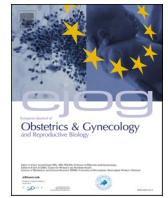


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Full length article

## Comparison of international guidelines on the management of twin pregnancy

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## ABSTRACT

**Objectives:** To review current international clinical guidelines on the antenatal and intrapartum management of twin pregnancies, examining areas of consensus and conflict.

**Methods:** We conducted a database search using Medline, Pubmed, Scopus, Academic Search Complete, CINAHL and ERCI Guidelines website. Guidelines were screened for eligibility using our inclusion and exclusion criteria. Those deemed eligible were quality assessed using the AGREE II tool and relevant data was extracted.

**Results:** We identified 21 relevant guidelines from 16 countries including two international society guidelines. There was consensus in determination of chorionicity and amnionicity within the first trimester, fetal anomaly scan between 18 and 22 weeks and the recommended screening for twin-to-twin transfusion syndrome (TTTS). For those that provided intrapartum guidance, there was agreement in recommending caesarean section to deliver monochorionic monoamniotic (MCMA) twins, epidural anaesthesia for intrapartum analgesia and the use of cardiotocography (CTG) for intrapartum fetal monitoring.

The main areas of conflict included cervical length screening, frequency of ultrasound surveillance, timing of delivery of dichorionic twin pregnancies and circumstances for recommending vaginal delivery. There was a lack of advice on intrapartum management.

**Conclusions:** This review has highlighted the need for unified international guidance on the management of twin pregnancy. Comparisons of current guidance demonstrates a lack of confidence in the management of labour in twin pregnancies. Further evidence on intrapartum care of twin pregnancies is needed to inform practice guidelines and improve both short and long term maternal and fetal outcomes.

## Introduction

Over the last three decades the incidence of twin pregnancies has steadily increased [1] due to rising maternal age and increased demand for fertility treatments [2]. Twin pregnancies can present significant challenges with a six-fold increase in mortality and fivefold increase in long-term handicap compared to singleton pregnancies. This worsened perinatal mortality is often secondary to preterm birth and fetal growth restriction (FGR) [3]. The complications of monochorionic (MC) twin pregnancies, with a single shared placenta, pose an even greater management concern with higher rates of perinatal mortality and morbidity than dichorionic (DC) twins [4,5]. Recent advancements in fetoscopic

interventions have provided novel treatment options for some MC fetal complications such as twin-twin transfusion syndrome (TTTS) [6] or selective fetal growth restriction (sFGR) [7]. The management of twin pregnancy therefore requires routine surveillance to detect complications to allow early targeted interventions.

Clinical guidelines assist clinicians in the planning of routine care, screening for and managing complications. They are based on the latest evidence and expert opinion. The objective of this study is to review current international clinical guidelines on the antenatal and intrapartum management of twin pregnancies, highlighting areas of consensus and conflict.

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## Methods

### Search strategy and study selection

Prior to initiating the search, criteria for inclusion and exclusion were developed. We decided to exclude guidelines produced prior to 2010 due to developments in the understanding of MC complications, screening techniques and interventions. We included guidelines in any languages provided and from countries of any level of economic development.

We conducted a search for international guidelines that were published between September 2010 to November 2021 using the online health databases Medline, Pubmed, Scopus, Academic Search Complete, CINAHL as well as ERCI Guidelines website. The search terms used were ‘multiple, pregnancy’, ‘twin, pregnancy’ or ‘multiple, gestation’. Where possible, results were limited to ‘practice guidelines’ in terms of article type and the following MESH terms were applied: ‘pregnancy, multiple’, ‘pregnancy, twin’, ‘prenatal care’, ‘obstetrics’, ‘delivery, obstetrics’, ‘pregnancy complications’, ‘pregnancy outcome’ and ‘practice guideline as topic’. The results were then screened for relevance and eligibility.

### Data extraction

A standard data extraction tool was developed and used to obtain information on key aspects of care; antenatal screening and timing of ultrasound scans, assessments for TTTS, cervical length and preterm birth prevention, the timing and mode of birth and intrapartum care. The guidelines deemed to be eligible were read and relevant information was collected.

### Quality appraisal of guidelines

The assessment of the quality of the included guidelines was performed using “The Appraisal of Guidelines for Research and Evaluation (AGREE II)” tool [8]. The AGREE II tool is made up of 23 items assessing various aspects of the quality of the guideline. The items are split into six quality domains:

#### Domain 1: Scope and purpose.

1. The overall objective(s) of the guideline is (are) specifically described
2. The health question(s) covered by the guideline is (are) specifically described
3. The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described

#### Domain 2: Stakeholder involvement.

4. The guideline development group includes individuals from all the relevant professional groups
5. The views and preferences of the target population (patients, public, etc.) have been sought
6. The target users of the guideline are clearly defined

#### Domain 3: Rigour of development.

7. Systematic methods were used to search for evidence
8. The criteria for selecting the evidence are clearly described
9. The strengths and limitations of the body of evidence are clearly described
10. The methods for formulating the recommendations are clearly described
11. The health benefits, side effects, and risks have been considered in formulating the recommendations

12. There is an explicit link between the recommendations and the supporting evidence
13. The guideline has been externally reviewed by experts prior to its publication
14. A procedure for updating the guideline is provided

#### Domain 4: Clarity of presentation.

15. The recommendations are specific and unambiguous.
16. The different options for management of the condition or health issue are clearly presented
17. Key recommendations are easily identifiable

#### Domain 5: Applicability.

18. The guideline provides advice and/or tools on how the recommendations can be put into practice
19. The guideline describes facilitators and barriers to its application
20. The potential resource implications of applying the recommendations have been considered
21. The guideline presents monitoring and/or auditing criteria

#### Domain 6: Editorial independence.

22. The views of the funding body have not influenced the content of the guideline
23. Competing interests of guideline development group members have been recorded and addressed

Each item is given a score between 1 (strongly disagree) and 7 (strongly agree) with a final overall quality assessment rating the overall quality of the guideline (OA1) and whether the guideline is recommended to be used in practice (OA2). The overall assessments are again given a score between 1 and 7 [8].

The appraisal process is recommended to be undertaken by at least two and ideally four appraisers whom each review the individual guidelines using the tool. Three appraisers were involved in the assessment. This increases the reliability of the assessment [8]. The standardised score for a domain would be 0% if all appraisers scored each item in the domain as 1 [8].

The AGREE II tool does not provide any guidance on how to define the domain scores. We adopted the cut-off score according to Amer et al. [9]. If the overall guideline score was > 60% the guideline was recommended, if the overall score was 40%-59% the guideline was recommended with modifications and if the score was < 40% it was not recommended.

## Results

Our initial search identified 9 guidelines eligible for inclusion in our review, this included 2 not in the English language that required translation (Fig. 1). The search failed to detect guidelines from some of the major societies and institutes. After discussion we decided to do a further hand search of the websites of professional societies and an internet search of countries we expected to have produced guidelines. From this we included a further 11 guidelines bringing the total to 20 guidelines for review.

We also noted that professional bodies may have guidance on the management of multiple pregnancy within other guidelines rather than as a separate document, so from this another search was conducted through the databases Medline, Pubmed, Scopus and Academic Search Complete as well as websites Guideline Central, Up to Date and ERCI Guidelines. The terms ‘labour’ or ‘intrapartum’ and ‘guidelines’ were used and the same exclusion criteria was applied. Again, where possible the MESH terms ‘delivery, obstetric’, ‘obstetrics’ ‘fetal monitoring’, ‘labour, obstetrics’, ‘labour, induced’, ‘breech presentation’,

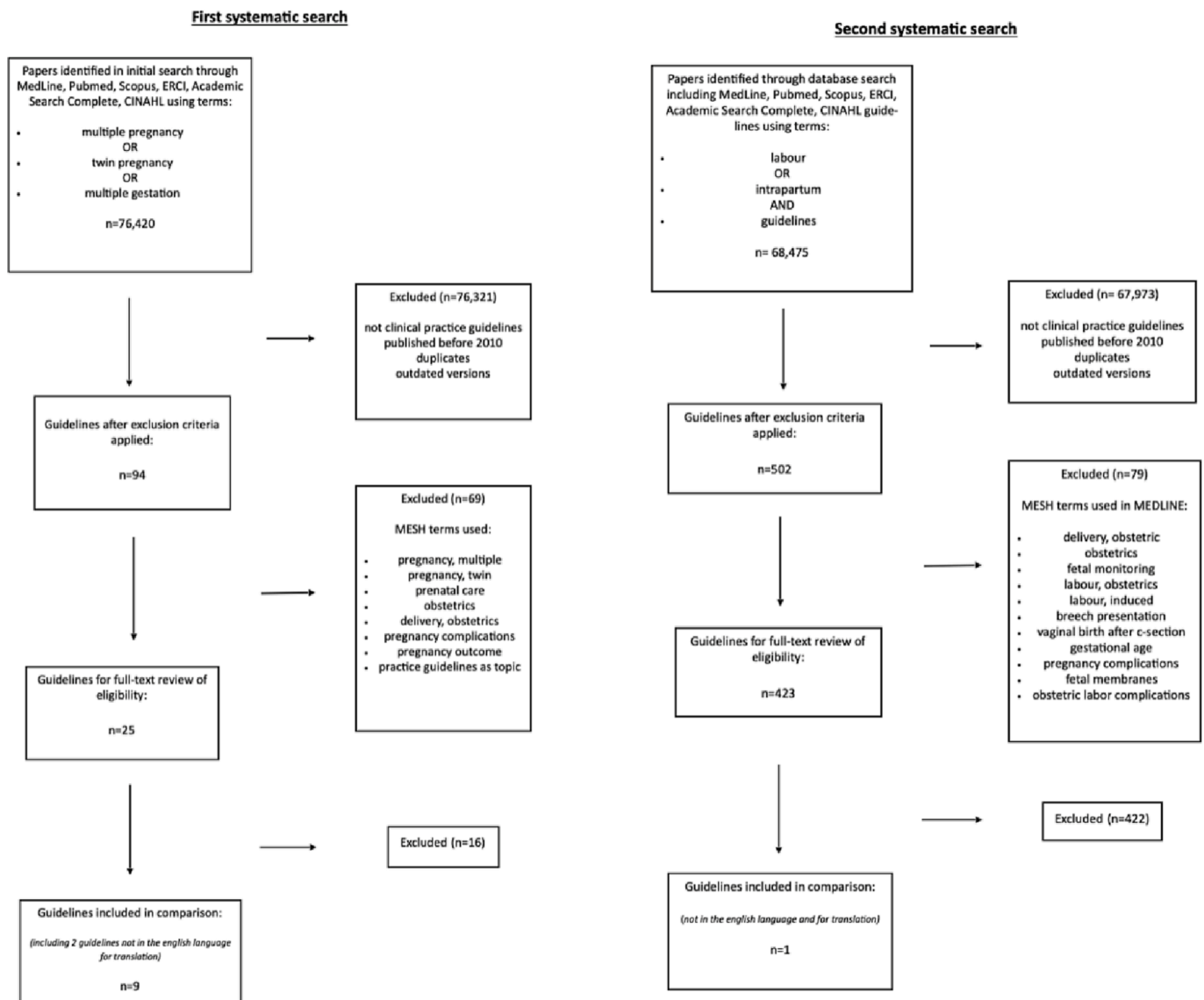


Fig. 1. PRISMA diagrams outlining the systematic searches for guidelines.

‘vaginal birth after c-section’, ‘gestational age’, ‘pregnancy complications’ and ‘fetal membranes’ were used and results were screened for relevance and eligibility. We identified one further guideline totalling twenty-one (Fig. 1).

Three of the guidelines we included were not published in the English language. These were translated by native speakers with a clinical background to assess the eligibility and extract relevant data.

Our search produced 21 national and international guidelines from sixteen countries as well as two international guidelines. These had been produced by the Australia and New Zealand (RANZCOG 2021), Canada (JOGC 2017), Denmark (DSOG 2020), France (CNGOF 2011), Germany (AWMF 2020), Ireland (IOGRCP 2012), Italy (SIGO 2016), Japan (JAOG 2011), Mexico (2013), Netherlands (NVOG 2019), North America (ACR 2017, SMFM 2020, ACOG 2016, NAFTnet 2015), Oman (Oman MOH 2010), Poland (PGS 2020), Sri Lanka (SICOG 2013), UK (NICE 2019 and RCOG 2016). The international guidelines were from ISUOG (2016) and FIGO (2019).

#### Methodological quality of guidelines

The AGREE II domains are summarised in Table 1. Those guidelines of high quality reaching the cut off > 60% are shown in green, medium

quality guidelines reaching the 40%–59% cut off in yellow and low-quality guidelines not reaching the 40% cut off in red.

The first part of the overall assessment (OA1) had an average score of 61%, 10 guidelines had a score over 60% and all of which were recommended either with or without modifications. Table 1. AGREE II assessment scores.

#### Recommendations with consensus

The determination of amnionicity and chorionicity in the first trimester was recommended by all sources (Table 2). In those that recommended a fetal anomaly scan, 84.6% advised that this should take place between 18 and 22 weeks. In those that provided guidance on DC twins, 59.0% advised ultrasound monitoring every four weeks with 57.1% advising every two weeks in MCDA. 90.0% encouraged screening for TTTS and 85.7% recommended serial fetal growth measurements. 52.3% of guidelines advised measuring umbilical artery flow and middle cerebral artery – peak systolic velocity (MCA-PSV) as assessments of fetal wellbeing. Where mentioned there was agreement in advising against interventions for pre-term birth prevention. In those that provided guidance, all advised caesarean section to deliver MCMA twins, 71.1% recommended vaginal delivery for DCDA twins and 71.4%

**Table 1**  
AGREE II assessment scores.

Guideline	Domain 1 (Items 1-3)	Domain 2 (Items 4-6)	Domain 3 (Items 7-14)	Domain 4 (Items 15-17)	Domain 5 (Items 18-21)	Domain 6 (Items 22-23)	OA1	OA2
RCOG	100%	72%	88%	86%	21%	88%	93%	Y (n=2) YWM (n=0) N (n=0)
RANZCO G	97%	64%	54%	89%	0%	63%	79%	Y (n=1) YWM (n=1) N (n=0)
JOGC	81%	19%	75%	69%	4%	50%	64%	Y (n=0) YWM (n=2) N (n=0)
IOGRCP	67%	53%	50%	86%	40%	13%	57%	Y (n=0) YWM (n=2) N (n=0)
ISUOG	97%	56%	59%	83%	6%	21%	79%	Y (n=1) YWM (n=1) N (n=0)
NICE	97%	86%	84%	86%	81%	75%	100%	Y (n=2) YWM (n=0) N (n=0)
SMFM	78%	36%	61%	69%	75%	88%	64%	Y (n=0) YWM (n=2) N (n=0)
CNGOF	58%	50%	67%	67%	0%	54%	64%	Y (n=0) YWM (n=2) N (n=0)
PGS	56%	28%	18%	53%	0%	25%	36%	Y (n=0) YWM (n=0) N (n=2)
AWMF	97%	69%	91%	64%	48%	100%	86%	Y (n=2) YWM (n=0) N (n=0)
DSOG	67%	19%	50%	86%	4%	29%	57%	Y (n=0) YWM (n=2) N (n=0)
MEXICO	100%	58%	64%	75%	13%	54%	79%	Y (n=1) YWM (n=1) N (n=0)

(continued on next page)

Table 1 (continued)

SIGO	53%	28%	32%	78%	13%	0%	50%	Y (n=0) YWM (n=1) N (n=1)
JAOG	83%	36%	20%	53%	6%	0%	43%	Y (n=0) YWM (n=1) N (n=1)
OMAN MOH	44%	39%	6%	50%	8%	0%	29%	Y (n=0) YWM (n=0) N (n=2)
NVOG	42%	36%	40%	58%	27%	25%	50%	Y (n=0) YWM (n=1) N (n=1)
NAFTnet	94%	42%	44%	83%	8%	67%	57%	Y (n=0) YWM (n=2) N (n=0)
ACOG	97%	50%	45%	67%	0%	100%	57%	Y (n=0) YWM (n=2) N (n=0)
ACR	44%	58%	74%	50%	19%	88%	64%	Y (n=0) YWM (n=2) N (n=0)
FIGO	83%	36%	15%	58%	0%	42%	36%	Y (n=0) YWM (n=1) N (n=1)
SLCOG	86%	14%	25%	44%	6%	0%	36%	Y (n=1) YWM (n=0) N (n=2)
<b>Average score for each domain (n%)</b>	<b>78%</b>	<b>45%</b>	<b>51%</b>	<b>69%</b>	<b>18%</b>	<b>47%</b>	<b>61%</b>	

recommended considering vaginal breech extraction (VBE) and manoeuvres to aid vaginal delivery if the second twin is non-cephalic.

No guideline made a recommendation on the use of computerised CTG in the antenatal period.

For the guidelines that provided intrapartum guidance, 66.6% recommended the use of CTG for fetal heart rate monitoring during labour and 55.5% advised the use of epidural anaesthesia for intrapartum analgesia. All of those that gave advice on the management of the third stage of labour recommended active management (Table 2).

*Recommendations with conflict*

*General guidance*

An area of conflict in the recommendations is the assessment of cervical length as a predictor for preterm birth. 33.3% recommend measuring cervical length, 23.8% advise against doing so with the remaining 42.8% either undecided or not mentioning this within their guidance. 42.9% of institutions advise no interventions for preventing preterm birth with only two institutions recommending either vaginal

**Table 2**  
General guidance table.

Aspect of Care	Result
<i>General Antenatal Guidance</i>	
Determination of Chorionicity and Amnionity	<ul style="list-style-type: none"> <li>• Within first trimester: 100% agreement</li> </ul>
Twin labelling	<ul style="list-style-type: none"> <li>• Recommended by 42.9% (9/21)</li> </ul>
Anomaly Scan	<ul style="list-style-type: none"> <li>• Recommended by 62.0% (13/21)</li> <li>• 18–22 weeks gestation: 11/13</li> <li>• 20–22 weeks gestation 1/13</li> </ul>
Umbilical Artery flow	<ul style="list-style-type: none"> <li>• Recommended by 66.6%</li> <li>• At every ultrasound 23.8%</li> <li>• If TTTS suspected/ discordance in growth/fluids: 28.6%</li> <li>• After 16 weeks: 4.8%</li> <li>• After 20 weeks: 9.5%</li> <li>• No guidance: 33.3%</li> </ul>
MCA-PSV measurement (middle cerebral artery – peak systolic velocity)	<ul style="list-style-type: none"> <li>• Recommended by 52.3%</li> <li>• At every ultrasound: 14.2%</li> <li>• After 20 weeks gestations: 23.8%</li> <li>• If abnormal UPI without explanation: 4.8%</li> <li>• Recommended but unclear on timing: 14.3%</li> <li>• No guidance: 42.9%</li> </ul>
Fetal growth measurements	<ul style="list-style-type: none"> <li>• Recommended by 85.7%</li> </ul>
Fetal echocardiogram	<ul style="list-style-type: none"> <li>• On an individual basis: 4.8%</li> <li>• In MC twins: 14.3%</li> <li>• At 18–22 weeks gestation: 9.5%</li> <li>• No guidance: 71.4%</li> </ul>
Cervical length assessment	<ul style="list-style-type: none"> <li>• Yes: 33.3%</li> <li>• No: 23.8%</li> <li>• Undecided: 9.5%</li> <li>• No guidance: 33.3%</li> </ul>
Pre-term birth prevention	<ul style="list-style-type: none"> <li>• No interventions: 42.9%</li> <li>• Vaginal progesterone in individual cases: 4.8%</li> <li>• Cervical pessary (CL &lt; 25th centile): 4.8%</li> <li>• No guidance: 47.6%</li> </ul>
Administration of corticosteroids	<ul style="list-style-type: none"> <li>• Anticipated delivery before 34 weeks gestation: 9.5%</li> <li>• On an individual basis: 23.8%</li> <li>• Before delivery in MCMA twins: 14.3%</li> <li>• No guidance: 52.4%</li> </ul>
Mode of birth if second twin is non-cephalic	<ul style="list-style-type: none"> <li>• Vaginal Breech Extraction (VBE) with External Cephalic Version and Internal Podalic Version considered: 23.8%</li> <li>• VBE only: 9.5%</li> <li>• No guidance: 66.6%</li> </ul>
<i>General Intrapartum Guidance</i>	
9 guidelines out of 21 provided any intrapartum guidance, the following figures look at those that provided advice.	
Intrapartum fetal monitoring	<ul style="list-style-type: none"> <li>• Use of cardiotocography (CTG) or continuous fetal heart rate monitoring: 28.6%</li> <li>• No guidance: 71.4%</li> </ul>
Analgesia	<ul style="list-style-type: none"> <li>• Epidural anaesthesia recommended: 55.5%</li> <li>• No guidance: 44.4%</li> </ul>
Intertwin delivery interval	<ul style="list-style-type: none"> <li>• 20 min: 11.1%</li> <li>• Within 30 min: 33.3%</li> <li>• Longer than 30 min with appropriate monitoring: 11.1%</li> <li>• No guidance: 44.4%</li> </ul>
Management of 3rd stage of labour	<ul style="list-style-type: none"> <li>• Active management: 44.4%</li> <li>• Not guidance: 55.5%</li> </ul>

progesterone or cervical pessary in individual cases (Table 2).

52.3% of guidelines advise assessing umbilical artery flow but the indication for when to do so varies. The indications include if TTTS is suspected or there is discordance in growth or fluid volumes, after 20 weeks or at every ultrasound which is advised by 23.8%.

There is similar conflict in the measurement of MCA-PSV, again 52.3% recommend assessing with the indications for doing so varying. The majority advise after 20 weeks' gestation (23.8%) with others recommending only if there is an abnormal uterine artery pulsatility index

(UAPI) without explanation.

In general, the advice on intrapartum care is lacking with only nine guidelines out of twenty-one providing any guidance. There is a lack of consensus in the optimum inter-twin delivery interval with one guideline advising 20 min, 33.3% within 30 min and one guideline recommending longer than 30 min with appropriate monitoring.

*Dichorionic twin pregnancy*

There was conflict in the optimum timing of delivery of DC twin pregnancies (Table 3). The range of advised gestations was between 37 and 40 weeks' gestation, with seven variations of timings. A maximum of two guidelines agreed on any particular timing (37<sup>+0</sup>–38<sup>+0</sup> weeks and 38<sup>+0</sup> weeks). There was also some variation around the conditions for recommending vaginal delivery. 47.1% advise this can be allowed if the leading twin is cephalic, one guideline recommends only if both twins are cephalic and 18.0% state vaginal delivery can be 'considered'.

*Monochorionic diamniotic twin pregnancy*

There is again a lack of consensus in the advised timing of birth for MCDA twin pregnancies (Table 4). The range is larger than seen with DC twins, starting at 34<sup>+0</sup> weeks with one guideline advising up to 38<sup>+6</sup> weeks' gestation. 19.0% agree on advising delivery between 36<sup>+0</sup> and 37<sup>+0</sup> weeks. For the recommended mode of delivery in MCDA twins 33.3% of guidelines did not provide any advice, 28.6% advise vaginal delivery if the leading twin is cephalic, 28.6% if there are no contraindication to vaginal delivery and one guideline recommends only if both twins are cephalic.

*Monochorionic monoamniotic twin pregnancy*

For MCMA twin pregnancies there is a lack of agreement in the frequency at which to monitor the fetuses by ultrasound (Table 5). This varies between every 1–2 weeks to every 2–4 weeks, with a maximum of 33.3% of guidelines recommending surveillance every 2 weeks. 38.1% of guidelines did not provide any guidance on this.

**Discussion**

*Summary of key findings*

The purpose of this study was to identify and review national and international clinical guidelines on the management of twin pregnancies, aiming to highlight areas of consensus and conflict.

From the guidelines we identified, advice on managing MC twins was

**Table 3**  
Dichorionic twin guidance.

Aspect of Care	Result
Frequency of Ultrasound in DCDA twins (dichorionic diamniotic)	<ul style="list-style-type: none"> <li>• Every 2 weeks: 11.8%</li> <li>• Every 4 weeks: 59.0%</li> <li>• Every 5 weeks: 6.0%</li> <li>• Every 4–6 weeks: 6.0%</li> <li>• No guidance: 18.0%</li> </ul>
Timing of birth in DCDA twins (dichorionic diamniotic)	<ul style="list-style-type: none"> <li>• 36 weeks: 6.0%</li> <li>• 37 weeks: 6.0%</li> <li>• 37<sup>+0</sup>–38<sup>+0</sup> weeks: 11.8%</li> <li>• 38<sup>+0</sup>–38<sup>+6</sup> weeks: 6.0%</li> <li>• 38–40 weeks: 6.0%</li> <li>• 38<sup>+0</sup> weeks: 11.8%</li> <li>• Before 40 weeks: 6.0%</li> <li>• Not mentioned: 47.1%</li> </ul>
Mode of birth in DCDA twins (dichorionic diamniotic)	<ul style="list-style-type: none"> <li>• Vaginal if leading twin is cephalic: 47.1%</li> <li>• Vaginal if both twins are cephalic: 6.0%</li> <li>• Vaginal delivery considered: 18.0%</li> <li>• Elective caesarean section: 6.0%</li> <li>• Not mentioned: 24.0%</li> </ul>

17 guidelines provided guidance on dichorionic twins, the following figures look at those that provided guidance.

**Table 4**  
MCDA guidance.

Aspect of Care	Result
Frequency of Ultrasound in MCDA twins ( <i>monochorionic diamniotic</i> )	<ul style="list-style-type: none"> <li>• Every 1–2 weeks: 4.8%</li> <li>• Every 2 weeks: 57.1%</li> <li>• Every 2–3 weeks: 19.0%</li> <li>• Every 2–4 weeks: 4.8%</li> <li>• No guidance: 14.3%</li> </ul>
Screening for TTTS ( <i>twin to twin transfusion syndrome</i> )	<ul style="list-style-type: none"> <li>• Recommended by 90.0%</li> <li>• Amniotic fluid volumes: 47.6%</li> <li>• Amniotic fluid volumes &amp; visualise bladders: 38.1%</li> <li>• Not mentioned: 14.3%</li> </ul>
Timing of birth in MCDA twins ( <i>monochorionic diamniotic</i> )	<ul style="list-style-type: none"> <li>• 34<sup>+0</sup> – 37<sup>+6</sup> weeks: 9.5%</li> <li>• 36 weeks: 14.3%</li> <li>• 36<sup>+0</sup> – 37<sup>+0</sup> weeks: 19.0%</li> <li>• By 37 weeks: 9.5%</li> <li>• 36–38<sup>+6</sup> weeks: 4.8%</li> <li>• Not mentioned: 38.1%</li> </ul>
Mode of Birth in MCDA twins ( <i>monochorionic diamniotic</i> )	<ul style="list-style-type: none"> <li>• Vaginal if leading twin is cephalic: 28.6%</li> <li>• Vaginal if both twins are cephalic: 4.8%</li> <li>• Vaginal if not contraindicated: 28.6%</li> <li>• Elective caesarean section: 4.8%</li> <li>• Not mentioned: 33.3%</li> </ul>

**Table 5**  
MCMA guidance.

Aspect of Care	Result
Frequency of Ultrasound in MCMA Twins ( <i>monochorionic monoamniotic</i> )	<ul style="list-style-type: none"> <li>• Every 1–2 weeks: 4.8%</li> <li>• Every 2 weeks: 33.3%</li> <li>• Every 2–3 weeks: 14.3%</li> <li>• Every 2–4 weeks: 4.8%</li> <li>• No guidance: 38.1%</li> </ul>
Timing of Birth in MCMA twins ( <i>monochorionic monoamniotic</i> )	<ul style="list-style-type: none"> <li>• 32<sup>+0</sup> – 33<sup>+0</sup> weeks: 9.5%</li> <li>• 32<sup>+0</sup> – 34<sup>+0</sup> weeks: 38.1%</li> <li>• By 34 weeks: 4.8%</li> <li>• 33–36 weeks: 4.8%</li> <li>• Not mentioned: 38.1%</li> </ul>
Mode of Birth in MCMA twins ( <i>monochorionic monoamniotic</i> )	<ul style="list-style-type: none"> <li>• Caesarean section: 65.0%</li> <li>• Not mentioned: 35.3%</li> </ul>

generally detailed and comprehensive, due to the risks involved in such pregnancies. However, indication and rationale for assessing UAPI and MCA-PSV was conflicting. TTTS, TAPS and other placental insufficiencies are associated with adverse fetal and neonatal outcomes if not detected and treated appropriately [10–13]. Therefore, it would be beneficial if a clear strategy of surveillance is advised, which is not reflected in all guidance. In MC twin pregnancies the threshold for suspecting TTTS or similar placental disorders is generally low given the implications of these conditions, however it should be questioned whether those with less rigorous protocols will miss or delay detection.

The mode of delivery in MCMA twin pregnancy had complete agreement with all guidelines advising caesarean section due to the risk of acute cord entanglement and locked twins [14,15]. However, in MCDA twins there was less consensus and the language used was similar to that in DC twins. Additionally, there was greater emphasis on allowing vaginal delivery if not contraindicated but clarification on which conditions and circumstances were classed as a contraindication was brief if included.

Guidance on intrapartum management of twin pregnancies was sparse, often lacking detail and clarity. This is unfortunate as twin labour and delivery may involve critical decision making. Those guidelines that mention the use of intrapartum ultrasound predominantly suggest a role for confirmation of presentation, particularly after the delivery of the second twin however clarity of information could be better addressed. There was little recommendation about monitoring in twin labour, although the RCOG and FIGO guideline did both advocate the use of a fetal scalp electrode if the presenting twin is cephalic. This is

most apparent in the lack of guidance on induction of labour. Similar to singletons, twin pregnancies are frequently induced for both maternal and fetal indications. However, the guidelines we identified provided little to no information on this, particularly regarding the timing of induction or preferred methods of induction of a twin pregnancy. For an intervention that is common in twin pregnancy, high-quality evidence to support recommendations is needed.

There was paucity in advice on managing a vaginal delivery in twin pregnancy, including stabilisation of the second fetus' position and the optimal inter-twin delivery interval. Lack of defined timings and clear management strategies for the delivery of DC and MCDA twins may lead to a discontinuity of care and variable outcomes for women and their fetuses. This may leave management choices and outcomes dependent on the hospital the woman chooses to book at and the confidence of the obstetric and midwifery team in managing twin pregnancies.

No guidance gave advice on the use or not of cord clamping in twin pregnancy.

#### Clinical and research implications

The areas of conflict in guidance generally reflect the lack of research evidence in many aspects of twin pregnancy. Few guidelines recommended an intervention for preterm birth which may reflect the paucity of evidence for efficacy of interventions to prevent preterm birth and improve perinatal and neonatal outcomes in twin pregnancies. A systematic review and meta-analysis of 23 randomised controlled trials and over 6500 women by Jarde et al compared progesterone, cerclage and pessary for prevention of preterm birth in asymptomatic twin pregnancies. They concluded there was no significant reduction in the risk of preterm birth between 34 and 37 weeks' gestation using any of the interventions compared to the control but found that vaginal progesterone reduced the risk of requiring ventilation and early neonatal death in some cases [16]. A 2021 systematic review and meta-analysis by the EPPPIC Group however evaluated the use of progestones as prevention for pre-term birth and found in twins and higher order pregnancies, there was no benefit [17].

There was conflict in the recommended timing of birth in DC and MCDA twins. This reflects the current lack of evidence in the literature to inform guidance as to the optimum timing of delivery for DCDA and MCDA twins [18–21]. Timing of delivery is individualised in many cases and presents a complex balance between preventing complications of prematurity versus the risk of stillbirth with increasing gestational age [18,22]. Over half of the guidelines mention vaginal delivery as an option in DCDA twins but conditions for recommendation vary. The language used throughout the guidelines gives a sense of hesitation or lack of confidence in the option of vaginal delivery for twins. For a delivery which will often be more complex than a singleton vaginal delivery, recommendations would benefit from being unified, decisive and supportive.

#### Strengths and weaknesses

The guidelines identified were primarily from institutions representing western culture in more economically developed countries. Healthcare systems in these countries have resources and infrastructure to practice evidence-based medicine and deliver high quality care with the latest technologies providing them with a platform to research and develop guidelines that less economically developed countries may not have. A limitation of our study therefore is that we are unable to fully represent and compare all strategies of management of multiple pregnancies used across the globe and throughout different cultures. Our findings were comparable to previous reviews by Tsakiridis [23] and Nicholas [24]. There was complete consensus in first trimester determination of chorionicity and amnionity and near agreement in the timing of fetal anomaly scan and screening for TTTS. Conflict in guidance was seen in cervical length screening, MCA-PSV measurement and

timing of delivery.

We have included all guidelines that we could identify even though some are quite dated. This was a conscious decision as these guidelines remain active and would likely influence practice in those countries. The impact of out of date guidance may be to reduce the quality of the care provided and encourage clinicians to seek guidance elsewhere. Generally, guidance is commonly advised to be updated every 3–5 years and as such questions could be asked as to why this has not been done in some cases.

Previous research is limited by comparing selected guidelines or reviewing one aspect of twin pregnancy management. Our review includes 21 guidelines from sixteen countries and explores both antenatal and intrapartum management of twin pregnancy which previously has not been covered.

## Conclusions

We suggest that national and international guidelines should strive for greater consistency in approach to the management of all twin pregnancies irrespective of chorionicity to aid clinical decision making in both the antenatal and intrapartum management.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Contribution to authorship

KN and AS planned the study. EO, KN and JG performed data collection and processing. EO performed initial data analysis. JG performed further analysis. EO, KN, JG, AK and AS interpreted results. EO wrote the manuscript. All authors contributed to manuscript review.

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Ethics were not required for this study.

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## References

- [1] Office for National Statistics. Birth Characteristics, 2022, [2020 Edition of Dataset: [Available from: <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/livebirths/datasets/birthcharacteristicsinenglandandwales>.
- [2] HFEA. UK statistics for IVF and DI treatment, storage, and donation, 2021, [Available from: <https://www.hfea.gov.uk/about-us/publications/research-and-data/fertility-treatment-2019-trends-and-figures/>.
- [3] Mazhar SB, Peerzada A, Mahmud G. Maternal and perinatal complications in multiple versus singleton pregnancies: a prospective two years study. *J Pak Med Assoc* 2002;52(4):143–7.
- [4] Hack KE, Derks JB, Elias SG, Franx A, Roos EJ, Voerman SK, et al. Increased perinatal mortality and morbidity in monochorionic versus dichorionic twin pregnancies: clinical implications of a large Dutch cohort study. *BJOG* 2008;115(1):58–67.
- [5] Lewi L, Van Schoubroeck D, Gratacos E, Witters I, Timmerman D, Deprest J. Monochorionic diamniotic twins: complications and management options. *Curr Opin Obstet Gynecol* 2003;15(2):177–94.
- [6] Bamberg C, Hecher K. Update on twin-to-twin transfusion syndrome. (1532-1932 (Electronic)).
- [7] Townsend R, D'Antonio F, Sileo FG, Kumbay H, Thilaganathan B, Khalil A. Perinatal outcome of monochorionic twin pregnancy complicated by selective fetal growth restriction according to management: systematic review and meta-analysis. *Ultrasound Obstet Gynecol* 2019;53(1):36–46.
- [8] Brouwers MKM, Browman GP, Burgers JS, Cluzeau F, Feder G, Fervers B, et al. AGREE II: Advancing guideline development, reporting and evaluation in healthcare. *Can Med Assoc J* 2010;2010.
- [9] Amer YS, Titi MA, Godah MW, Wahabi HA, Hneiny L, Abouelkheir MM, et al. International alliance and AGREE-ment of 71 clinical practice guidelines on the management of critical care patients with COVID-19: a living systematic review. *J Clin Epidemiol* 2022;142:333–70.
- [10] Di Mascio D, Khalil A, D'Amico A, Buca D, Benedetti Panici P, Flacco ME, et al. Outcome of twin-twin transfusion syndrome according to Quintero stage of disease: systematic review and meta-analysis. *Ultrasound Obstet Gynecol* 2020;56(6):811–20.
- [11] Duncombe G. Perinatal characteristics and outcomes of pregnancies complicated by twin-twin transfusion syndrome. *Obstet Gynecol* 2003;101(6):1190–6.
- [12] Lopriore E, Oepkes D, Walther FJ. Neonatal morbidity in twin-twin transfusion syndrome. *Early Hum Dev* 2011;87(9):595–9.
- [13] Simpson LL. Twin-twin transfusion syndrome. *Am J Obstet Gynecol* 2013;208(1):3–18.
- [14] Baxi LV, Walsh CA. Monoamniotic twins in contemporary practice: a single-center study of perinatal outcomes. *J Matern Fetal Neonatal Med* 2010;23(6):506–10.
- [15] D'Antonio F, Odibo A, Berghella V, Khalil A, Hack K, Saccone G, et al. Perinatal mortality, timing of delivery and prenatal management of monoamniotic twin pregnancy: systematic review and meta-analysis. *Ultrasound Obstet Gynecol* 2019;53(2):166–74.
- [16] Biggio Jr JR. Progesterone, pessary or cerclage for preterm birth prevention in twins: no answers yet. *BJOG* 2017;124(8):1175.
- [17] Group E. Evaluating Progestogens for Preventing Preterm Birth International Collaborative (EPPPIC): meta-analysis of individual participant data from randomised controlled trials. *Lancet* 2021;397(10280):1183–94.
- [18] Wood S, Tang S, Ross S, Sauve R. Stillbirth in twins, exploring the optimal gestational age for delivery: a retrospective cohort study. *BJOG*. 2014;121(10):1284-90; discussion 91.
- [19] Lee HJ, Kim SH, Chang KH, Sung JH, Choi SJ, Oh SY, et al. Gestational age at delivery and neonatal outcome in uncomplicated twin pregnancies: what is the optimal gestational age for delivery according to chorionicity? *Obstet Gynecol Sci* 2016;59(1):9–16.
- [20] Breathnach FM, McAuliffe FM, Geary M, Daly S, Higgins JR, Dornan J, et al. Optimum timing for planned delivery of uncomplicated monochorionic and dichorionic twin pregnancies. *Obstet Gynecol* 2012;119(1):50–9.
- [21] Bakr AF, Karkour T. What is the optimal gestational age for twin delivery. *BMC Pregnancy Childbirth* 2006;6:3.
- [22] Cheong-See F, Schuit E, Arroyo-Manzano D, Khalil A, Barrett J, Joseph KS, et al. Prospective risk of stillbirth and neonatal complications in twin pregnancies: systematic review and meta-analysis. *BMJ* 2016;i4353.
- [23] Tsakiridis I, Giouleka S, Mamopoulos A, Athanasiadis A, Dagklis T. Management of twin pregnancies: a comparative review of national and international guidelines. *Obstet Gynecol Surv* 2020;75(7):419–30.
- [24] Nicholas L, Fischbein R, Ernst-Milner S, Wani R. Review of international clinical guidelines related to prenatal screening during monochorionic pregnancies. *J Clin Med* 2021;10(5).