100.0 %**	**1.20 [0.60, 2.39]**

Total events: 20 (Immersion), 17 (No immersion)

Heterogeneity: Chi² = 1.07, df = 1 (P = 0.30); I² =7%

Test for overall effect: Z = 0.51 (P = 0.61)

Analysis 1.30. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 30 Abnormal fetal heart rate patterns.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

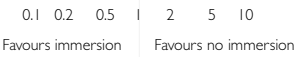
Outcome: 30 Abnormal fetal heart rate patterns

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Odds Ratio M-H,Fixed,95% CI
Eckert 2001	58/137	59/137		0.97 [0.60, 1.57]
Schorn 1993	0/45	0/48		0.0 [0.0, 0.0]
Taha 2000	4/59	10/61		0.37 [0.11, 1.26]
Total (95% CI)	**241**	**246**		**0.84 [0.54, 1.31]**

Total events: 62 (Immersion), 69 (No immersion)

Heterogeneity: Chi^2 = 2.07, df = 1 (P = 0.15); I^2 =52%

Test for overall effect: Z = 0.76 (P = 0.45)



Analysis 1.31. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 31 Apgar score less than seven (five minutes).

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 31 Apgar score less than seven (five minutes)

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Cammu 1994	1/54	0/56		6.6 %	3.17 [0.13, 79.48]
Eckert 2001	1/137	0/137		6.8 %	3.02 [0.12, 74.83]
Ohlsson 2001	4/612	5/625		67.6 %	0.82 [0.22, 3.05]
Schorn 1993	3/45	1/48		12.4 %	3.36 [0.34, 33.52]
Taha 2000	1/59	0/61		6.6 %	3.15 [0.13, 78.98]
Total (95% CI)	**907**	**927**		**100.0 %**	**1.59 [0.63, 4.01]**

Total events: 10 (Immersion), 6 (No immersion)

Heterogeneity: Chi^2 = 1.89, df = 4 (P = 0.76); I^2 =0.0%

Test for overall effect: Z = 0.98 (P = 0.33)

Analysis 1.32. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 32 Apgar score at five minutes.

Review: Immersion in water in labour and birth

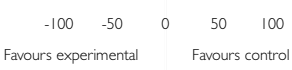
Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 32 Apgar score at five minutes

Study or subgroup	Immersion N	Mean(SD)	Non immersion N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
da Silva 2007	54	9.4 (0.5)	54	9.5 (0.5)		19.8 %	-0.10 [-0.29, 0.09]
Rush 1996	393	9.15 (0.69)	392	9.16 (0.65)		80.2 %	-0.01 [-0.10, 0.08]
Total (95% CI)	**447**		**446**			**100.0 %**	**-0.03 [-0.11, 0.06]**

Heterogeneity: Chi^2 = 0.70, df = 1 (P = 0.40); I^2 =0.0%

Test for overall effect: Z = 0.65 (P = 0.52)



Analysis 1.33. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 33 Umbilical artery pH less than 7.20.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 33 Umbilical artery pH less than 7.20

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Cammu 1994	2/54	0/56		100.0 %	5.38 [0.25, 114.71]
Total (95% CI)	**54**	**56**		**100.0 %**	**5.38 [0.25, 114.71]**

Total events: 2 (Immersion), 0 (No immersion)

Heterogeneity: not applicable

Test for overall effect: Z = 1.08 (P = 0.28)

Analysis 1.34. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 34 Neonate temperature.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 34 Neonate temperature

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
1 Temperature less than 36.2 degrees C at birth					
Subtotal (95% CI)	**0**	**0**		**0.0 %**	**0.0 [0.0, 0.0]**
Total events: 0 (Immersion), 0 (No immersion)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
2 Temperature greater than 37.5 degrees C at birth					
Subtotal (95% CI)	**0**	**0**		**0.0 %**	**0.0 [0.0, 0.0]**
Total events: 0 (Immersion), 0 (No immersion)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
3 Temperature greater than 37.8 degrees C as an indicator for infection					
Eckert 2001	1/137	1/137		100.0 %	1.00 [0.06, 16.15]
Subtotal (95% CI)	**137**	**137**		**100.0 %**	**1.00 [0.06, 16.15]**
Total events: 1 (Immersion), 1 (No immersion)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.0 (P = 1.0)					

Analysis 1.35. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 35 Admission to neonatal intensive care unit.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

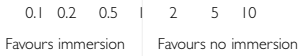
Outcome: 35 Admission to neonatal intensive care unit

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Eckert 2001	4/137	1/137		2.3 %	4.09 [0.45, 37.07]
Ohlsson 2001	41/612	43/625		94.7 %	0.97 [0.62, 1.51]
Woodward 2004	3/40	1/20		2.9 %	1.54 [0.15, 15.83]
Total (95% CI)	**789**	**782**		**100.0 %**	**1.06 [0.70, 1.62]**

Total events: 48 (Immersion), 45 (No immersion)

Heterogeneity: Chi^2 = 1.69, df = 2 (P = 0.43); I^2 =0.0%

Test for overall effect: Z = 0.27 (P = 0.78)



Analysis 1.36. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 36 Neonatal infection.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

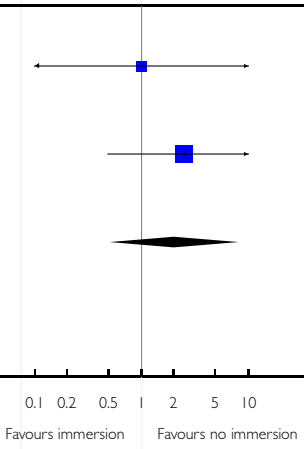
Outcome: 36 Neonatal infection

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Odds Ratio M-H,Fixed,95% CI
Cammu 1994	0/54	0/56		0.0 [0.0, 0.0]
Eckert 2001	1/137	1/137		1.00 [0.06, 16.15]
Kuusela 1998	0/18	0/15		0.0 [0.0, 0.0]
Rush 1996	5/393	2/392		2.51 [0.48, 13.03]
Schorn 1993	0/45	0/48		0.0 [0.0, 0.0]
Total (95% CI)	**647**	**648**		**2.01 [0.50, 8.07]**

Total events: 6 (Immersion), 3 (No immersion)

Heterogeneity: Chi^2 = 0.31, df = 1 (P = 0.58); I^2 =0.0%

Test for overall effect: Z = 0.98 (P = 0.33)



Analysis 1.40. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 40 Neonatal gestational age at birth.

Review: Immersion in water in labour and birth

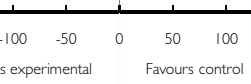
Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 40 Neonatal gestational age at birth

Study or subgroup	Immersion N	Mean(SD)	No Immersion N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Cammu 1994	54	278.6 (9.1)	56	277.2 (8.3)		1.40 [-1.86, 4.66]
da Silva 2007	54	276 (6.3)	54	276.5 (7.7)		-0.50 [-3.15, 2.15]
Eckert 2001	137	279.3 (7)	137	279 (7)		0.30 [-1.36, 1.96]
Kuusela 1998	18	273 (7)	15	280 (7)		-7.00 [-11.80, -2.20]
Ohlsson 2001	612	282.8 (0)	625	282 (0)		0.0 [0.0, 0.0]
Rush 1996	393	276 (9.1)	392	276 (9.24)		0.0 [-1.28, 1.28]
Schorn 1993	45	273.7 (9.8)	48	274.4 (7.7)		-0.70 [-4.30, 2.90]
Taha 2000	59	271.6 (8.33)	61	270.2 (7.56)		1.40 [-1.45, 4.25]
Woodward 2004	40	273 (7.7)	20	273 (7.7)		0.0 [-4.13, 4.13]
Total (95% CI)	**1412**		**1408**			**-0.01 [-0.82, 0.80]**

Heterogeneity: Chi^2 = 10.23, df = 7 (P = 0.18); I^2 =32%

Test for overall effect: Z = 0.03 (P = 0.98)



Analysis 1.41. Comparison 1 Immersion in water versus no immersion during first stage of labour, Outcome 41 Birth weight in grams.

Review: Immersion in water in labour and birth

Comparison: 1 Immersion in water versus no immersion during first stage of labour

Outcome: 41 Birth weight in grams

Study or subgroup	Immersion N	Mean(SD)	No Immersion N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Cammu 1994	54	3315 (419)	56	3320 (427)		-5.00 [-163.10, 153.10]
da Silva 2007	54	3205 (389)	54	3316 (367.4)		-111.00 [-253.71, 31.71]
Eckert 2001	137	3536 (384)	137	3548 (424)		-12.00 [-107.79, 83.79]
Kuusela 1998	18	3726 (394)	15	3566 (472)		160.00 [-140.31, 460.31]
Ohlsson 2001	612	3654 (0)	625	3655 (0)		0.0 [0.0, 0.0]
Rush 1996	393	3466 (454)	392	3495 (494)		-29.00 [-95.38, 37.38]
Schorn 1993	45	3340 (379.4)	48	3456 (468.6)		-116.00 [-288.80, 56.80]
Taha 2000	59	3246 (422.8)	61	3161 (483.9)		85.00 [-77.43, 247.43]
Woodward 2004	40	3500 (414.3)	20	3468 (485.5)		32.00 [-216.51, 280.51]
Total (95% CI)	**1412**		**1408**			**-22.74 [-66.44, 20.96]**

Heterogeneity: Chi^2 = 6.02, df = 7 (P = 0.54); I^2 =0.0%

Test for overall effect: Z = 1.02 (P = 0.31)

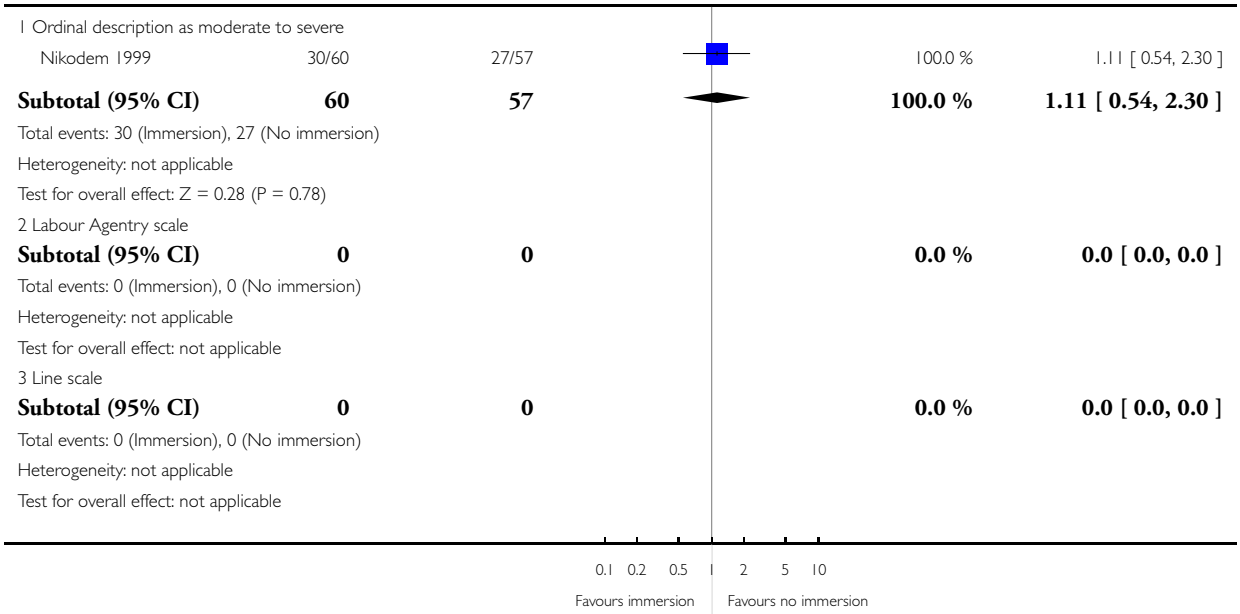
Analysis 2.1. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 1 Experience of moderate to severe pain.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 1 Experience of moderate to severe pain

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
1 Ordinal description as moderate to severe					
Nikodem 1999	30/60	27/57		100.0 %	1.11 [0.54, 2.30]
Subtotal (95% CI)	**60**	**57**		**100.0 %**	**1.11 [0.54, 2.30]**
Total events: 30 (Immersion), 27 (No immersion)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.28 (P = 0.78)					
2 Labour Agentry scale					
Subtotal (95% CI)	**0**	**0**		**0.0 %**	**0.0 [0.0, 0.0]**
Total events: 0 (Immersion), 0 (No immersion)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
3 Line scale					
Subtotal (95% CI)	**0**	**0**		**0.0 %**	**0.0 [0.0, 0.0]**
Total events: 0 (Immersion), 0 (No immersion)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					



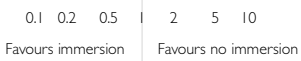
Analysis 2.2. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 2 Satisfied with labour.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 2 Satisfied with labour

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
1 Labour and delivery satisfaction index					
Subtotal (95% CI)	**0**	**0**		**0.0 %**	**0.0 [0.0, 0.0]**
Total events: 0 (Immersion), 0 (No immersion)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
2 Little or not satisfied with coping experience					
Nikodem 1999	3/60	12/57		100.0 %	0.20 [0.05, 0.74]
Subtotal (95% CI)	**60**	**57**		**100.0 %**	**0.20 [0.05, 0.74]**
Total events: 3 (Immersion), 12 (No immersion)					
Heterogeneity: not applicable					
Test for overall effect: Z = 2.40 (P = 0.016)					



Analysis 2.3. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 3 Does not wish to use bath next delivery.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 3 Does not wish to use bath next delivery

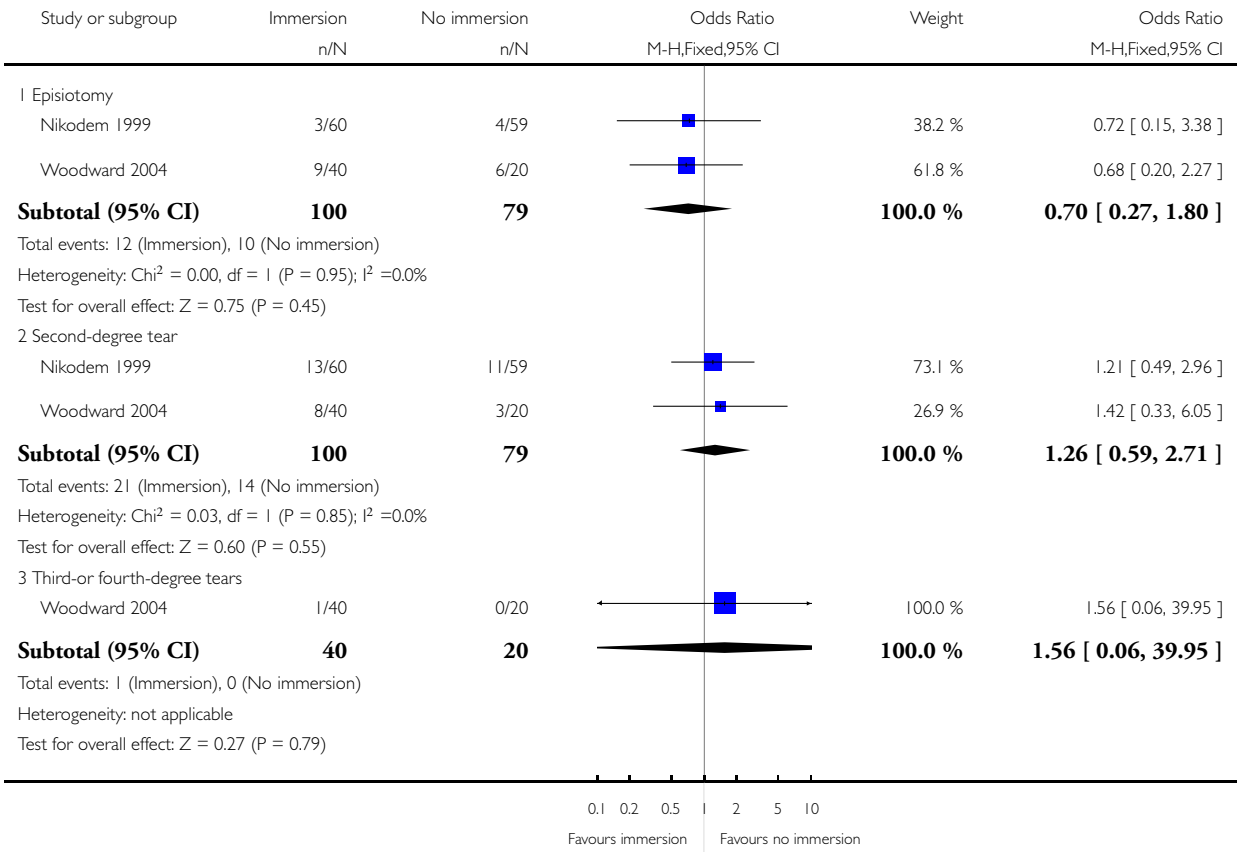
Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Nikodem 1999	6/60	10/57		100.0 %	0.52 [0.18, 1.55]
Total (95% CI)	**60**	**57**		**100.0 %**	**0.52 [0.18, 1.55]**
Total events: 6 (Immersion), 10 (No immersion)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.17 (P = 0.24)					

Analysis 2.4. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 4 Perineal trauma after vaginal birth.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 4 Perineal trauma after vaginal birth



Analysis 2.5. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 5 Duration of second stage (minutes).

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 5 Duration of second stage (minutes)

Study or subgroup	Immersion N	Mean(SD)	No immersion N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Nikodem 1999	60	40 (41.3)	60	42.5 (39.5)		73.7 %	-2.50 [-16.96, 11.96]
Woodward 2004	40	47.3 (46.8)	20	58.7 (44.3)		26.3 %	-11.40 [-35.63, 12.83]
Total (95% CI)	**100**		**80**			**100.0 %**	**-4.84 [-17.25, 7.58]**

Heterogeneity: Chi² = 0.38, df = 1 (P = 0.54); I² =0.0%

Test for overall effect: Z = 0.76 (P = 0.45)

Analysis 2.6. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 6 Instrumental/surgical delivery.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 6 Instrumental/surgical delivery

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
1 Assisted vaginal deliveries					
Nikodem 1999	1/60	1/60		21.5 %	1.00 [0.06, 16.37]
Woodward 2004	4/40	3/20		78.5 %	0.63 [0.13, 3.13]
Subtotal (95% CI)	**100**	**80**		**100.0 %**	**0.71 [0.18, 2.86]**
Total events: 5 (Immersion), 4 (No immersion)					
Heterogeneity: Chi² = 0.08, df = 1 (P = 0.78); I² =0.0%					
Test for overall effect: Z = 0.48 (P = 0.63)					
2 Caesarean section					
Nikodem 1999	0/60	1/60		28.1 %	0.33 [0.01, 8.21]
Woodward 2004	2/40	3/20		71.9 %	0.30 [0.05, 1.95]
Subtotal (95% CI)	**100**	**80**		**100.0 %**	**0.31 [0.06, 1.57]**

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Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Total events: 2 (Immersion), 4 (No immersion)					
Heterogeneity: Chi^2 = 0.00, df = 1 (P = 0.96); I^2 =0.0%					
Test for overall effect: Z = 1.42 (P = 0.16)					

Analysis 2.7. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 7 Postpartum haemorrhage more than 500 ml.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 7 Postpartum haemorrhage more than 500 ml

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Nikodem 1999	0/60	3/60		100.0 %	0.14 [0.01, 2.69]
Total (95% CI)	**60**	**60**		**100.0 %**	**0.14 [0.01, 2.69]**
Total events: 0 (Immersion), 3 (No immersion)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.31 (P = 0.19)					

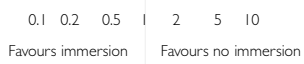
Analysis 2.8. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 8 Presence of meconium stained liquor.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 8 Presence of meconium stained liquor

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Nikodem 1999	7/60	5/60		52.5 %	1.45 [0.43, 4.86]
Woodward 2004	10/40	4/20		47.5 %	1.33 [0.36, 4.94]
Total (95% CI)	**100**	**80**		**100.0 %**	**1.40 [0.57, 3.39]**
Total events: 17 (Immersion), 9 (No immersion)					
Heterogeneity: Chi^2 = 0.01, df = 1 (P = 0.92); I^2 =0.0%					
Test for overall effect: Z = 0.74 (P = 0.46)					



Analysis 2.9. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 9 Apgar score less than seven (five minutes).

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 9 Apgar score less than seven (five minutes)

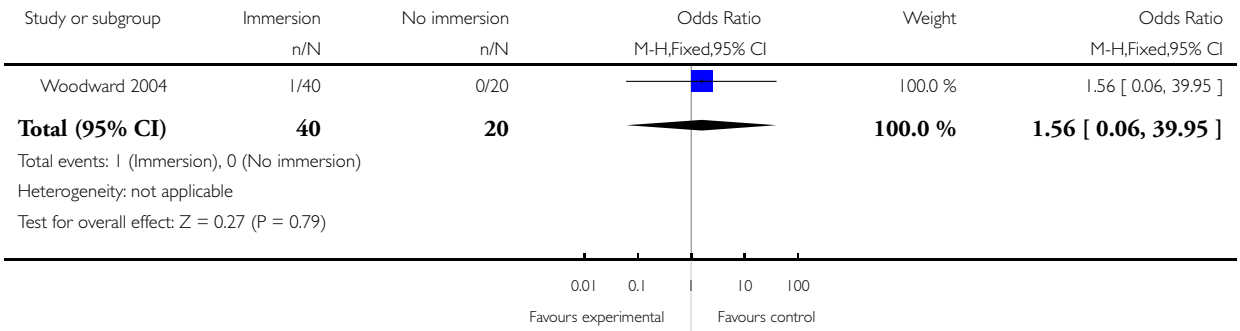
Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Nikodem 1999	2/60	0/59		100.0 %	5.09 [0.24, 108.22]
Total (95% CI)	**60**	**59**		**100.0 %**	**5.09 [0.24, 108.22]**
Total events: 2 (Immersion), 0 (No immersion)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.04 (P = 0.30)					

Analysis 2.10. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 10 Apgar less than eight at five minutes.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 10 Apgar less than eight at five minutes

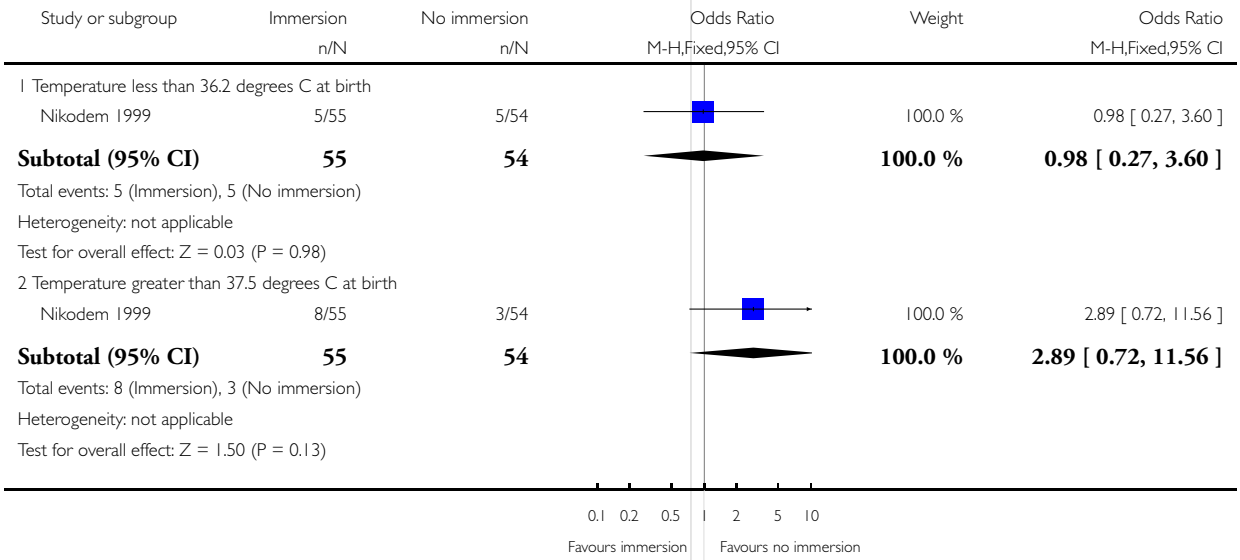


Analysis 2.11. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 11 Neonate temperature.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 11 Neonate temperature



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Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
3 Temperature greater 37.8 degrees C as an indicator for infection					
Subtotal (95% CI)	**0**	**0**		**0.0 %**	**0.0 [0.0, 0.0]**
Total events: 0 (Immersion), 0 (No immersion)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					

0.1 0.2 0.5 1 2 5 10

Favours immersion Favours no immersion

Analysis 2.12. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 12 Umbilical artery pH less than 7.20.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 12 Umbilical artery pH less than 7.20

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Nikodem 1999	12/57	14/59		100.0 %	0.86 [0.36, 2.06]
Total (95% CI)	**57**	**59**		**100.0 %**	**0.86 [0.36, 2.06]**
Total events: 12 (Immersion), 14 (No immersion)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.35 (P = 0.73)					

0.1 0.2 0.5 1 2 5 10

Favours immersion Favours no immersion

Analysis 2.13. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 13 Cord arterial pH.

Review: Immersion in water in labour and birth

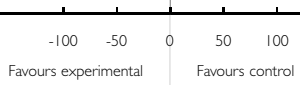
Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 13 Cord arterial pH

Study or subgroup	Immersion N	Mean(SD)	No immersion N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Woodward 2004	35	7.23 (0)	13	7.18 (0)		0.0 [0.0, 0.0]
Total (95% CI)	**35**		**13**			**0.0 [0.0, 0.0]**

Heterogeneity: not applicable

Test for overall effect: Z = 0.0 (P < 0.00001)



Analysis 2.14. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 14 Admission to neonatal intensive care unit.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 14 Admission to neonatal intensive care unit

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Nikodem 1999	3/60	5/60		79.4 %	0.58 [0.13, 2.54]
Woodward 2004	3/40	1/20		20.6 %	1.54 [0.15, 15.83]
Total (95% CI)	**100**	**80**		**100.0 %**	**0.78 [0.23, 2.59]**

Total events: 6 (Immersion), 6 (No immersion)

Heterogeneity: Chi^2 = 0.48, df = 1 (P = 0.49); I^2 =0.0%

Test for overall effect: Z = 0.41 (P = 0.68)

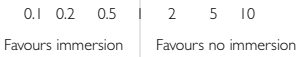
Analysis 2.15. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 15 Perinatal deaths.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 15 Perinatal deaths

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Nikodem 1999	1/60	0/60		100.0 %	3.05 [0.12, 76.39]
Total (95% CI)	**60**	**60**		**100.0 %**	**3.05 [0.12, 76.39]**
Total events: 1 (Immersion), 0 (No immersion)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.68 (P = 0.50)					



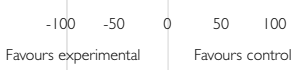
Analysis 2.16. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 16 Satisfaction with labour and birth on scale of 0-6 where 0 is not at all satisfied.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 16 Satisfaction with labour and birth on scale of 0-6 where 0 is not at all satisfied

Study or subgroup	Immersion N	Mean(SD)	No immersion N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Woodward 2004	40	4.32 (1.2)	20	4.29 (1.26)		100.0 %	0.03 [-0.64, 0.70]
Total (95% CI)	**40**		**20**			**100.0 %**	**0.03 [-0.64, 0.70]**
Heterogeneity: not applicable							
Test for overall effect: Z = 0.09 (P = 0.93)							



Analysis 2.17. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 17 Maternal temperature.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 17 Maternal temperature

Study or subgroup	Immersion N	Mean(SD)	No immersion N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Woodward 2004	40	36.9 (0.5)	20	36.7 (0.8)		100.0 %	0.20 [-0.18, 0.58]
Total (95% CI)	**40**		**20**			**100.0 %**	**0.20 [-0.18, 0.58]**

Heterogeneity: not applicable

Test for overall effect: Z = 1.02 (P = 0.31)

Analysis 2.18. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 18 Breast feeding.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

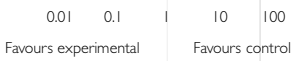
Outcome: 18 Breast feeding

Study or subgroup	Immersion n/N	No immersion n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Woodward 2004	31/40	18/20		100.0 %	0.38 [0.07, 1.97]
Total (95% CI)	**40**	**20**		**100.0 %**	**0.38 [0.07, 1.97]**

Total events: 31 (Immersion), 18 (No immersion)

Heterogeneity: not applicable

Test for overall effect: Z = 1.15 (P = 0.25)

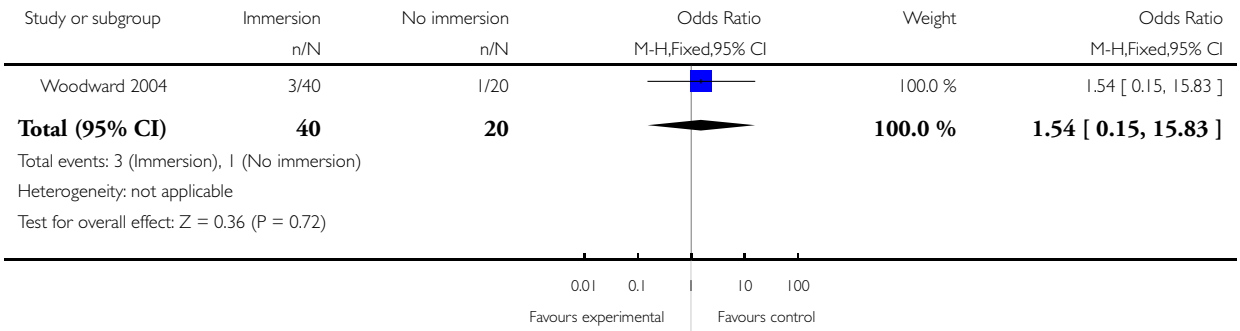


Analysis 2.19. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 19 Antibiotics given to neonate.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 19 Antibiotics given to neonate

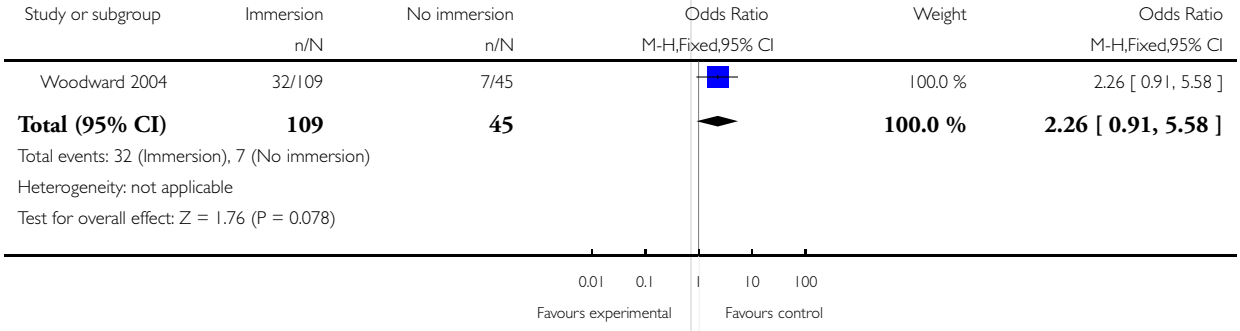


Analysis 2.20. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 20 Positive neonatal swab of ear, mouth or umbilicus.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 20 Positive neonatal swab of ear, mouth or umbilicus

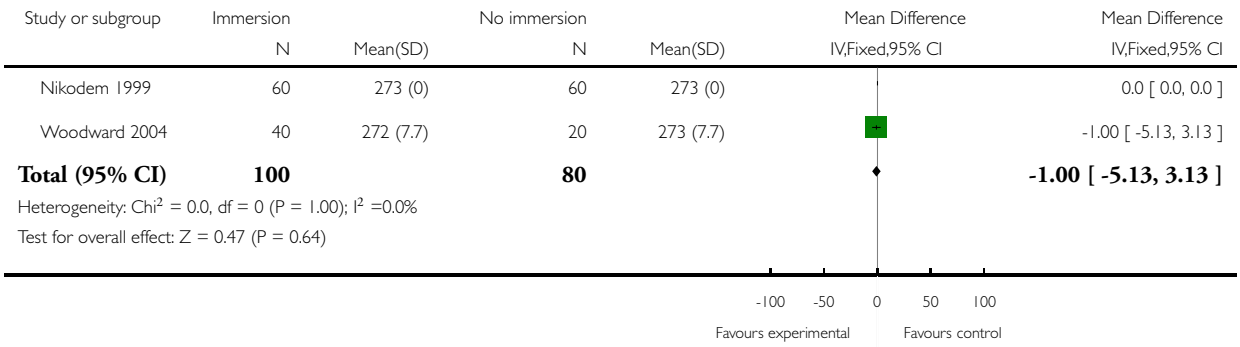


Analysis 2.21. Comparison 2 Immersion in water versus no immersion during second stage of labour, Outcome 21 Neonatal gestational age at birth in days.

Review: Immersion in water in labour and birth

Comparison: 2 Immersion in water versus no immersion during second stage of labour

Outcome: 21 Neonatal gestational age at birth in days

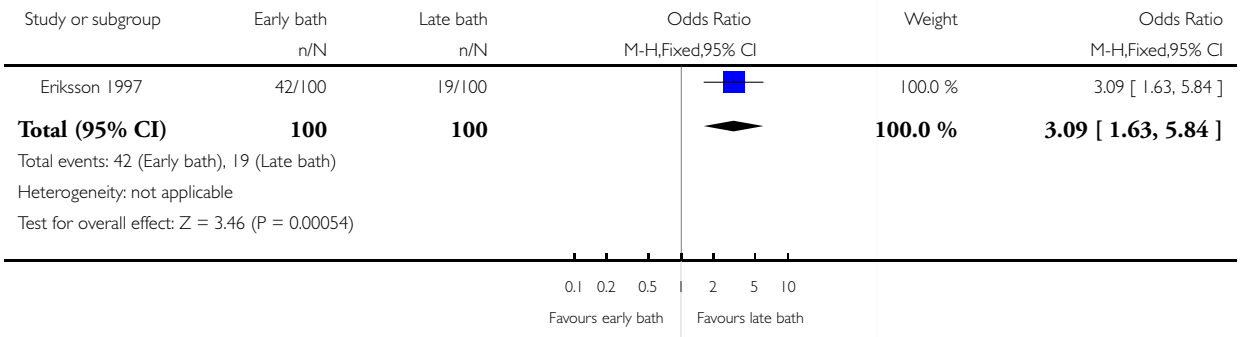


Analysis 5.1. Comparison 5 Early versus late immersion in water, Outcome 1 Epidural/spinal analgesia/paracervical block.

Review: Immersion in water in labour and birth

Comparison: 5 Early versus late immersion in water

Outcome: 1 Epidural/spinal analgesia/paracervical block



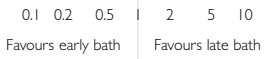
Analysis 5.2. Comparison 5 Early versus late immersion in water, Outcome 2 Use of oxytocin.

Review: Immersion in water in labour and birth

Comparison: 5 Early versus late immersion in water

Outcome: 2 Use of oxytocin

Study or subgroup	Early bath n/N	Late bath n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Eriksson 1997	57/100	30/100		100.0 %	3.09 [1.73, 5.54]
Total (95% CI)	**100**	**100**		**100.0 %**	**3.09 [1.73, 5.54]**
Total events: 57 (Early bath), 30 (Late bath)					
Heterogeneity: not applicable					
Test for overall effect: Z = 3.80 (P = 0.00015)					



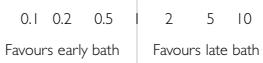
Analysis 5.4. Comparison 5 Early versus late immersion in water, Outcome 4 Abnormal fetal heart rate patterns.

Review: Immersion in water in labour and birth

Comparison: 5 Early versus late immersion in water

Outcome: 4 Abnormal fetal heart rate patterns

Study or subgroup	Early bath n/N	Late bath n/N	Odds Ratio M-H,Fixed,95% CI	Odds Ratio M-H,Fixed,95% CI
Eriksson 1997	0/100	0/100		0.0 [0.0, 0.0]
Total (95% CI)	**100**	**100**		**0.0 [0.0, 0.0]**
Total events: 0 (Early bath), 0 (Late bath)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				



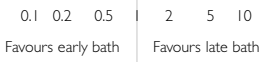
Analysis 5.5. Comparison 5 Early versus late immersion in water, Outcome 5 Apgar score less than seven at one minute.

Review: Immersion in water in labour and birth

Comparison: 5 Early versus late immersion in water

Outcome: 5 Apgar score less than seven at one minute

Study or subgroup	Early bath n/N	Late bath n/N	Odds Ratio M-H,Fixed,95% CI	Odds Ratio M-H,Fixed,95% CI
Eriksson 1997	0/100	0/100		0.0 [0.0, 0.0]
Total (95% CI)	**100**	**100**		**0.0 [0.0, 0.0]**
Total events: 0 (Early bath), 0 (Late bath)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				



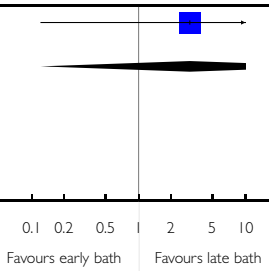
Analysis 5.6. Comparison 5 Early versus late immersion in water, Outcome 6 Neonatal infection.

Review: Immersion in water in labour and birth

Comparison: 5 Early versus late immersion in water

Outcome: 6 Neonatal infection

Study or subgroup	Early bath n/N	Late bath n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Eriksson 1997	1/100	0/100		100.0 %	3.03 [0.12, 75.28]
Total (95% CI)	**100**	**100**		**100.0 %**	**3.03 [0.12, 75.28]**
Total events: 1 (Early bath), 0 (Late bath)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.68 (P = 0.50)					

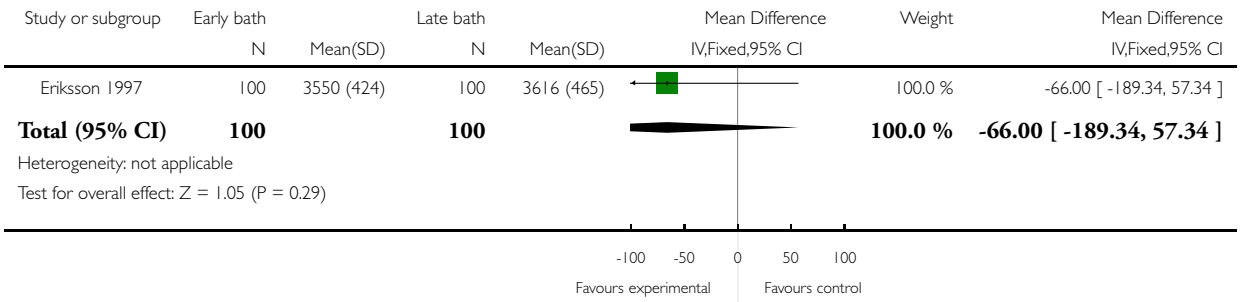


Analysis 5.8. Comparison 5 Early versus late immersion in water, Outcome 8 Neonatal birth weight in grams.

Review: Immersion in water in labour and birth

Comparison: 5 Early versus late immersion in water

Outcome: 8 Neonatal birth weight in grams



F E E D B A C K

Wein, December 2006

Summary

How can the review authors conclude "Overall, the evidence indicates that immersion in water decreases maternal reported pain levels and the uptake of pharmacological analgesia" when their analysis reports the odds ratio for pharmacological analgesia as 1.08 (95% CI 0.71 to 1.65)?
(Summary of comment from Peter Wein, December 2006)

Reply

In the authors' conclusions section of the previous update of this review (CDSR 2002), the statement "immersion in water decreases maternal reported pain levels" was based on the one trial (Taha 2000) that reported this outcome (OR 0.23, 95% CI 0.08 to 0.63). The limitation of only one study is indicated in the maternal outcome section of the review. The reference to a decrease in maternal 'uptake of pharmacological analgesia' was based on the outcome 'use of epidural/spinal/paracervial block' (OR 0.84, 95% CI 0.71 to 0.99), which included data from four trials, not the outcome 'any pharmacological analgesia' which include data from two trials and is the one cited by Wein above. We accept the wording was ambiguous, and have clarified it in the current update.
Interestingly, in this update data for these outcomes have altered minimally: use of epidural/spinal/paracervial block is now OR 0.82, 95% CI 0.70 to 0.98, with data from six trials; 'any pharmacological analgesia', remains unchanged, as do the data for maternal pain experience.
(Response from Elizabeth Cluett, October 2008)

Contributors

Peter Wein

WHAT'S NEW

Last assessed as up-to-date: 19 November 2008.

5 January 2009	New citation required but conclusions have not changed	Change in authorship.
20 November 2008	Feedback has been incorporated	Response from authors to feedback from Wein incorporated.
20 November 2008	New search has been performed	Search updated. New trials identified, appraised and data are included. Title changed to reflect focus on water immersion in labour and birth, so pregnancy removed from title, and outcomes updated accordingly. Background information updated. Results and discussion sections updated but no change to overall conclusions.

HISTORY

Protocol first published: Issue 3, 1996

Review first published: Issue 3, 1997

29 October 2008	Amended	Converted to new review format.
25 April 2004	New citation required and conclusions have changed	The inclusion of the new trials has resulted in a change in the implications for practice, which now indicates that immersion in water during the first stage of labour reduces reported maternal pain and the use of analgesia. The outcome measures have been modified to ensure clarity. Neonatal outcomes have been added to reflect current methods of wellbeing assessment. Change in authorship for this update.
25 April 2004	New search has been performed	Search updated. Five new trials are included (Eckert 2001; Eriksson 1997; Nikodem 1999; Ohlsson 2001; Taha 2000).

CONTRIBUTIONS OF AUTHORS

Two review authors (EC and EB) read all newly identified reports and reached consensus about inclusion and exclusion for each study. Using an agreed form, we separately extracted data from each included study, then met to compare these and agree about data to be analysed. We jointly considered the analysis and wrote the review. EC entered the data onto Review Manager and EB evaluated them for accuracy. EC is the contact author.

DECLARATIONS OF INTEREST

The first review author (EC) is chief investigator of two trials related to the subject of this review (Cluett 2001; Cluett 2004); we have excluded both.

SOURCES OF SUPPORT

Internal sources

- OCHRAD Oxford Brookes University, UK.
- School of Health Sciences, UK.

University Of Southampton

External sources

- No sources of support supplied

INDEX TERMS

Medical Subject Headings (MeSH)

*Immersion; *Labor Stage, First; *Labor Stage, Second; *Water; Analgesia, Obstetrical [utilization]; Natural Childbirth; Randomized Controlled Trials as Topic

MeSH check words

Female; Humans; Pregnancy