

The outcomes of complementary and alternative medicine use among pregnant and birthing women: current trends and future directions

Complementary and alternative medicine is used by a substantial number of pregnant women and maternity care providers are often faced with the task of ensuring women are using safe and effective treatments while respecting a woman's right to autonomous decision-making. In the era of evidence-based medicine maternity health professionals are expected to draw upon the best available evidence when making clinical decisions and providing health advice. This review will outline the current trends in research evidence associated with the outcomes of complementary and alternative medicine use amongst pregnant and birthing women as well as highlight some potential directions for future development in this important yet largely unknown topic in contemporary maternity care.

Keywords: alternative medicine • birth outcomes • complementary medicine • labor • pregnancy

Complementary & alternative medicine use in pregnancy

Complementary and alternative medicine (CAM) includes a range of products and treatments not traditionally associated with the conventional medical profession or medical curriculum [1–3]. Despite CAM existing outside of conventional health systems, a substantial number of women have been found to use CAM to manage their health during pregnancy [4–7] with a similar prevalence of use between women consulting with a CAM practitioner and those using a CAM product or treatment [4]. This pattern of usage has received research attention in recent years and this has led to more nuanced insights. Recent findings highlight variation in the rates at which women consult with different CAM practitioners, with massage therapists (34.1%), chiropractors (16.3%) and meditation/yoga classes (13.6%) being accessed more commonly than acupuncturists (9.5%), naturopaths/herbalists (7.2%) and osteopaths (6.2%) [8]. Similarly, the conditions for which pregnant women consult a CAM practitioner can range between back

pain to gestational diabetes and there is evidence that women select different CAM practitioners for different health concerns [8]. The diversity of factors associated with pregnant women's choice of CAM practitioner extends beyond health to include socioeconomic status, health insurance coverage, level of education and personal attitudes and perceptions toward both CAM and maternity care [4,9–10].

The significant rates of CAM use by pregnant women seem to contrast with concerns of low levels of safety evidence for CAM use during pregnancy raised by critics of CAM. Most commentary about the risk or safety of CAM use in pregnancy, labor and birth has focused on herbal medicine [11–14]. Particular concern for the safety of herbal medicine in pregnancy has been identified in terms of the physiological effects of specific herbs, or alternatively as related to a lack or variability in product quality due to adulteration, contamination, mislabeling or plant misidentification [15]. Concerns have also been raised by those responsible for providing intrapartum care regarding possible drug interactions

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with labor analgesics, as well as intrapartum complications such as perioperative bleeding [13,14]. The safety of other CAM treatments such as chiropractic and osteopathy has also come under some scrutiny [16,17].

Beyond the direct effects of CAM products and treatments, safety issues may also be associated with a possible lack of communication of CAM use with conventional care providers. This is of particular concern given the prevalence of consultations with a CAM practitioner reported by pregnant women [8] and the rates of CAM recommendation by maternity care providers [18,19]. In some instances low levels of communication about CAM may be linked to nondisclosure on the part of the woman [20], while in others it may be connected to the location of CAM practitioners outside of mainstream health provision and their subsequent underdeveloped or inadequate communication with conventional providers [21]. For women consulting with both CAM and conventional care providers their exposure to contrasting philosophies of care may result in women receiving conflicting information regarding their care options. This may lead to women making autonomous decisions about their maternity care without full consideration of all pertinent information [22].

In light of the strengthening evidence for a substantive use of CAM by pregnant women and the concerns raised for the safety of CAM, a closer examination of the peripartum outcomes associated with the use of CAM during pregnancy is needed. The efficacy of a number of specific CAM therapies for pregnancy-related symptoms and conditions have been analyzed through systematic reviews in recent years. This is the case for yoga, massage, chiropractic, acupuncture, acupressure, relaxation techniques (e.g., hypnotherapy and meditation) and aromatherapy. Other CAM modalities such as osteopathy and naturopathy/herbalism have not yet received systematic attention [23], but have still benefited from varying levels of empirical examination. This paper overviews the current trends in research examining the outcomes of CAM use in pregnancy and outlines future directions to expand and strengthen our knowledge in this vital area of public health and health services research.

Outcomes associated with CAM use during pregnancy, labor & birth

Acupuncture & associated treatments

The current literature examining the role of acupuncture, acupressure and other related treatments for pregnancy, labor and birth includes two systematic reviews and seven additional original research articles (see Table 1). Research examining outcomes related to the use of acupuncture and acupressure by women during pregnancy, labor and birth was reviewed in a paper

published by the Cochrane Collaboration in 2011 [24]. This meta-analysis included 13 trials of pregnant women ($n = 1986$) and focused primarily on the use of acupuncture or acupressure for pain management in labor. The reviewers reported that women using acupuncture experienced less intense pain compared with no pain management techniques, with some indication acupuncture may also reduce the likelihood of pharmacological analgesia when compared with placebo control or standard care. The reviewers also identified fewer instrumental deliveries for women using acupuncture during birth. Another systematic review [25] has also been published recently which examined the role of acupuncture as an adjunctive treatment for discomforts of pregnancy. The researchers identified eight randomized controlled trials (RCTs) and eight systematic reviews. The trends reported in this review were of a beneficial effect of acupuncture on nausea and emotional disorders in pregnancy as well as back and pelvic pain. This review also identified a possible benefit of moxibustion for breech presentation and cervical ripening/induction/ augmentation of labor but suggested further high quality studies of these topics is needed.

Since these reviews above were conducted additional clinical trials have been reported. One RCT [26] of 43 women experiencing tension headaches during pregnancy compared weekly acupuncture treatments for 8 weeks with standard care. The treatment group experienced a reduction in headaches immediately after treatment as well as successive lowering of the intensity of headache pain across the duration of the study (reduction in pain scale: 3.9 vs 1.7; $p = 0.035$). Other research examining the effects of acupuncture for pregnancy-related pain has focused on labor pain. A controlled trial [27] of 60 primiparae examined the effects of moxibustion on acupoint SP6 and identified a reduced duration of first stage of active labor (time in minutes: 131.0 vs 170.9; $p < 0.01$) and an amelioration of labor pain (visual analog scale [VAS]: 87.3 vs 94.0; $p < 0.05$). The same acupoint was also used in a study involving electroacupuncture compared with sham electroacupuncture on laboring women ($n = 350$) and found reduced pain scores persisting 4 h after needle withdrawal (VAS: 82.4 vs 94.5; $p < 0.05$) [28]. Another study [29] examined a different acupoint (LI4) for the management of labor pain for birthing women ($n = 100$) and reported reduced subjective pain scores (VAS: 6.8 vs 8.3; $p = 0.001$) for the intervention group. While these three studies report reduced pain for birthing women using acupuncture, a study involving women ($n = 105$) undergoing labor induction at term found acupuncture to have no effect on the use of epidural analgesia (65 vs 77%; $p = 0.62$) [30]. Researchers have also examined the outcomes of acupuncture as an adjunctive treatment

Table 1. Peer-reviewed literature examining the outcomes associated with complementary and alternative medicine during pregnancy, labor and birth.

Study (year)	Sample (size)	Country	Method	Intervention	Outcomes reported	Ref.
Cui <i>et al.</i> (2011)	Pregnant women (n = 60)	China	Quasi-randomized controlled trial	Moxibustion stimulation of SP6 for the management of first stage of labor and labor pain	First stage active phase labor (131.10 min vs 170.90 min, $p < 0.01$); labor pain (VAS: 87.28 vs 93.97; $p < 0.05$)	[27]
El-Deeb and Ahmady (2011)	Pregnant women (n = 450)	Egypt	Randomized controlled trial	Electroacupuncture stimulation of P6 to manage postoperative nausea and vomiting following a caesarean birth	Reduced: postoperative nausea and vomiting Increased: satisfaction with postoperative control of nausea and vomiting	[32]
Guerreiro da Silva <i>et al.</i> (2012)	Pregnant women (n = 43)	Brazil	Randomized controlled trial	Acupuncture stimulation of LR3, LU4, LU7, GB21, GB41, <i>Yintang</i> and GV20 for weekly treatments over 8 weeks	Headache pain (pretest- post-test difference in numerical rating scale: 3.9 vs 1.7); doses of pain medication (pretest- post-test difference: 6.0 vs 0.6) Mood improvement of 25% ($p = 0.004$) and sleep improvement of 15% ($p = 0.032$) more common in treatment group	[26]
Hamidzadeh <i>et al.</i> (2012)	Pregnant women (n = 100)	Iran	Randomized controlled trial	Acupressure stimulation of LI4 to manage labor pain during first stage, labor duration and patient satisfaction	Reduced: labor pain scores at all time points (immediately, 20 min, 60 min and 120 min post intervention) ($p = 0.01$); active phase (2.44 vs 3.09 h) and second stage labor duration (20.5 vs 28.5 min)	[29]
Ma <i>et al.</i> (2011)	Pregnant women (n = 350)	China	Randomized controlled trial	Electroacupuncture stimulation of SP6 for the management of labor pain	Reduced: labor pain scores 2 and 4 h after needle withdrawal when needle retained for 30 min ($p < 0.05$)	[28]
Mackenzie <i>et al.</i> (2011)	Pregnant women (n = 105)	UK	Randomized controlled trial	Manual and electric acupuncture for analgesia associated with labor induction	No reported differences between acupuncture and sham (relative risk: 1.18) or acupuncture and control (relative risk: 0.88)	[30]
Marra <i>et al.</i> (2011)	Pregnant women (n = 42)	Italy	Randomized controlled trial	Acupuncture to manage perineal pain after mediolateral episiotomy	Reduced: use of pharmacological analgesia ($p < 0.01$)	[31]
Sinha <i>et al.</i> (2011)	Pregnant women (n = 340)	Australia	Randomized controlled trial	Acupressure wristband stimulation of P6 to prevent nausea and vomiting during labor and birth	No reported difference	[33]

Table 1. Peer-reviewed literature examining the outcomes associated with complementary and alternative medicine during pregnancy, labor and birth (cont.).

Study (year)	Sample (size)	Country	Method	Intervention	Outcomes reported	Ref.
Smith and Cochrane (2009)	Randomized controlled trial (n = 16)	International	Review (3 databases)	Acupuncture/acupressure as an adjunctive treatment for pregnancy and birth	Reduced: nausea and vomiting; pelvic and back pain; need for external cephalic version to correct breech presentation; need for induction	[25]
Smith <i>et al.</i> (2011)	Randomized controlled trial (n = 13)	International	Review (Cochrane databases)	Acupuncture/acupressure for pain management in labor	Reduced rates of: pain; pharmacological analgesia; instrumental birth; Increased: satisfaction with pain relief	[24]
Babbar <i>et al.</i> (2012)	Prospective observational (n = 5); randomized controlled trial (n = 3)	International	Review (1 database)	Yoga/meditation	Reduced rates of: intrauterine growth restriction (p < 0.003); preterm labor (p < 0.0006); low birth weight infants (< 0.01); pregnancy discomforts (p = 0.01); sleep disturbances (p = 0.03); reduced perceived stress (p = 0.001); improved quality of life in physical domains (p = 0.001)	[35]
Curtis <i>et al.</i> (2012)	Randomized controlled trial (n = 6)	International	Review (6 databases)	Yoga/meditation	Improved stress levels; quality of life; aspects of interpersonal relating; autonomic nervous system functioning; and comfort, pain and duration of labor	[36]
Field <i>et al.</i> (2012)	Pregnant women (n = 84)	USA	Controlled trial	Yoga/meditation	Reduced: depression scores (F = 82.40; p < 0.001), anxiety scores (F = 26.23; p < 0.001), back pain (F = 39.06; p < 0.001), leg pain (F = 19.77; p > 0.001) Increased: interpersonal relationship scores (F = 7.88; p < 0.001); gestational age (F = 18.83; p < 0.005); birth weight (F = 31.52; p < 0.001)	[37]
Muzik <i>et al.</i> (2012)	Pregnant women (n = 18)	USA	Uncontrolled trial	Yoga/meditation	Reduced: depression (p = 0.025). Increased: mindfulness (p = 0.007) and maternal-fetal attachment (p = <0.001)	[38]
Rakhshani <i>et al.</i> (2012)	Pregnant women (n = 68)	India	Randomized controlled trial	Yoga/meditation	Reduced: pregnancy induced hypertension (p = 0.018); gestational diabetes (p = 0.042); intrauterine growth restriction (p = 0.049); small for gestational age (p = 0.006); low APGAR scores (p = 0.033)	[39]

Table 1. Peer-reviewed literature examining the outcomes associated with complementary and alternative medicine during pregnancy, labor and birth (cont.).

Study (year)	Sample (size)	Country	Method	Intervention	Outcomes reported	Ref.
Drobbin and Welsh (2009)	Pregnant woman (n = 1)	USA	Case study	Webster <i>In-Utero</i> Constraint technique	Turned from breech to vertex fetal position after application of five adjustments	[45]
Hajiamini et al. (2012)	Pregnant women (n = 90)	Iran	Randomized controlled trial	Ice massage compared with acupressure and placebo	Reduced: pain in labor (most persistent with ice massage) at 30 min post intervention (p < 0.05)	[42]
Mortazavi et al. (2012)	Pregnant women (n = 120)	Iran	Randomized controlled trial	Massage for 30 min at each stage of labor	Lowered pain state (p < 0.05) and level of anxiety (p < 0.05) across second and third stages of labor. Higher satisfaction level with the birth experience across second, third and fourth stages of labor (p < 0.001). Active phase was shorter in massage group (p < 0.001)	[41]
Smith et al. (2012)	Randomized controlled trial (n = 6)	International	Review	Massage	Reduced rates of: labor pain; anxiety during first stage of labor	[40]
Stuber and Smith (2008)	All study designs (n = 6)	International	Review (4 databases)	Chiropractic care for lower back pain in pregnancy	Improvement in lower back pain	[43]
Stuber et al. (2012)	All study designs (n = 5)	International	Review (3 databases)	Adverse events from spinal manipulation in pregnancy and postpartum period	Pain after treatment (resolved <3 days); fracture; stroke; epidural hematoma	[44]
Holst et al. (2011)	All study designs	International	Review (2 databases)	Current evidence for safety and efficacy of herbal medicines identified through a survey of 578 women as used during pregnancy	Limited data examining safety and efficacy of herbal medicines during pregnancy available (Number of studies: ginger – 10; cranberry – 1; raspberry leaf – 2; echinacea – 1)	[47]
Dhany et al. (2012)	Pregnant women (n = 2158)	UK	Retrospective cohort	Unreported method of administration of essential oils (bergamot, lavender, clary sage, frankincense, peppermint, jasmine, rose)	Reduced use of: epidural (p = 0.004); spinal anesthesia (p < 0.001); general anesthesia (p = 0.033). Increased use of: TENS (p < 0.001); nitrous oxide (p < 0.001). No effects on use of: pethidine	[51]

Table 1. Peer-reviewed literature examining the outcomes associated with complementary and alternative medicine during pregnancy, labor and birth (cont.).

Study (year)	Sample (size)	Country	Method	Intervention	Outcomes reported	Ref.
Ghani and Ibrahim (2013)	Pregnant women (n = 101)	Saudi Arabia	Randomized controlled trial	Administration of five drops of essential oil (four drops lavender, one drop peppermint) via vaporizer	Reduced: nausea and vomiting episodes by day 3 (p = 0.001). Improved: energy (p = 0.001)	[70]
Igarashi (2012)	Pregnant women (n = 13)	Japan	Randomized controlled trial	Exposure to five drops of essential oil chosen from lavender, petigrain and bergamot) via a diffuser	Reduced: tension-anxiety (p < 0.05) and anger-hostility (p < 0.05) scores Improved: parasympathetic nervous system activity (p < 0.05)	[71]
Igarashi and Fujita (2010)	Pregnant women (n = 16)	Japan	Randomized controlled trial	Aroma pendants containing 1 cc essential oil (chosen from lavender, petigrain and bergamot)	Reduced: perceived anxiety (p < 0.05) No effects on: physiological stress symptoms; birth outcomes	[50]
Pasha et al. (2012)	Pregnant women (n = 60)	Iran	Randomized controlled trial	Four drops of 'mint oil' placed on the floor near the bed for four consecutive nights	No significant difference	[49]
Smith et al. (2011b)	Randomized controlled trial (n = 2)	International	Systematic review	Aromatherapy	No significant difference	[48]
Steel et al. (2014)	Postnatal women (n = 1835)	Australia	Cross-sectional survey	Use of CAM during pregnancy: acupuncturist, chiropractor, naturopath, massage therapist, yoga classes, osteopath, herbal medicines, meditation/yoga home practice, aromatherapy oils, homeopathy, herbal teas, flower essences	Acupuncture: reduced episiotomy (OR: 0.32; p = 0.02); Chiropractor: reduced premature birth (OR: 0.29, p = 0.04) and caesarean section after onset of labor (OR: 0.10; p = 0.008); increased instrumental delivery (OR: 2.13; p = 0.05) and emotional distress associated with labor (OR: 3.27, p = 0.001); Yoga: increased postpartum hemorrhage (classes; OR: 3.66; p = 0.03), increased emotional distress (home practice) (OR: 2.40; p = 0.02); Herbal medicines: reduced caesarean section before onset of labor (OR: 0.26; p = 0.05); Herbal teas: reduced premature birth (OR: 0.32; p = 0.03); increased retained placenta (OR: 2.10; p = 0.02); Flower essences: increased emotional distress associated with labor (OR: 3.04; p = 0.02)	[34]

for managing the effects of obstetric interventions. A clinical trial examined the effects of wrist-ankle acupuncture on 42 women to manage perineal pain after episiotomy and reported significantly lower use of oral analgesics (38 vs 100%, $p < 0.01$) [31]. Likewise, a beneficial effect of acupuncture has been reported for women experiencing intraoperative and postoperative (0–6 h) nausea (intra: 46 vs 22%, $p = 0.001$; post: 34 vs 8%, $p = 0.003$) and vomiting (intra: 38 vs 17%; $p = 0.001$; post: 28 vs 6%; $p = 0.003$) as an adverse effect of intrapartum anesthetics associated with caesarean delivery [32] but not for those experiencing nausea (52 vs 45%) and vomiting (27 vs 28%) as a pregnancy-related health condition [33].

Most recently, an observational cross-sectional study has examined the incidence of adverse birth events for women using CAM and included an analysis of consultations with an acupuncturist [34]. This study of women ($n = 1835$) identified a reduced incidence of episiotomy associated with women consulting with an acupuncturist for pregnancy-related health conditions (OR: 0.32; $p = 0.02$). However, the study does not identify for which condition the women were consulting an acupuncturist and as such the implications of this finding are not clear.

Yoga & meditation practice

Research examining birth outcomes associated with yoga and meditation practice during pregnancy has been summarized in two reviews in recent years and further developed through three additional original research articles (see **Table 1**) of which the principal focus has been yoga, with meditation included primarily as an aspect of yoga practice. The first review summarized any research available on the PubMed database which explored the outcomes associated with yoga practice during pregnancy [35]. The review identified eight studies – five prospective observational studies and three RCTs. A range of outcomes were identified as significant to yoga practice by the nonrandomized studies including reduced rates of: intrauterine growth retardation; preterm labor; low birth weight infants; pregnancy discomforts; and perceived sleep disturbances. These outcomes were not reflected in the RCTs of which the only significant outcomes reported were lower pain and discomfort during labor, reduced perceived stress and improved quality of life. A second systematic review [36] focusing only on clinical trials but accessing six databases found a further three controlled (but not randomized) clinical trials and reported additional outcomes for yoga practice during pregnancy including improved autonomic nervous system function.

Since the publication of these reviews further clinical trials have been reported. The focus and

findings of these trials vary substantially. The first [37] targeted prenatally depressed women ($n = 84$) and trialed yoga classes compared with massage therapy sessions (20 min each) and controls for 12 weeks. The reviews reported lowered scores on depression, anxiety, and back and leg pain scales as well as a lower incidence of preterm birth and higher birth weight for the massage and yoga group compared with the controls. A second study [38] with a similar group of participants ($n = 18$) piloted 10 weeks of mindfulness yoga and reported a reduction in symptoms of depression and an increase in mindfulness and maternal-fetal attachment. A third study [39] was an RCT and focused more on physical rather than mental health by targeting women with high-risk pregnancies ($n = 68$). The yoga group in this study undertook 1-h yoga sessions (three-times per week) for 16 weeks while the controls received standard care plus conventional antenatal exercises. The intervention group developed significantly less complications such as preeclampsia, gestational hypertension, gestational diabetes and intrauterine growth restriction. There was also an improved outcome for babies with fewer infants born small for gestational age births or with low APGAR scores in the yoga group.

Massage therapy

The outcomes of massage for pregnant women have been reviewed very recently in the context of its effects on pain management in labor and very little additional research since this review has been conducted (see **Table 1**). A Cochrane review [40] of this topic identified six trials of massage for labor pain management. The use of massage was found to result in women reporting less pain during labor and reduced anxiety during the first stage of labor; however, the authors concluded the quality of the current research was low and further research was needed. Since this review, an RCT [41] of 120 primiparae were treated with either 3 × 30 min massages intrapartum, constant birth attendance, or a standard care control. This study identified the massage group had lower subjective pain scores but those with constant birth attendance had lower anxiety levels. Satisfaction was higher across the entire birth experience for the women receiving the massage intervention, and the duration of stage 1 of labor was reduced for these women. Another pseudo-randomized trial [42] ($n = 90$) investigated the effects of ice massage on birthing women compared with acupressure or placebo. This study found ice massage to provide the most persistent pain relief compared with the other two groups. An analysis of cross-sectional survey data involving women who had recently given birth ($n = 1835$) has also examined the outcomes of massage

during pregnancy on birth outcomes and found no significant difference on any reported outcomes [34].

Chiropractic & osteopathy

Due to the similarities between, and common history of, the methods applied through chiropractic and osteopathic treatment and the limited research related to either of these practices in the context of pregnancy, labor and birth (see **Table 1**) these therapies will be discussed together here. A systematic review [43] of the effects of chiropractic care in the treatment of lower back pain during pregnancy was conducted in 2008 and included six research papers ranging from case series through to quasi-experimental pretest and post-test design. The methodological rigor of the studies was questioned by the reviewer and as such the validity of the findings reported in this review is unclear. The results do, however, indicate a potential benefit for chiropractic treatment of lower back pain in all included studies on subjective measures of pain. Alongside this work, a separate literature review [44] has been conducted examining the safety of spinal manipulation such as chiropractic for pregnant and postpartum women which included five studies (three on pregnant women and two on postpartum). One study reported three cases of increased pain after treatment associated with an observational cohort study of chiropractic for pregnancy-related lumbopelvic pain. The symptoms for these women resolved within between 48 h and 1 week. The other two papers reporting adverse effects for pregnant women were case reports describing symptoms following cervical manipulation. While the authors acknowledge the low level of evidence offered by these studies and a need for higher reporting it can be concluded from the current evidence that there may be some minor safety issues associated with chiropractic in pregnancy.

Since publication of these two reviews there has been limited further research in this area. A case study [45] was, however, reported in 2009 which described a 41-year-old pregnant woman ($k = 36$) who was treated with a chiropractic manipulation after her pregnancy was identified as breech and she was recommended a caesarean section. The technique used was called Webster *In-Utero* Constraint technique and was described as light-force and contact specific. In conjunction with this technique other chiropractic methods of trigger point therapy and adjustments were included in the treatment. After application of five chiropractic treatments the fetus moved to a vertex position and cephalic version was confirmed. The findings of a qualitative study [46] examining the experience of pregnant women receiving chiropractic care have also been reported. The findings of this study highlighted

the practitioner-client interaction associated with chiropractic care and the women interviewed in the study expressed appreciation of the individualized treatment they received from their chiropractor.

Interestingly, the only study which provides comparative outcomes for women consulting with a chiropractor and those who consulted with an osteopath for pregnancy-related health conditions found a notable difference in outcomes [34]. This study drew on cross-sectional data from postnatal women ($n = 1835$) and found that women who consulted with a chiropractor were less likely to have a premature birth or a caesarean section after onset of labor but were more likely to have an instrumental delivery or experience emotional distress associated with the birth. None of these outcomes were associated with consultations with an osteopath.

Naturopathy or western herbal medicine

The outcomes associated with naturopath or western herbal practitioner care for pregnant and birthing women has only recently been examined through a cross-sectional survey ($n = 1835$) which reported no difference in risk of adverse birth events compared with women who did not consult with a naturopath [34]. Some of the tools utilized by these professional groups have, however, received some interest from researchers. Primarily this interest has focused on herbal medicine and a recent systematic review [47] which identified 14 controlled studies examining herbal medicine in pregnancy. The majority of these studies (ten of 14) explored the outcomes associated with ginger for nausea and vomiting in pregnancy. Five of these trials reported ginger as superior to placebo and another four comparing ginger with vitamin B6 found it to be equally as effective. The ongoing use of ginger by pregnant women was linked to adverse effects such as indigestion, heartburn and allergic reactions. Beyond ginger, the review also reported the results of one study comparing cranberry extract with placebo for urinary tract infections among pregnant women but found no benefit. Another study examining raspberry leaf extract for augmenting contractions and easing labor found no significant difference compared with controls. The results of a study investigating the effects of St. John's Wort ointment on postpartum wound healing and scar formation was included in the review but no effect on these outcomes was identified although the participants in the treatment group did describe lower pain and pruritus. Finally, the findings from a study trialing the use of garlic in pregnant women with elevated blood pressure was included in the review but no significant findings were reported.

Other treatments accessed by pregnant women that are commonly utilized in naturopathy or herbalism

practice such as flower essences or homeopathy have no known clinical research to verify their safety or efficacy for pregnancy-related health conditions or to support the outcomes of labor and birth. However, a recently published cross-sectional cohort study [34] which examined the birth outcomes of women who consulted with a naturopath or herbalist, also analyzed the outcomes of women who utilized specific CAM commonly associated with naturopathy or western herbal medicine practice. The analysis of this study found a reduction in cesarean section before onset of labor for those who used herbal medicines, and an increased incidence of emotional distress associated with labor and birth for women using flower essences. Those women using herbal teas were associated with a reduced incidence of premature birth but an increased likelihood of retained placenta.

Aromatherapy

There have been some attempts to examine the outcomes associated with the use of aromatherapy during PLB in recent years (see **Table 1**). A systematic review of RCTs examined the effects of aromatherapy in the management of labor pain [48]. The review included two studies (n = 535) and reported no difference in a range of parameters including pain intensity, assisted vaginal birth, caesarean section, admittance to special care nursery, use of PPMT, spontaneous vaginal delivery, length of labor and augmentation. This conclusion is also supported by a recent observational study of 1835 postnatal women [34].

One study [49] employed an RCT design to investigate the potential effects of mint oil to attenuate nausea and vomiting during pregnancy. No significant difference was reported between the intervention and control groups; however, the method of administration used for this study does not align with preferred methods within aromatherapy practice and the botanical name of the essential oil used was not provided. As such the clinical relevance of the findings from this study remain unclear. A more recent study (n = 101) also examined the effects of aromatherapy oils (lavender and peppermint) for nausea and vomiting in the early stages of pregnancy and detected a reduction in nausea and vomiting episodes within 12 h of treatment in the second and third day of the intervention. By the third day, women from the treatment group also reported an increase in energy.

Another small RCT (n = 16) [50] examined the long-term effects of the use of a participant-preferred essential oil (lavender [*Lavandula angustifolia*], petitgrain [*Citrus aurantium* (Fe)], or bergamot [*Citrus aurantium* L. ssp. *Bergamia*]) on anxiety from 28 weeks gestation with follow-up assessments at 32 and 36 weeks. This

study reported reduced state-trait anxiety in general, but also through a dose-dependent relationship. A follow up study examined the short term treatment effects using the same essential oils and identified reduced tension-anxiety and anger-hostility scores in the treatment group. This latter study also identified improved parasympathetic nervous system activity which was non-significant in the earlier study [50]. However, the significant findings from this follow-up study were based upon an intragroup comparison as the intergroup analysis of the data was insignificant. Overall, both of these studies, while promising, are limited by sample size.

Research has also evaluated the outcomes of an established aromatherapy and massage service provided to women in a UK hospital during labor and birth. This cohort study (n = 2158) [51] compared the use of pharmacological intrapartum pain management between women who received the aromatherapy and massage treatment with control cases and found reduced use of spinal (including epidural) and general anesthesia, increased use of TENS and nitrous oxide and no change in pethidine use.

Quality of studies examining the outcomes of CAM use during pregnancy, labor & birth

In recent years, the body of research investigating the outcomes of CAM use during pregnancy, labor and birth has continued to grow. The majority of CAM have been critically reviewed in the last three to four years. However, the conclusions drawn from these reviews included the existence of a high level of heterogeneity and small sample sizes in most of the available studies [24–25,35–36,40,43,47–48,52–53]. These issues have not been addressed in any substantial manner in the additional studies reviewed in this paper. There are still significant issues with low sample sizes as only two studies included in this paper [32,51] achieved the minimum number (>385) of participants to account for possible sampling error [54].

The quality of findings currently available on this topic area is also affected by the potential impact of selection bias. A number of the included studies are RCTs with specific inclusion and exclusion criteria, some included studies draw their findings from cohort [51], case study [45] or cross-sectional survey [34] design or reflect a review of a diverse range of studies including any of the above design approaches [35,43,47,53]. As such the women electing to use CAM in these studies may display different characteristics to women choosing not to use CAM. The researchers involved in the studies in question have, where possible, controlled for confounders as is appropriate in an attempt to reduce the impact of differential characteristics [55]; however,

there may be some confounders which have not been included in their statistical modelling and as such may be skewing the outcome.

There is also substantial diversity in the research questions being addressed in the available research. Outcomes being measured in the additional research range include antenatal maternal outcomes ranging between mood [26,37–41], musculoskeletal pain [37,43] and labor pain [27–29,31,40–42] as well as fetal outcomes such as APGAR scores [39], and birth weight [37,39]. While these outcomes are all individually important there is a need for consistency in the use of outcome measures across studies which examine a particular topic to allow for more conclusive findings. This is especially important for research areas with consistently low participant numbers as reflected in the included CAM research due to similar outcome measures between studies allowing for meta-analysis of findings which are regarded as the highest level of evidence within the guidelines for evidence-based practice [56].

The current research evidence examining the outcomes of CAM use in pregnancy, labor and birth also largely overlooks the birth outcomes (as distinct from labor outcomes such as the experience of labor pain and use of pharmacological intrapartum pain management) of women utilizing CAM during pregnancy. While some attention to the birth outcomes is evident for the use of some CAM such as yoga [37–39] and acupuncture [25] these studies primarily focus on the birth outcomes of intrapartum use of CAM and very few examine the birth outcomes of women who use CAM during pregnancy.

Conclusion

Despite the high levels of use of CAM by women during pregnancy and birth, the current evidence that evaluates the effectiveness and safety of CAM treatments and therapies in the context of this important life stage, while emerging remains limited in many areas. The quantity and quality of available evidence related to the outcomes of CAM use during pregnancy differs across CAM therapies. Higher levels of evidence support the use of acupuncture, yoga and individual herbal medicines for defined conditions. Large gaps in our knowledge still exist for some therapies which are frequently used by pregnant women or recommended by maternity health professionals including chiropractic, osteopathy and aromatherapy.

Future perspective

There are significant gaps in the existing research examining the outcomes, both in terms of safety and effectiveness, of CAM use in pregnancy. Given the high rate of CAM use by pregnant women [5,8], this requires urgent research attention. To effectively address these gaps it is

important that future research builds on a strong understanding of CAM use before focusing on specific research examining safety and effectiveness.

Understanding CAM use

A key foundational step to developing a better understanding of the safety and effectiveness of CAM use in pregnancy is to more clearly identify patterns of use. This work can be most effectively achieved through a health service research approach [57,58]. There is a need to explore further details regarding the CAM used by women in pregnancy, particularly for broad CAM categories such as vitamins and minerals, herbal medicines and aromatherapy. The current evidence suggests the safety profile of specific CAM differs within these categories and it is important that further research in this area describe a discrete list of treatments accessed by pregnant women, similar to attempts made by Holst *et al.* [47], but encompassing a broader range of CAM categories and large, representative samples. Such research should also broaden in scope to include reasons for use as this will allow clinical and epidemiological researchers to structure relevant and useful studies examining the effectiveness of treatments in achieving intended outcomes.

In addition, there is an urgent need to identify the approach to the care of pregnant women employed by CAM practitioners. This is particularly important given that concerns have been raised regarding the safety of CAM [12,14], but these specific concerns have not yet been identified in research examining the outcomes of women who have consulted with a CAM practitioner who would be most likely to recommend or use these treatments [8]. The result of this gap in knowledge is uncertainty for women, policy makers and other health professionals as to the safety and appropriateness of care women may receive from CAM practitioners. Such an examination of CAM practice must also include the reasons practitioner use specific treatments to better inform clinical effectiveness research.

A broader knowledge of the safety of CAM use in pregnancy

Given the high rates of CAM use in pregnancy, there is a pressing demand to scrutinize the safety of treatments. Building upon a health services research approach, future research examining safety can be focused to target specific treatments and therapies known to be commonly used. Identified CAM must then be evaluated using a range of research approaches including basic science research through to large-scale epidemiological studies, including gathering risk and adverse event data from practitioners responsible for client management who may be observing effects of treatment. However, it is important that the collection of safety data from clinical

practice does not simply capture rare unexpected events but rather that it be integrated into larger and structured research approaches including both epidemiological and *ad hoc* studies [59].

Alongside the pharmacological and physiological safety issues of CAM use, there are other facets of this topic which also requires exploration to accurately understand the full safety implications of women's use of CAM in pregnancy. It is important that factors which may impact on women's use of CAM in pregnancy are also examined to ascertain the likelihood that women use treatments known to be unsafe or with an uncertain safety profile. This involves better understanding the information sources women access regarding CAM, both specific types of media as well as individuals. In addition, the sources of referral and recommendation for the CAM used by women in pregnancy requires mapping including a clear picture of self-prescribed CAM use by women and those recommended by non-CAM practitioners. Despite safety concerns raised for both of these referral sources [21,60] only preliminary empirical work is available [61,62].

There are also possible safety implications associated with the level of knowledge and skill of CAM practitioners providing care to women during pregnancy. Women consulting with CAM practitioners may be at risk of incorrect information or poor advice due to inconsistencies in training standards for some CAM practitioner groups. While such inconsistencies in professions such as naturopathy have been highlighted by researchers [63] the real impact of an absence of minimum professional standards on the care provided to pregnant women is not clear. As such, it will be important for future research to comprehensively assess the pregnancy-specific training incorporated into CAM practitioner training programs and compare this against the level expected of health professionals generally.

Even in the event that additional research confirms that CAM practitioners are appropriately trained to provide care to pregnant women, safety issues may still arise if there is insufficient collaboration and communication between all practitioners, including CAM and conventional health professionals, providing care to the same women. However, at this stage we have very little data examining the interprofessional dynamics across the CAM-conventional divide as well as the interface between CAM practitioners from different disciplines. Pilot data in this research area has indicated that while practitioners acknowledge the need for interprofessional communication and collaboration, this may not be occurring in practice [62,64–65]. This is of particular concern given women may not be disclosing their use of CAM to their conventional maternity care providers [20]. The potential outcome of these dynamics is over-prescription,

conflicting prescriptions and missed opportunities for care, all of which present a significant risk to the pregnant woman. As such a more concerted focus needs to be given to charting inter-professional dynamics, including the management and transfer of key information, when both CAM and conventional maternity health professionals are providing care to the same woman.

The effectiveness of CAM for pregnancy-related health conditions

A complement to improved knowledge of CAM safety would be an evaluation of the CAM most effective and economical for the management of pregnancy-related health conditions. In the case of the former, the current research in this area is insufficient to be relevant in contemporary maternity care. In part, this is due to a disconnect between the treatments and conditions examined through clinical research, and those that women are attempting to treat or manage through CAM use [8]. Strengthening our knowledge in this important topic area requires not only consolidating findings in the existing literature through systematic reviews and meta-analyses of clinical trials such as those reported in this paper. It also necessitates additional rigorous and critical investigations to be undertaken, particularly given the issues with the quality of research design consistently highlighted by those evaluating the current evidence through systematic reviews [24–25,35–36,40,43,47–48,52,61]. Alongside a closer examination of effectiveness, health economic analyses including cost-benefit analyses are also needed in order to understand the true value of any treatment. While it is beyond the capacity and scope of this article to provide detailed economic analysis of treatments, it is important that this field is given appropriate attention in the future.

Not only does future clinical research need to be high quality, it also needs to focus on treatments relevant not only to women's patterns of use but also the realities of clinical practice [66]. In the case of CAM this necessitates a divergence from the classical randomized clinical trial design to account for the complexity of the individualized approach to care embedded in underpinning philosophical concepts of health and healing characteristics of many CAM therapies [67,68]. In response, the application of a modified randomized clinical trial approach, described as whole systems research should be considered [67]. The success of the whole systems research design relies on a full and detailed understanding of not only the common treatments used, but also the philosophy and principles of practice which drive practitioner diagnosis and prescription decisions. This can best be achieved by having a CAM practitioner engaged with the research project as a collaborator from inception through to conclusion [68], an approach valuable to both practitioner and researcher.

It is also an approach being encouraged and embraced in certain sectors of the research community [69].

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Executive summary

Complementary & alternative medicine use in pregnancy

- A substantial number of women use complementary and alternative medicine (CAM; both practitioners and products) during pregnancy.
- There is a low level of safety evidence for the use of many CAM during pregnancy and birth.

Outcomes of the use of acupuncture & associated treatments in pregnancy

- Acupuncture may reduce the likelihood of intrapartum pharmacological analgesia or instrumental delivery.
- Acupuncture may reduce nausea and emotional disorders in pregnancy.
- Moxibustion may assist women with breech presentation or requiring induction/augmentation of labor.

Outcomes of yoga & meditation practice in pregnancy

- Yoga practice may reduce rates of intrauterine growth retardation, preterm labor, low birth weight infants, pregnancy discomforts and perceived sleep disturbances.
- There is a high amount of variability in research examining yoga and meditation practice in pregnancy.

Outcomes of massage therapy in pregnancy

- Preliminary results suggests massage during birth may reduce labor pain and anxiety.
- Further research is needed to understand the value of massage therapy in pregnancy and birth.

Outcomes of chiropractic & osteopathy in pregnancy

- The methodological rigor in existing research for chiropractic and osteopathy is low.
- Some benefits such as reduced lower back pain have been identified.
- Minor and infrequent safety issues have been reported.

Outcomes of naturopathy & Western herbal medicine in pregnancy

- The risk of adverse birth events for women who consult with a naturopath or herbalist during pregnancy is no different to women who do not.
- Ginger has some benefit for nausea and vomiting in pregnancy.
- A limited number of other herbal medicines have been examined for pregnancy conditions but have not been found to have a beneficial effect.

Outcomes of aromatherapy in pregnancy

- There is an insufficient number of aromatherapy studies to draw conclusive statements.

Conclusion

- There are significant gaps in research examining the outcomes of CAM use during pregnancy.
- A better understanding of the patterns of CAM use, including the approach to care of pregnant women by CAM practitioners, is needed.
- A broader knowledge of the safety of CAM use in pregnancy is needed.
- A range of effectiveness studies for pregnancy-related health conditions are needed which focus on CAM products, treatments and practitioners.
- Studies with appropriate design and high epidemiological standard (including multivariate analysis) are needed before any final conclusions can be drawn on the efficacy of specific CAM on pregnancy and birth.

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