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Induction of labour indications and timing: A systematic analysis of clinical guidelines

Abstract

Background: There is widespread and some unexplained variation in induction of labour rates between hospitals. Some practice variation may stem from variability in clinical guidelines. This review aimed to identify to what extent induction of labour guidelines provide consistent recommendations in relation to reasons for, and timing of, induction of labour and ascertain whether inconsistencies can be explained by variability guideline quality.

Method: We conducted a systematic search of national and international English-language guidelines published between 2008 and 2018. General induction of labour guidelines and condition-specific guidelines containing induction of labour recommendations were searched. Guidelines were reviewed and extracted independently by two reviewers. Guideline quality was assessed using the Appraisal of Guidelines for Research and Evaluation II Instrument.

Findings: 49 guidelines of varying quality were included. Indications where guidelines had mostly consistent advice included prolonged pregnancy (induction between 41 and 42 weeks), preterm premature rupture of membranes, and term preeclampsia (induction when preeclampsia diagnosed ≥ 37 weeks). Guidelines were also consistent in agreeing on decreased fetal movements and

oligohydramnios as valid indications for induction, although timing recommendations were absent or inconsistent. Common indications where there was little consensus on validity and/or timing of induction included gestational diabetes, fetal macrosomia, elevated maternal body mass index, and twin pregnancy.

Conclusion: Substantial variation in clinical practice guidelines for indications for induction exists. As guidelines rated of similar quality presented conflicting recommendations, guideline variability was not explained by guideline quality. Guideline variability may partly account for unexplained variation in induction of labour rates.

Keywords: clinical guidelines, guideline review, AGREE II, induction of labour, clinical variation

Statement of Significance

Problem

There is significant unexplained variation in induction of labour rates between hospitals.

What is Already Known

Variation cannot be adequately explained by differences in women's demographics, co-morbidities, or hospital factors. The causes of variation in induction of labour rates remain unknown but it has been suggested that variation may stem from inconsistencies in clinical guidelines.

What this Paper Adds

This study shows that there is substantial variation in clinical practice guidelines for common indications for induction, which cannot be explained by guideline quality. Guideline variability appears to reflect differing, subjective interpretations of often sparse underlying evidence.

Background

There has been a considerable rise in women having induction of labour (IOL) over recent decades in high income countries¹⁻⁴. In Australia, with around 300,000 births per year, the IOL rate increased from 25% in 2006 to 31% in 2016⁵. This increase of 6% means that in 2016 a total of 18,615 more women had an IOL than in 2006⁶. Labour can be induced using a range of methods, most commonly using vaginal prostaglandins or cervical catheter if the woman's cervix is not favourable, followed by artificial rupture of membranes (ARM) and oxytocin (or ARM ± oxytocin only if the cervix is favourable)⁷.

IOL is associated with premature births⁸, decreased maternal satisfaction and a potential intervention cascade^{2,9}. Despite these issues, IOL rates continue to increase in high income countries, and there is widespread variation in IOL incidence between hospitals, even after adjusting for case mix or hospital factors^{4,10,11}. Evidence from Australia indicates that IOL rates range from 9.7% to 41.2% between hospitals¹¹, and that 44% of hospitals have an adjusted IOL rate that significantly differs from the state average¹⁰. Similar findings are reported from Europe¹² and the US¹³. This variations cannot be adequately explained by differences in women's demographics, co-morbidities, or hospital factors^{4,10,11}, and this requires further investigation.

Unexplained variation in rates of intervention raises doubt about the appropriateness of the intervention^{14,15}. It also suggests different practice styles and variability in the extent to which evidence-based clinical guidelines are followed¹⁶⁻¹⁹. Furthermore, it is possible that practice variation stems from inconsistencies in clinical guidelines despite using the same evidence-base^{18,20}. Guidelines developed by different groups addressing the same clinical issue can result in conflicting

recommendations ²¹, and vary in quality ²², making it hard for clinicians to provide consistent care and difficult for women to know what is likely to be best for them.

To help make sense of variations in the incidence and timing of IOL, we conducted a review of IOL guidelines for areas of divergence and convergence. We compared recommendations in relation to the timing and indications for IOL and assessed the quality of guidelines using the Appraisal of Guidelines for Research and Evaluation (AGREE II) Instrument ²³. The aim of this review was to (a) identify the extent to which IOL guidelines provide consistent recommendations in relation to reasons for, and timing of, planned birth, and (b) ascertain whether inconsistencies can be explained by variability in the quality of guidelines.

Method

Search strategy and guideline eligibility

We conducted a systematic search to identify guidelines in relation to indications for IOL published in English between January 1st 2008 and December 31st 2018. International and Australian guidelines were included, as well as guidelines from countries considered similar to Australia in terms of their availability and delivery of healthcare, namely New Zealand (NZ), the United States (US), the United Kingdom (UK), Ireland and Canada. Guidelines from national and state government and professional bodies were included; guidelines developed at local health district (LHD) or hospital level were excluded unless they are the guidelines used across the state (e.g. King Edward Memorial Hospital in Perth often provides the guidance for the whole of the state of Western Australia). All international guidelines were considered providing they were written in English (2 identified for inclusion ^{24,25}).

We used a number of search strategies to identify guidelines. As other guidelines reviews have found that guidelines are best sourced by a systematic grey literature search^{20,26}, in the first instance, we searched the internet using the search terms 'induction of labo(u)r' and 'guideline' and the individual indications for IOL in combination with 'guideline'. The indications searched for included prolonged pregnancy; premature rupture of membranes; uncomplicated twin pregnancy; breech presentation; cholestasis of pregnancy; antepartum haemorrhage; chorioamnionitis; hypertension, preeclampsia; gestational or Type I or II diabetes; elevated maternal body mass index; maternal age; maternal ethnicity; maternal cardiac disease; maternal request; mental health reason; previous adverse perinatal outcome; history of precipitate labour; fetal macrosomia; fetal growth restriction; decreased fetal movements; oligohydramnios; fetal isoimmunisation/alloimmune disease or Rhesus disease; and fetal death).

Guidelines were also purposively sought from key national authorities in relation to obstetrics and maternity care in each of the six countries, specifically: Australian Health Departments; Australian National Health and Medical Research Council (NHMRC); New Zealand Guidelines Group (NZGG); Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG); Royal College of Obstetricians and Gynaecologists (RCOG), United Kingdom; National Institute of Clinical Excellence (NICE), United Kingdom; The Scottish Intercollegiate Guidelines Network (SIGN); Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland; the Society of Obstetricians and Gynaecologists of Canada (SOGC); and World Health Organization (WHO), Geneva. Guidelines from national bodies that could not be accessed without member access were excluded (e.g. Women's Hospitals Australasia). This initial search strategy identified 59 guidelines for full review, of which 46 were included (see Figure 1).

To cross check that our search strategy was comprehensive, we also searched the electronic database PubMed, using the terms 'induction of labo(u)r' or 'labo(u)r induction' in combination with 'guideline'. This search generated 2401 articles for screening, but only identified two further guidelines for inclusion. Lastly, we searched the International Guideline Library using the terms 'induction' and 'induction of labo(u)r' and this search identified one further guideline for inclusion.

Insert Figure 1

All guidelines that addressed IOL in relation to indications and/or timing were included. Guidelines devoted specifically to IOL and general guidelines in relation to maternity care were also included, providing the guideline included a recommendation in relation to indications or timing of IOL.

Data extraction and quality appraisal

The guidelines were independently reviewed by two reviewers. Recommendations in relation to the reasons for, and timing of, IOL were extracted using a purposely designed data extraction template. Recommendations in relation to the possible IOL indications were systematically extracted. The quality of each guideline was assessed using the Appraisal of Guidelines for Research and Evaluation (AGREE II) Instrument²³. The AGREE II Instrument is a valid and reliable tool for assessing the quality of guidelines, which evaluates six domains: scope and purpose; stakeholder involvement; rigour of development; clarity and presentation; applicability; and editorial independence. The instrument has been endorsed by the World Health Organization and is widely accepted as the gold standard for the development of quality clinical guidelines²⁷. Two assessors independently appraised each guideline, with a third reviewer to resolve discrepancies (which was not required).

In the first instance, appraisers' scores for each of the six domains were entered into a spreadsheet, and calculated as a percentage. Discrepancies of greater than 30% were discussed at a consensus meeting and resolved, until the difference between the score was less than 30% (required for five guidelines). The final score was calculated by averaging the scores. As each of the six domains evaluates discrete aspects of the guideline quality, the six domains are considered independently and were not aggregated into a single quality score. The guidelines were also given an overall assessment score of between 1 and 7. In terms of the use of the guideline in practice, following the approach used in similar studies²⁸ a guideline was labelled as 'strongly recommended' if most domain scores (at least four of six) were greater than 60%. Guidelines were 'recommended with provisions or alterations' if most domain scores were between 30 and 60%, or at least two domain scores were no less than 60%. This label was also given to guidelines that had insufficient or lacking information for some items; however, if provisions or alterations were performed, then the guidelines were still considered for use in practice, especially when no other guidelines on the same clinical topic were available. A guideline was labelled as 'not recommended' if most of the domain scores were less than 30%.

Results

We identified 49 guidelines for inclusion (Table i), assessed as of varying quality (Table ii).

Twenty four guidelines were from Australia²⁹⁻⁵², 12 from the UK^{7,53-63}, eight from Ireland⁶⁴⁻⁷¹, one from the US⁷², one from Canada⁷³, one from New Zealand⁷⁴ and two international guidelines^{24,25}. The Australian guidelines included two national guidelines^{31,32}, nine from Western Australia³³⁻⁴¹, six from Queensland⁴²⁻⁴⁷, three from South Australia⁴⁸⁻⁵⁰, two from New South Wales^{29,30}, one from the Australian Capital Territory⁵¹ and one from Victoria⁵².

A total of 38 guidelines regarded specific indications for IOL, nine regarded IOL generally, and two regarded maternity care more broadly (but included recommendations in relation to indication or timing of IOL). Indications covered by the guidelines are outlined in Figure 1.

Insert Table i

Insert Table ii

Pregnancy indications

Prolonged pregnancy

With the exception of one guideline that did not address timing⁷², these guidelines consistently recommend IOL between 41 and 42 weeks gestation^{7,24,30,31,35,42,48,51,52,57,73,74}. While most guidelines state that IOL is indicated when women are ‘between 41+0 and 42+0 weeks’, two guidelines are more specific and recommend IOL by 41+5 weeks⁷⁴ or by no later than 41+3 weeks³⁵. Seven guidelines emphasised that IOL timing should be informed by women’s preferences and a process of shared decision-making^{7,30,31,42,51,52,57}. Four of these further stipulated that if a woman chooses not to have IOL that her decision should be respected^{7,30,52,57}. There is some variation in the guidelines in terms of when increased fetal monitoring for women with prolonged pregnancy should commence, ranging from 41+0 weeks^{30,35}, 41+3 weeks⁵², to 42 weeks⁵⁷.

Premature Rupture of Membranes

Premature Rupture of Membranes (PROM) – at term (at or over 37 weeks)

Guidelines present conflicting recommendations in relation to PROM at term. While some guidelines state that IOL is indicated (as soon as possible or within 24 hours)^{24,36,52,72,73}, other guidelines state

that women should be offered a choice of IOL or expectant management ^{7,45,74}. Some guidelines differentiate between women with PROM at term who are positive for group B streptococcus versus those who are negative. These indicate that women who are positive should receive an IOL with greater urgency than those who are not, and should be induced 'as soon as possible' ^{45,52}, within 24 hours ⁷³, or within 6 hours ³⁶.

Premature Rupture of Membranes – Preterm (<37 weeks)

Recommendations in terms of the management of preterm PROM is consistent across guidelines. All relevant guidelines state that IOL should not be carried out before 34 weeks unless there are additional obstetric indications such as suspected fetal compromise, and that women with preterm PROM after 34 weeks can be offered IOL or managed expectantly, depending on the risks and benefits for the woman and baby ^{7,49,52,59,67}.

Twin pregnancy

The relevant guidelines recommend planned birth for women with an uncomplicated twin pregnancy (i.e. first twin cephalic) ^{42,51,66,73}, with slightly varying recommendations around timing. Some guidelines recommend IOL at ≥ 37 weeks ⁴², at ≥ 38 weeks ⁷³, or between 37 and 38 weeks ⁷⁴ without differentiating between monochorionic or dichorionic pregnancies. Guidelines that differentiate between monochorionic or dichorionic pregnancies, recommend IOL for monochorionic pregnancies at 36+0 ^{51,55} or 37+0 weeks ⁶⁶, and for dichorionic pregnancies at 37+0 ^{51,55} or 38+0 weeks ⁶⁶. The WHO (2011) guideline does not provide a recommendation, stating that there is insufficient evidence to issue a recommendation on IOL in women with an uncomplicated twin pregnancy at or near term ²⁴.

Breech presentation

Those guidelines that mention IOL for breech presentations, indicate that IOL is not recommended, ^{7,52,63,71}. Two guidelines indicate that if a woman wishes to have a vaginal breech birth and planned birth is indicated, IOL can be offered after discussing the associated risks ^{7,52}.

Cholestasis of pregnancy

Cholestasis of pregnancy is listed as possible indication for IOL \geq 37 weeks depending on individual circumstances ^{33,42,51,60}, with slightly different recommendations around timing. Most guidelines state that IOL can be offered from 37 weeks, and earlier (at 36 weeks) for severe cases ^{33,42,51}. The RCOG (2011) guideline is more tentative in its recommendation and indicates IOL should be offered after 37+0 weeks depending on the severity and the circumstances and preferences of the woman ⁶⁰.

Antepartum haemorrhage

Antepartum haemorrhage is identified as an indication for IOL by three guidelines. Two guidelines list this as an indication without providing additional information ^{52,73}. The RCOG (2011) guideline indicates that IOL may or may not be indicated depending on severity and whether the antepartum haemorrhage is associated with maternal and/or fetal compromise ⁶¹. This guideline states that the optimum timing of birth of women presenting with unexplained antepartum haemorrhage and no associated maternal and/or fetal compromise is not established ⁶¹.

Chorioamnionitis

Three guidelines list chorioamnionitis as an indication for IOL ^{45,72,73}, without providing additional information.

Maternal Indications

Hypertension and preeclampsia

All of the guidelines that address IOL for women with hypertension or preeclampsia recommend IOL, with slightly different recommendations around the timing of planned birth^{25,29,34,43,48,52,54,68,69,72-74}. In terms of chronic hypertension, most guidelines recommend IOL from 37 weeks^{43,54,74}, while one guideline suggests waiting until 38+0 to 39+6 weeks, providing the woman is 'otherwise well'⁶⁹. Regarding gestational hypertension, some guidelines recommend IOL from 37 weeks^{29,54,69} while others recommend waiting until between 38 and 39 weeks^{25,73}. One guideline states that women with hypertension (without preeclampsia) can be offered the choice of IOL from 37 weeks or expectant management⁷⁴.

For preeclampsia, there is consistency across a number of guidelines that women with onset of preeclampsia at ≥ 37 weeks should be offered IOL^{25,34,43,54,72-74}. Recommendations in terms of the timing of IOL for women with pre-term (<37 weeks) preeclampsia vary, in particular for the management of preeclampsia with mild to moderate hypertension. Some guidelines recommend IOL for women with preeclampsia with mild to moderate hypertension to be delayed until 37 weeks²⁵, while others recommend IOL from 34 weeks^{54,68}.

Only two guidelines stipulate the need to consider women's needs and preferences in decision-making around timing of IOL for hypertensive disorders^{54,74}.

Maternal Diabetes

Gestational Diabetes

In relation to gestational diabetes, the guidelines present inconsistent recommendations in terms of whether this is an indication for IOL, in particular in relation to gestational diabetes with no maternal

or fetal complications. While some guidelines state that, in the absence of other indications, IOL is not indicated (before 42 weeks)^{46,56}, others indicate that IOL can be offered from 40 weeks⁷⁴, 40+6 weeks⁵⁶, or 41 weeks²⁴. Those guidelines that address gestational diabetes with maternal or fetal complications (e.g. suspected macrosomia or women who require insulin) agree that IOL between 38 and 39 weeks may be required^{41,46,56}. A number of guidelines identify gestational diabetes as an indication for IOL, without commentary around the timing that this should occur⁴⁸, or stating more broadly that timing depends on individual risks and preferences and local circumstances^{42,51,52}.

Type I or type II Diabetes

Three guidelines state that IOL is indicated for type I and type II diabetes^{56,72,73}, with only one of these providing guidance around timing. This guideline recommends IOL for women with type I or type II diabetes between 37 and 38 weeks, and earlier if there are metabolic or other maternal or fetal complications⁵⁶. Only one of the included guidelines stipulates the importance of shared decision-making with women in decision around timing of IOL for diabetes⁴⁶.

Other maternal indications

Elevated Maternal Body Mass Index (BMI)

In terms of elevated maternal BMI, out of four guidelines, two stipulate BMI as not an acceptable indication for IOL in the absence of other indications^{37,65}. One guideline recommends planned birth at 38 and 39 weeks for all women with a BMI ≥ 50 , and the option for all women who are “above their healthy weight range” to have an IOL⁵². A fourth guideline states that while, in the absence of other obstetric or medical indications, obesity alone is not an indication for planned birth, a low threshold for IOL at term may be appropriate⁴⁴.

Maternal age

In terms of maternal age, guidelines present conflicting recommendations. Most guidelines indicate that women ≥ 40 years of age may be offered an IOL^{42,51,62,73,74}, while one guideline states that maternal age alone is not an acceptable indication for IOL⁵². The guidelines that recommend IOL suggest that occurs at different gestations. This includes recommendations for IOL at 39 weeks⁷³, at between 39 and 40 weeks^{42,51,62}, or at 40 weeks⁷⁴.

Maternal ethnicity

Three guidelines comment on maternal ethnicity as an indication for IOL, consistently stating that IOL at term for maternal ethnicity alone is not acceptable^{42,51,52}.

Maternal Cardiac Disease

Two guidelines comment on IOL for women with heart disease, and both indicate that if a planned birth is required, IOL is preferred over caesarean section (CS), but where possible women should be allowed to labour spontaneously^{39,50}.

Maternal request

In relation to maternal request, one guideline identifies this as an unacceptable indication for IOL⁷³, and the other guidelines state that while IOL should not be routinely offered for maternal request, it can be offered under exceptional circumstances (undefined)^{7,42,51,52}, after 39 weeks⁵². One example given of an exceptional circumstance is if the woman's partner is soon to be posted abroad with the armed forces⁷.

Mental health reason

One guideline addresses maternal mental health as a reason for IOL, stating that IOL may be indicated for mental health reasons depending on the woman's circumstances⁵².

Previous adverse perinatal outcome

Only one guideline addresses whether a woman's previous adverse perinatal outcome is an indication for IOL, in this instance a previous intrauterine death, stating that this may be an appropriate indication for IOL to alleviate parental anxiety ⁷³.

History of precipitate labour

In relation to women having a history of precipitate labour, one guideline identifies this as an acceptable indication for IOL ⁷³, while two guidelines indicate this not an appropriate indication ^{7,52}.

Fetal indications

Suspected macrosomia

In relation to suspected macrosomia, guidelines consistently state that this is not an acceptable indication for IOL in the absence of other indications ^{7,24,42,51,52,73}. Three of these guidelines do recommend IOL in cases of 'confirmed' macrosomia ^{24,42,51}, with two of these recommending that an ultrasound for estimated fetal weight is conducted when macrosomia is suspected ^{42,51}. These guidelines recommend that IOL is offered at 38+0 weeks if weight is estimated at 3500 g at approximately 36 weeks, 3700 g at approximately 37 weeks or 3900 g at approximately 38 weeks ^{42,51}.

Suspected fetal compromise

Suspected fetal compromise may arise with suspected fetal growth restriction, reduced fetal movements, oligohydramnios or fetal alloimmune disease or Rhesus disease.

Suspected fetal growth restriction

In relation to suspected fetal growth restriction, the majority of guidelines indicate that planned early birth is appropriate depending on the severity^{42,48,51,52,70,72,73}. The exact timing and mode of birth should be informed by the severity of the concern and results of a fetal test of wellbeing^{7,42,51,74}. Three guidelines recommend delaying IOL until 40+0 weeks, with appropriate monitoring^{42,51,74}, provided there are normal middle cerebral artery and uterine Doppler studies⁷⁴. If these studies have not been performed, one guideline recommends IOL around 38 weeks⁷⁴. Another guideline recommends IOL is offered for suspected fetal growth restriction from 37+0 weeks, or earlier if indicated (i.e. static growth over 3-4 weeks and MCA Doppler PI <5th centile)³⁸. The NICE (2008) guideline states that if there is severe fetal growth restriction with confirmed fetal compromise, CS is preferred⁷.

Decreased fetal movements

In relation to decreased fetal movements, all guidelines indicate that this may be an appropriate indication for a woman's IOL, depending on clinical circumstances^{32,40,42,51,52,74}. The timing should be informed by results of tests for fetal wellbeing, and increased fetal surveillance may be required with expectant management^{32,42,51}. Only one guideline offers a recommended timing of >38 weeks or earlier if indicated⁴⁰.

Oligohydramnios

In relation to oligohydramnios, all guidelines indicate that this is an appropriate indication for IOL, depending on clinical circumstances^{42,48,51,53,72-74}. The timing of birth depends on the severity of concern and results of tests of fetal wellbeing^{42,51,53}, but may be offered between 37-38 weeks⁵³. Increased fetal surveillance is required if expectant management is chosen^{42,51,53}.

Alloimmune disease/Isoimmunisation or Rhesus disease

Five guidelines list alloimmune disease an indication^{48,72,73} or possible indication for IOL^{42,51} without any further details provided. No guidelines comment on Rhesus disease.

Fetal death

In terms of fetal death, most guidelines state that IOL is recommended^{24,72-74}, or that women should be offered the choice of IOL or expectant management^{7,47,52,64}. Two guidelines state that vaginal birth is the recommended mode of birth for most women, but caesarean section will need to be considered in some cases^{47,58}. Two guidelines stipulate that recommendations about labour and birth should take into account the woman's preferences and a process of shared decision-making should be used^{58,64}.

Discussion

This review indicates some consistency as well as considerable variability across the guidelines. Indications where guidelines had mostly consistent advice included prolonged pregnancy (induction between 41 and 42 weeks), preterm premature rupture of membranes, and term preeclampsia (induction when preeclampsia diagnosed ≥ 37 weeks). Guidelines were also consistent in agreeing on decreased fetal movements and oligohydramnios as valid indications for induction, although timing recommendations were absent or inconsistent. Common indications where there was little consensus on validity and/or timing of induction included gestational diabetes, fetal macrosomia, elevated maternal body mass index, and twin pregnancy. This variability does not appear reflective of variations in the quality of guidelines, as guidelines rated as similar in terms of quality also present conflicting recommendations. Similarly, recommendations from guidelines ranked as of low quality are often consistent with recommendations from high quality guidelines.

More likely, the variability reflects the limited and conflicted evidence base in this space ^{75,76}. For some indications, there are very few or no high quality studies especially randomised controlled trials (RCTs) which often drive the recommendations in guidelines, with the literature largely consisting of case reports (e.g. alloimmune disease or Rhesus disease, antepartum haemorrhage, chorioamnionitis, heart disease) ⁷⁵⁻⁷⁷. As such it is not surprising that for these indications guidelines provide unclear or conflicting recommendations. In relation to more common indications that have been studied more, there remains significant ambiguity in the literature and the tensions in the guidelines can be understood in terms of this complexity (see Table iii).

Insert Table iii

Table iii: Evidence supporting indications

<p>Prolonged pregnancy</p> <p>There remains uncertainty around the optimal timing of IOL ^{78,79}. As such the variations in guidelines in terms of the recommended timing of birth of for prolonged pregnancy is not unexpected.</p>
<p>Premature Rupture of Membranes at term</p> <p>Evidence from a Cochrane review that included 23 RCTs indicates that planned early birth may help to reduce maternal and neonatal infection without increasing CS rates; however the quality of the evidence is low. As such, variation in guidelines are not unexpected.</p>
<p>Twin pregnancies</p> <p>The existing evidence indicates that early planned birth for uncomplicated twin pregnancy does not improve outcomes ⁸⁰. In light of this, variations in terms of the recommended timing of IOL for twin pregnancy are not surprising.</p>
<p>Intrahepatic cholestasis of pregnancy</p> <p>Evidence from one RCT indicates that early planned birth is not associated with improved outcomes, however this study was underpowered to detect clinically important differences ⁸¹. Evidence from retrospective cohort studies suggests that planned early birth is associated with a significant reduction in the incidence of stillbirths, and that planned birth at 36 weeks gestation was associated with lower perinatal mortality ^{82,83}. Ambiguous and inconsistent guideline recommendations can be understood in light of this.</p>
<p>Hypertension</p> <p>There is limited high quality evidence to inform decisions about optimal timing of birth ⁸⁴, with little to no agreement in the literature on timing of birth for women with chronic hypertension, gestational hypertension or mild preeclampsia at term ⁷⁵. Some evidence indicates that planned birth between 38 and 39 weeks balances the lowest maternal and neonatal morbidity/mortality for both women with gestational hypertension and those with chronic hypertension ^{85,86}. As such the variability in the guidelines in relation to timing, with some recommending IOL at 37 weeks and others recommending delaying IOL until 38 or 39 weeks can be understood in light of this literature.</p>
<p>Preeclampsia</p>

While there is a consensus in both the literature and across guidelines that women with onset of preeclampsia at ≥ 37 weeks should be offered IOL, there is uncertainty around the management of preeclampsia with mild to moderate hypertension between 34 and 37 weeks⁷⁵. The uncertainty in the literature is reflected in inconsistent recommendations across guidelines, with range from IOL at 34 to 37 weeks.

Diabetes

There is little quality evidence to inform management between IOL at term or expectant management, and the little evidence that is available is largely limited to gestational diabetes^{87,88}. Again, this uncertainty in the literature is reflected in conflicting recommendations in guidelines.

Maternal elevated BMI

Evidence from retrospective cohort studies presents mixed findings. While some studies indicate that IOL is associated with reduced CS rates and improved maternal and neonatal outcomes⁸⁹⁻⁹¹, other studies demonstrate the reverse⁹². Again, given this it is not unexpected that guidelines indicate IOL is appropriate while other guidelines do not.

Maternal age,

The conflicting recommendations in guidelines can be understood in light of the limited and conflicting evidence base. Evidence from one RCT indicates that IOL does not improve outcomes or CS rates for women greater than 35 years⁹³. However this study was underpowered and contradicted by a retrospective cohort study that suggests that IOL at 40 weeks reduces perinatal mortality⁹⁴.

Suspected macrosomia,

Evidence from four RCTs included in a Cochrane review indicates that there are no benefits associated with early IOL⁹⁵, however the included studies were underpowered and evidence from an observational study based on known birthweight suggests that IOL may reduce CS rates⁹⁶. While most guidelines indicate IOL is not appropriate for suspected macrosomia, some guidelines indicate that it is appropriate in the context of 'known' birthweight following an ultrasound for estimated fetal weight.

Suspected fetal compromise

In the context of suspected fetal growth restriction, reduced fetal movements, oligohydramnios or fetal alloimmune disease or Rhesus disease, current studies are largely underpowered and there is significant uncertainty around when IOL is indicated and when birth can be delayed^{97,98}. The somewhat vague recommendation in most guidelines that planned early birth is appropriate 'depending on clinical circumstances' can be understood in light of this.

As indicated in Table iii, the existing evidence base for most of the IOL indications is limited and further high quality study designs, in particular RCTs, are required. Furthermore, given the complexity of the existing literature, and subsequent variability in recommendations in clinical guidelines, there is a need for more research into shared decision-making in a context of uncertainty. While much of the literature points to the importance of shared decision-making between consumers and practitioners, how shared decision-making is best performed in a context of medical uncertainty or ambiguity has not received much attention. There is an increasing

recognition that practitioners are often not well equipped to tolerate ambiguity and engage consumers in shared decision-making in a context of uncertainty⁹⁹. Our findings indicate significant variability in clinical guidelines in relation to indication and timing of IOL. While this can be largely understood in light of the existing evidence, this finding is also consistent with findings from other guideline reviews which highlight wide variability in guideline quality and recommendations, within maternity care^{20,21,100} and other areas of healthcare¹⁰¹.

Rather than stipulating recommendations that are aligned with some of the evidence, but contradictory to other study findings, it may be more appropriate for guidelines to stress the importance of shared decision-making, and better support practitioners to engage in shared decision-making in a context of uncertainty and mixed study findings. Currently, only 20% of the included guidelines (10/49) mention that decisions should be informed by women's preferences and a process of shared decision-making^{7,30,31,42,46,51,52,57,58,64}, and only four stipulate that if a woman chooses not to have IOL that her decision should be respected (mostly in the context of prolonged pregnancy)^{7,30,52,57}. Furthermore, this review identified that some countries developed multiple guidelines, highlighting the health system structures in different countries (for example, a federated country like Australia can easily develop different guidelines in each state and territory as well as different professional groups). Rather than developing lots of different guidelines at a state or regional level, a focus on further improvement of national guidelines and then a push to preferential use of national guidelines may help improve practices around IOL.

The review provides an up to date assessment of IOL guidelines for all the common IOL indications, systematically analysed by two reviewers for both content and quality. Limitations include inclusion of English-language guidelines only, as there may have been additional valuable guidance and/or underlying contributing studies not published in English in the non-English language guidelines. We also may not have been able to access all relevant guidelines due to the online nature of data

collection. The review is also of necessity limited by the quality and quantity of the underlying trials/original research that included guidelines draw upon: hence the necessity for further high-quality IOL RCTs.

Conclusion

Substantial variation in clinical practice guidelines for common IOL indications exists, both within Australia and in other English-speaking high-income countries with broadly comparable healthcare systems. As guidelines rated of similar quality in this review presented conflicting recommendations, guideline variability was not explained by guideline quality. Rather, guideline variability appears to be reflecting differing, subjective interpretations of often sparse objective underlying evidence. This inconsistency underscores the difficulty of translating evidence into practice, and guideline variability may partly account for unexplained variation in IOL rates in different Australian settings. Implementation research into shared decision-making, as well as further high quality research to broaden the evidence base for contested IOL indications is recommended.

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Conflict of Interest

The Editor-in-Chief, Caroline Homer, played no role in the decision to peer review or ultimately accept this paper due to being a co-author. This was managed by the Deputy Editor Linda Sweet to avoid any perception or reality of conflict of interest.

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Table i: IOL Indications

Name of guideline	Antepartum haemorrhage	Isoimmunisation or Rh disease – Fetal	Body Mass Index	Breech presentation	Cholestasis of pregnancy	Chorioamnionitis (includes suspected)	Diabetes - gestational and Type I and II	Decreased fetal movements	Fetal death	Fetal growth restriction	Fetal macrosomia	History of precipitate labour	Hypertension, pre-eclampsia	Maternal age	Maternal ethnicity	Maternal Cardiac Disease	Maternal request	Mental health reason	Oligohydramnios	Previous adverse perinatal outcome	Prolonged pregnancy	Premature Rupture of Membranes – At Term	Premature Rupture of Membranes – Preterm	Twin pregnancy - Uncomplicated
Department of Health ³¹ (2018) [†]																					Y WC			
PSANZ ³² (2016) [†]							M																	
King Edward Memorial Hospital ³³ (2014) [†]				Y																				
King Edward Memorial Hospital ³⁴ (2015) [†]												Y												
King Edward Memorial Hospital ³⁵ (2015) [†]																					Y			
King Edward Memorial Hospital ³⁶ (2016) [†]																						Y		
King Edward Memorial Hospital ³⁷ (2016) [†]			N																					
King Edward Memorial Hospital ³⁸ (2016) [†]									Y															
King Edward Memorial Hospital ³⁹ (2018) [†]															M									

*Not relevant to high risk pregnancies and only covers prolonged pregnancy
 † IOL guidelines; ‡Guidelines about specific indicators; † Maternity care guidelines
 WC= Woman's Choice; M= Maybe; Y= yes; N=No; Blank – not mentioned

Table ii: AGREE Scores

	Name of guideline	Country	Scope and Purpose %	Stakeholder involvement %	Rigor of development %	Clarity of presentation %	Applicability %	Editorial independence %	Overall Guideline Assessment
Department of Health ³¹ (2018) [†]	Pregnancy Care	Australia, national	93	97	95	97	66	67.5	6; highly recommended
PSANZ ³² (2016) [‡]	Clinical Practice Guideline for the Care of Women with Decreased Fetal Movements	Australia, national	97	95	89	95	46	57	6; highly recommended
King Edward Memorial Hospital ³³ (2014) [‡]	Cholestasis in Pregnancy	Australia, WA	40	14	29	55	14	14	2; not recommended
King Edward Memorial Hospital ³⁴ (2015) [‡]	Hypertension in pregnancy: medical management	Australia, WA	47	16	31	47	14	14	2.5; not recommended
King Edward Memorial Hospital ³⁵ (2015) [‡]	Pregnancy Beyond 41 weeks: management of	Australia, WA	50	14	27	62	14	14	2; not recommended
King Edward Memorial Hospital ³⁶ (2016) [‡]	Pre-labour rupture of membranes at term	Australia, WA	45	21	28	64	14	14	2; not recommended
King Edward Memorial Hospital ³⁷ (2016) [‡]	Increased Body Mass Index: management of a woman with	Australia, WA	76	21	36	71	14	14	3; not recommended
King Edward Memorial Hospital ³⁸ (2016) [‡]	Small for Gestational Age and Intrauterine Growth Restriction	Australia, WA	67	38	36	76	21	14	3; not recommended
King Edward Memorial Hospital ³⁹ (2018) [‡]	Cardiac Disease	Australia, WA	64	21	27	55	14	14	3; not recommended
King Edward Memorial Hospital ⁴⁰ (2018) [‡]	Decreased Fetal Movements: Management of	Australia, WA	57	14	27	55	14	14	2.5; not recommended
King Edward Memorial Hospital ⁴¹ (2018) [‡]	Diabetes in Pregnancy	Australia, WA	21	14	28	52	14	14	1.5; not recommended
Queensland Health ⁴² (2017) [†]	Induction of Labour	Australia, QLD	64	59	31	83	19	14	3.5; recommended with provisions or alterations

Queensland Health ⁴³ (2015) [‡]	Hypertensive disorders of pregnancy	Australia, QLD	95	61	52	76	71	64	6; highly recommended
Queensland Health ⁴⁴ (2015) [‡]	Obesity in pregnancy	Australia	86	74	56	86	61	78	6; highly recommended
Queensland Health ⁴⁵ (2017) [‡]	Early Onset Group B Streptococcal disease	Australia	92	71	55	71	77	64	6; highly recommended
Queensland Health ⁴⁶ (2017) [‡]	Gestational diabetes mellitus 2017	Australia	88	69	53	78	71	78	6; highly recommended
Queensland Health ⁴⁷ (2018) [‡]	Stillbirth care	Australia	88	74	51	81	55	75	6; highly recommended
NSW Ministry of Health ²⁹ (2011) [‡]	Management of hypertensive disorders of pregnancy	Australia, NSW	90	45	38	51	45	28	4; recommended with provisions or alterations
NSW Ministry of Health ³⁰ (2014) [‡]	Management of pregnancy beyond 41 weeks gestation	Australia, NSW	88	38	38	73	23	14	3; recommended with provisions or alterations
SA Maternal & Neonatal Clinical Network ⁴⁸ (2014) [†]	Induction of labour techniques	Australia, SA	62	45	37	57	17	14	3; recommended with provisions or alterations
SA Maternal & Neonatal Clinical Network ⁴⁹ (2015) [‡]	Preterm Prelabour Rupture of the Membranes	Australia, SA	50	31	29	59	19	14	3; not recommended
SA Department of Health and Ageing ⁵⁰ (2018) [‡]	Cardiac disease in pregnancy	Australia, SA	73	31	23	57	17	14	3.5; recommended with provisions or alterations
Victoria Health ⁵² (2018) [†]	Induction of Labour	Australia, Victoria	33	16	25	66	43	14	3.5; recommended with provisions or alterations
ACT Health ⁵¹ (2018) [†]	Induction of Labour	Australia, ACT	64	59	31	83	19	14	3.5; recommended with provisions or alterations
ADAU protocol group ⁵³ (2015) [‡]	Guideline for the management of oligohydramnios	UK	43	21	19	43	25	14	2.5; not recommended
NICE ⁵⁷ (2008) [†]	Antenatal care for uncomplicated pregnancies	UK	85	78	46	81	34	21	4.5; recommended with provisions or alterations
NICE ⁷ (2008) [†]	Induction of labour: NICE clinical guideline	UK	76	71	85	78	30	21	6; highly recommended
NICE ⁵⁴ (2010) [‡]	Hypertension in pregnancy: diagnosis and management	UK	90	97	85	93	47	17	5; highly recommended

NICE ⁵⁵ (2011) [‡]	Multiple pregnancy: antenatal care for twin and triplet pregnancies	UK	90	76	80	81	30	36	5.5; highly recommended
NICE ⁵⁶ (2015) [‡]	Diabetes in pregnancy: management from preconception to the postnatal period	UK	100	92	82	95	84	68	6; highly recommended
RCOG ⁵⁸ (2010) [‡]	Late Intrauterine Fetal Death and Stillbirth	UK	97	83	97	91	66	14	6; highly recommended
RCOG ⁵⁹ (2010) [‡]	Preterm Prelabour Rupture of Membranes	UK	95	71	79	76	43	21	6; highly recommended
RCOG ⁶⁰ (2011) [‡]	Obstetric Cholestasis	UK	83	57	94	81	52	14	5; recommended with provisions or alterations
RCOG ⁶¹ (2011) [‡]	Antepartum haemorrhage	UK	71	62	82	83	31	17	4.5; recommended with provisions or alterations
RCOG ⁶² (2013) [‡]	Induction of Labour at Term in Older Mothers	UK	52	40	42	24	14	14	3; recommended with provisions or alterations
RCOG ⁶³ (2017) [‡]	Management of Breech Presentations	UK	86	57	88	97	51	57	5; recommended with provisions or alterations
Institute of Obstetricians and Gynaecologists ⁶⁴ (2011) [‡]	Investigation and management of late fetal intrauterine death and stillbirth	Ireland	88	45	61	88	62	14	4.5; highly recommended
Institute of Obstetricians & Gynaecologists ⁶⁵ (2011) [‡]	Obesity and Pregnancy Clinical Practice Guideline	Ireland	71	57	61	83	41	14	3.5; recommended with provisions or alterations
Institute of Obstetricians and Gynaecologists ⁶⁶ (2012) [‡]	Management of multiple pregnancy	Ireland	76	57	61	83	30	25	4; recommended with provisions or alterations
Institute of Obstetricians and Gynaecologists ⁶⁷ (2013) [‡]	Preterm Prelabour Rupture of the Membranes	Ireland	42	38	29	43	14	14	2.5; recommended with provisions or alterations
Institute of Obstetricians and Gynaecologists ⁶⁸ (2016) [‡]	The diagnosis and management of severe pre-eclampsia and eclampsia	Ireland	83	66	55	81	46.5	14	3.5; recommended with provisions or alterations
Institute of Obstetricians and Gynaecologists ⁶⁹ (2016) [‡]	The Management of Hypertension in Pregnancy	Ireland	88	64	35	52	32	14	3.5; recommended with provisions or alterations
Institute of Obstetricians and Gynaecologists ⁷⁰ (2017) [‡]	Fetal-Growth-Restriction-Recognition-Diagnosis-and-Management	Ireland	76	57	38	45	28	14	3; recommended with provisions or alterations

Institute of Obstetricians and Gynaecologists ⁷¹ (2017) [‡]	The Management of Breech Presentation	Ireland	90	64	38	64	26	28	4; recommended with provisions or alterations
ACOG ⁷² (2009) [†]	Induction of Labor	USA	71	26	33	57	19	14	3.5; recommended with provisions or alterations
National Women's Health ⁷⁴ (2015) [†]	Induction of Labour	New Zealand	71	38	29	71	18	14	3; recommended with provisions or alterations
SOGC ⁷³ (2013) [†]	Induction of Labour	Canada	43	57	62	88	28	57	3.5; recommended with provisions or alterations
WHO ²⁴ (2011) [†]	WHO recommendations for Induction of labour	International	90	66	85	93	84	60	6; highly recommended
ISSHP ²⁵ (2018) [‡]	The hypertensive disorders of pregnancy: ISSHP classification, diagnosis & management recommendations for international practice	International	81	62	70	66	41	100	5; highly recommended

† IOL guidelines; ‡Guidelines about specific indicators; † Maternity care guidelines

ACT=Australian Capital Territory; NSW= New South Wales; SA= South Australia; WA=Western Australia; QLD=Queensland