International Journal of Nursing Studies 152 (2024) 104693

Contents lists available at ScienceDirect

International Journal of Nursing Studies

journal homepage: www.elsevier.com/locate/ns

Maternal outcomes using delayed pushing versus immediate pushing in the second stage of labour: An umbrella review

Paula Deusa-López [a,b], Ferran Cuenca-Martínez [a], Vanessa Sánchez-Martínez [c,d,*], Núria Sempere-Rubio [a]

[a] Department of Physiotherapy, Faculty of Physiotherapy, Universitat de València, Valencia, Spain
[b] Obstetrics Department, Hospital de Dénia, Alicante, Spain
[c] Department of Nursing, Faculty of Nursing and Chiropody, University of Valencia, Spain
[d] Frailty and Cognitive Impairment Group (FROG), University of Valencia, Spain

ARTICLE INFO

Article history:
Received 27 July 2023
Received in revised form 14 December 2023
Accepted 4 January 2024
Available online xxxx

Keywords:
Delayed pushing
Immediate pushing
Vaginal birth
Second stage of labour

ABSTRACT

Introduction: Different systematic reviews have been developed in the last decades about maternal risks of immediate pushing and delayed pushing, depending on the duration of the second stage of labour, but they do not provide conclusive evidence.
Aim: The main aim of this overview of systematic reviews was to assess the maternal outcomes using delayed pushing and immediate pushing in the second stage of labour in women receiving epidural analgesia.
Methods: We searched systematically in PubMed (Medline), EMBASE, CINAHL, and Scopus (October 26th, 2023). Methodological quality was analysed using AMSTAR and ROBIS scales, and the strength of evidence was established according to the guidelines advisory committee grading criteria. The outcome measures were the duration of the second stage of labour, duration of active pushing, caesarean section, instrumental vaginal birth, spontaneous vaginal birth, fatigue score, perineal lacerations, postpartum haemorrhage, and rate of episiotomy. Seven systematic reviews with and without meta-analysis were included.
Results: Results showed that delayed pushing increases the total time of the second stage of labour, although delayed pushing decreases the duration of active pushing with moderate quality of evidence. Mixed results were found with respect to the variables instrumental vaginal birth, spontaneous vaginal birth, and fatigue score although the results favour delayed pushing or show no statistically significant differences with respect to immediate pushing. No favourable results were ever found for immediate pushing with respect to delayed pushing, with a limited quality of evidence. Even so, delayed pushing seems to be associated with a significant increase in spontaneous vaginal birth rates. The results found no significant differences between the immediate pushing and delayed pushing groups in the caesarean section rates, perineal lacerations, postpartum haemorrhage, and episiotomy ratio, with a limited quality of evidence.
Conclusions: This study shows that delayed pushing during the second stage of labour produces at least the same maternal outcomes as immediate pushing, although we note that delayed pushing produces an increase of the duration of the second stage of labour, a shorter duration of the active pushing and a tendency to increase spontaneous vaginal birth and to reduce the instrumental vaginal birth rates and fatigue scores. This should be considered clinically. This review was registered in the International Prospective Register of Systematic Reviews PROSPERO (CRD42023397616).

What is already known

- Different systematic reviews developed in the last decades about maternal risks of immediate pushing and delayed pushing have not provided conclusive evidence for any specific pushing method in the routine clinical practice of primiparous women receiving epidural analgesia.
- Some reviews support the hypothesis that prolonging the second stage of labour increases maternal morbidity whilst others have not found this negative influence.
- No conclusive evidence supports or refutes any specific pushing method in routine clinical practice.

What this paper adds

In women receiving epidural analgesia:

* Corresponding author at: Department of Nursing, Faculty of Nursing and Chiropody, University of Valencia, Spain.
E-mail address: Vanessa.sanchez@uv.es (V. Sánchez-Martínez).

https://doi.org/10.1016/j.ijnurstu.2024.104693

- Delayed pushing seems to increase the total duration of the second stage of labour and decrease the duration of active pushing.
- Although mixed results were found, there is a trend that delayed pushing could be beneficial to instrumental vaginal birth rates, spontaneous vaginal birth and fatigue score compared to immediate pushing.
- Delayed and immediate pushing showed similar results for caesarean section rates, perineal lacerations, postpartum haemorrhage, and proportion of episiotomies.

1. Introduction

The second stage of labour is a continuous phase which begins with the full dilation of the cervix and ends with birth and it is the physiologically most demanding period of labour for both mother and foetus (Altman and Lydon-Rochelle, 2006; Borruto et al., 2008). During this process, the combination of uterine contractions with the descent of the foetal head prompts the woman in labour the involuntary need to push (Araújo et al., 2022). There are two common approaches for the second stage of labour: immediate pushing and delayed pushing. Immediate pushing means women are asked to begin pushing as soon as the cervix is completely dilated (Hansen, 2002). Delayed pushing involves letting a woman who is fully dilated but does not feel like pushing rest and wait until she feels like pushing before actively starting to do so (Kopas, 2014). In 2018, the World Health Organization (WHO) recommended that women in the second stage of labour should be encouraged and supported to follow their spontaneous urge to push (World Health Organization, 2018a). In line with this, a recent systematic review by Yao et al. (2022), concluded that, in women without epidural analgesia, spontaneous pushing resulted in at least the same maternal and neonatal outcomes, reducing the caesarean rates and the extended episiotomy incidence compared to directed pushing.

The duration of the second stage of labour has been a topic of debate for at least 200 years (Gimovsky and Berghella, 2016), but most nulliparous women complete this phase within 3 h, whilst multiparous women do it in 2 h (Cheng and Caughey, 2017). The duration of the second stage can be reduced by multiparity (Abalos et al., 2018), foetal vertex position or by obstetric interventions, such as the induction of labour with oxytocin (Yu et al., 2022). Contrarily, the duration of the second stage can be increased by the foetal head circumference (Salman et al., 2019) or the use of epidural analgesia (Anim-Somuah et al., 2018; Halliday et al., 2022; Kimmich et al., 2018).

Currently, there are different pharmacological and non-pharmacological approaches to relieve labour pain in pregnant women (Czech et al., 2018). Amongst the pharmacological, epidural analgesia stands out. The use of epidural analgesia varies widely in techniques and prevalence across countries (Callahan et al., 2022; Chau and Tsen, 2022; Halliday et al., 2022). Regarding the prevalence, it is estimated to be used in 10 % to 64 % of parturient women in high-income countries (Seijmonsbergen-Schermers et al., 2020).

The use of epidural analgesia affects the physiology of labour. It implies the administration of local anaesthesia in the epidural space, which produces a concentration-specific effect, affecting all the sensory modalities of the blocked nerves to varying degrees. This is why lower doses of anaesthetic drugs block partially and selectively painful stimuli preserving motor function, whilst higher anaesthetic doses cause complete sensory and motor blockade, limiting the woman's mobility during labour (Anim-Somuah et al., 2018). The concentration-specific motor blockade caused by the administration of epidural analgesia appears to affect the management of pushing efforts by reducing the bearing down reflex and thus increasing the first and the second stages of labour duration (Anim-Somuah et al., 2018). For women using epidural analgesia, the World Health Organization recommendations include delaying pushing between 1 and 2 h after full cervix dilation or until the woman feels the sensory impulse to push (World Health Organization, 2018b). The adherence to these clinical recommendations may justify the second stage to last about an hour longer in these women (Hutchison et al., 2023; Zang et al., 2023; Zipori et al., 2019). The optimum management of the second stage of labour in women with epidural anaesthesia concerning delayed pushing or immediate pushing is controversial (Kopas, 2014).

There are dissents regarding the influence of prolonging the second stage on maternal outcomes. Some studies support the hypothesis that prolonging the second stage increases maternal morbidity, including third and fourth-degree perineal lacerations, urinary retention, postpartum haemorrhage, caesarean sections and chorioamnionitis (Matta et al., 2019; Pergialiotis et al., 2020; Yee et al., 2016). Other studies have not found this negative influence (Blanc-Petitjean et al., 2021; Gitas et al., 2021; Zipori et al., 2019). These disagreements might be due to the heterogeneity in establishing the time frame to define the prolonged second stage.

Regarding pushing in women receiving epidural analgesia, different systematic reviews have been developed in the last decades about maternal risks of immediate pushing and delayed pushing, depending on the duration of the second stage of labour, but they do not provide conclusive evidence. Amongst maternal outcomes, the rates of spontaneous vaginal birth, emergency caesarean sections, operational deliveries, perineal lacerations, postpartum haemorrhage, and episiotomy have been identified as relevant outcome measures. Accordingly, the optimum obstetric management of the second stage of labour remains a challenge, for the needs of finding a balance between optimal maternal and neonatal outcomes and minimization of unnecessary interventions (Cheng et al., 2004). The lack of consensus regarding the optimal moment to begin pushing in nulliparous women receiving neuraxial analgesia highlights the need to group all the evidence from systematic reviews.

Therefore, the main aim of this overview of systematic reviews and evidence map was to assess the available evidence regarding different maternal outcome measures with delayed pushing and immediate pushing in the second stage of labour in women receiving epidural analgesia.

2. Methods

This study was conducted following the Preferred Reporting Items for Overviews of Systematic Reviews, including harm checklist (PRIO-harms), which consists of 27 items (56 sub-items), followed by a 5-stage process flow diagram (identification, screening, eligibility, inclusion, and separation of relevant systematic reviews) (Bougioukas et al., 2018). The review was previously registered in the International Prospective Register of Systematic Reviews PROSPERO (CRD42023397616).

2.1. Search strategy

We conducted the search for published scientific articles between 1950 and October 26th, 2023, in the following databases: PubMed (Medline), EMBASE, Scopus and CINAHL. The search strategy combined Medical Subjects' Headings: “Labour Stage, Second”[MeSH], or “Delivery, Obstetric”[MeSH Terms], and non-MeSH terms (“Delayed Pushing”, “Spontaneous pushing”, or “Immediate Pushing”, amongst others) adding a Boolean operator (AND and/or OR) to combine them. Annex 1 shows the search strategies, which were adapted for each database. The reference lists of the included reviews and their underlying original studies were screened manually, and the authors were contacted for further information if necessary. The searches were conducted by two independent reviewers (NSR and FCM) using the same methodology. Differences that emerged during this phase were resolved by consensus.

2.2. Inclusion and exclusion criteria

The inclusion criteria employed in this article were based on methodological and clinical factors such as population, intervention, control, outcomes and study design (PICOS) (Stone, 2002).

2.3. Population

The participants selected for the articles were healthy pregnant women, in the second stage of labour and undergoing neuraxial analgesia, whether they were nulliparous or multiparous.

2.4. Intervention and control

The exposures for this review were immediate pushing or delayed pushing in the second stage of labour.

2.5. Outcome measures

The only requirement for the variables included in the present study is that each variable had to have been evaluated in at least two systematic reviews. Therefore, the maternal outcomes included were: 1) duration of the second stage of labour; 2) duration of active pushing; 3) caesarean section; 4) instrumental vaginal birth (forceps and vacuum); 5) spontaneous vaginal birth; 6) fatigue score (self-reported); 7) perineal lacerations (second, third or fourth-degree tears); 8) postpartum haemorrhage (defined as a blood loss of ≥500 ml after vaginal birth or ≥1000 ml after caesarean birth); and 9) rate of episiotomy.

2.6. Study design

We selected systematic reviews (with or without a meta-analysis) of randomised controlled clinical trials or controlled clinical trials and excluded systematic reviews that included non-experimental designs. There were no restrictions for any specific language, as recommended by the international criteria (Moher et al., 1998).

2.7. Selection and data extraction

Two independent reviewers conducted a screening (NSR and FCM) assessing the relevance of the systematic reviews regarding the reviews' questions and objectives. The first screening was based on the title information, abstract, and keywords of each review. The full text was reviewed if there was no consensus or if the abstracts contained insufficient information. In the second phase of the screening, the full text was assessed if the review met all the inclusion criteria. Differences between the reviewers were resolved by a discussion and consensus process mediated by a third reviewer (PDL).

2.8. Methodological quality assessment

Two independent reviewers (PDL and VSM) assessed the methodological quality of the systematic reviews, assessing each of the selected reviews based on the Modified Quality Assessment Scale for Systematic Reviews (AMSTAR) developed by Barton et al. (2008), a scale shown to be a valid and reliable tool for assessing the methodological quality of systematic reviews. With a total of 13 items, each worth 2 points (with "yes" scoring 2; "in part" scoring 1; "no" scoring 0), the maximum possible score is 26. A high-quality cutoff of 20 or more points was provided by the developers. The exclusion and keyword criteria were modified to better evaluate the selected systematic reviews of this study. In addition, we calculated the kappa coefficient (κ) and percentage (%) agreement scores to assess reliability prior to any consensus and estimated the inter-rater reliability using κ: 1) $\kappa > 0.7$ indicates a high level of agreement between the reviewers; 2) κ of 0.5 to 0.7 indicates a moderate level of agreement; and 3) $\kappa < 0.5$ indicates a low level of agreement (McHugh, 2012). Disagreements on the final quality assessment score were resolved by consensus with a third independent reviewer (NSR).

2.9. Risk of bias assessment

We assessed the risk of bias with the Risk of bias in systematic reviews tool (ROBIS), which consists of 3 phases: 1) relevance assessment (optional); 2) identification of concerns with the review process through 4 domains related to study eligibility criteria, identification and selection of studies, data collection and study appraisal and synthesis and findings; and 3) judgement on the risk of bias. The ROBIS tool includes signalling questions to evaluate specific domains to help judge the systematic review's risk of bias, which should be answered as "yes", "probably yes", "probably no", "no", or "no information". The risk of bias is therefore judged as "low", high" or "unclear" (Whiting et al., 2016). The two independent reviewers (PDL and VSM) evaluated the risk of bias in the selected reviews. Disagreements were resolved through consensus and mediation by a third reviewer (FCM).

2.10. Grading of evidence

The Physical Activity Guidelines Advisory Committee Grading Criteria (PAGAC) were used to assess the grading of evidence. The criteria used to assess the quality of the evidence were as follows: 1) applicability of the study sample, exposures, and outcomes to the research question; 2) generalisability to the population of interest; 3) risk of bias/study limitations; 4) quantity and consistency of findings across reviews; 5) magnitude and precision of the effect. With these data, final evidence grades and conclusion statements for each research question were developed (Torres et al., 2018). This instrument was used because it allows the evaluation of the grading of evidence when the primary studies are systematic reviews.

2.11. Evidence map

We created a visual map of the scientific evidence for each systematic review (with and without meta-analysis) to visually display the information. The review information is based on 4 dimensions (Miake-Lye et al., 2016).

1. Number of studies (triangle size): The size of each triangle is directly proportional to the number of original studies included in each systematic review.
2. Outcome measures (triangle colour): Each assessed variable was determined by colour: 1) duration of the second stage of labour (blue); 2) duration of active pushing (green); 3) caesarean section (pink); 4) instrumental vaginal birth (gold); 5) spontaneous vaginal birth (purple); 6) fatigue score (black); 7) perineal lacerations (brown); 8) postpartum haemorrhage (red); 9) rate of episiotomy (dark blue).
3. Effect size (x-axis): The authors classified each review according to the effects found. When the delayed pushing showed greater benefits than the immediate pushing, the intervention was classified as "potentially better"; otherwise, the intervention was classified as "potentially worse". When there was insufficient evidence, the intervention was classified as "unclear." If there were no differences, the intervention was included as "no differences." If there were contradictory results, we included the intervention as "mixed results."
4. Strength of findings (y-axis): AMSTAR results.

3. Results

3.1. Study selection

The initial search revealed 67 records, and no additional study was retrieved manually from the references. Through the title and abstract screening and the full-text assessment, 7 systematic reviews were eligible according to our criteria. The study screening strategy is shown in the form of a flow chart (Fig. 1).

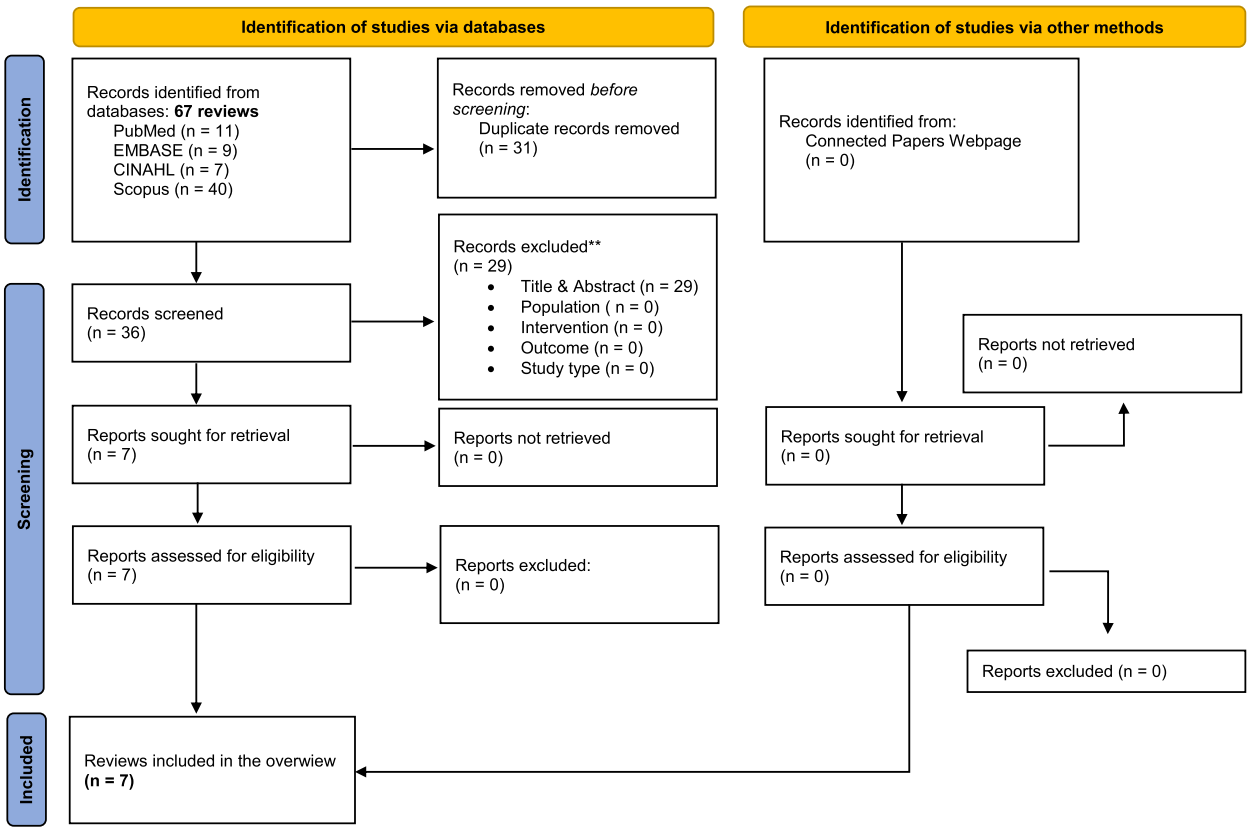

Fig. 1. PRISMA flowchart of studies selection.

3.2. Characteristics of the included systematic reviews

Table 1 reflects the characteristics of the systematic reviews included (study design, original studies included, demographic characteristics, interventions, variables, and results). Five studies (Fitzpatrick et al., 2002; Fraser et al., 2000; Hansen et al., 2002; Plunkett et al., 2003; Vause et al., 1998) were included in all the systematic reviews analysed, involving a sample of 2629 women.

3.3. Methodological quality (AMSTAR)

The scores ranged from 13 to 26 points out of a possible 26, with a mean score of 18.7 ± 4.4 points. Only 3 (43 %) reviews scored above 20 points and were considered high-quality. The remaining 57 % (n = 4) were considered reviews of lower quality (Table 2). The items with the highest scores were those related to "explicitly described to allow replication", and "meta-analysis conducted on only homogeneous data or limitations to homogeneity discussed". The lowest scoring item was "conclusions address levels of evidence for each intervention/comparison". The inter-rater reliability of the methodological quality assessment was high (κ = 0.816).

3.4. Risk of bias

Table 3 and Fig. 2 show the results of the risk of bias assessment using ROBIS. 57.1 % of the reviews had a low risk of bias. The domains related to the "study eligibility criteria" and the "synthesis and findings" had the lowest risk of bias. In contrast, the domain related to the "identification and selection of studies", and "data collection and study appraisal" had the highest risk of bias. The inter-rater reliability for the risk of bias assessment was high (κ = 0.891).

3.5. Grading of evidence results

Table 4 shows the findings regarding the quality of evidence for each outcome of the research question. The quality of evidence found for all outcome measures was limited except for the total duration of the second stage of labour, as well as the duration of the active pushing phase, which showed a moderate quality of evidence. The evidence map is represented in Fig. 3.

3.6. Duration of the second stage of labour

Four systematic reviews assessed the total duration of the second stage of labour (Di Mascio et al., 2020; Lemos et al., 2017; Szu et al., 2021; Tuuli et al., 2012). Szu et al. (2021) found that immediate pushing significantly shortened the duration of the second stage by 40.9 min compared to the delayed pushing group in the overall (n = 10; mean differences (MD) = 40.9; 95 % confidence interval (CI) 23.6 to 58.2; I^2 = 91.4 %). In addition, they compared the total duration of the second stage of labour between immediate pushing and delayed pushing in women from Western countries through analysis by subgroup. The multivariate analysis showed in a similar way that immediate pushing significantly reduced the duration of the second stage of labour compared to the delayed pushing group (n = 8, MD = 52.3; 95 % CI 36.0 to 68.6; I^2 = 90 %). However, Szu et al. (2021) found no significant results regarding women in Eastern countries (n = 2, MD = −0.8; 95 % CI −26.5 to 24.9). Szu et al. (2021) also compared subgroup analyses of immediate pushing to different delayed pushing times. Their main finding was that multivariate analysis did not show significant differences in the duration of the second stage of labour when the delayed pushing was commenced 60 min after full cervical dilation (n = 4, MD = 10.9; 95 % CI −11.8 to 33.6). However, significant differences were found when the delayed pushing delayed time exceeded

Table 1
Characteristics of the reviews included in the overview.

Reviews	Number of RCTs (total sample)	Meta-analysis	Population	Interventions	Outcome measures	Author's conclusions
Szu et al., 2020	15 RCTs (6121)	Yes	Healthy pregnant women	-DP -IP	-Duration of the second stage of labour -Duration of active pushing -CS rates -IB rates -Postpartum haemorrhage -Fatigue score	In the DP group, the duration of the second stage was extended, whilst the duration of pushing was reduced, with decreases in the use of instrumental delivery and fatigue scores. No significant differences were found in outcomes of CS rates or postpartum haemorrhage.
Di Mascio et al., 2020	12 RCTs (5445)	Yes	Healthy pregnant women	-DP -IP	-SVB rates -IB rates -CS rates -Non-SVB -Duration of the second stage of labour -Duration of active pushing -Postpartum haemorrhage -Rate of episiotomy and severe perineal lacerations	No significant differences were found between the IP and DP groups for either SVB, CS or Non-SVB. No differences were found when considering only CS performed in the second stage. In the DP group, the duration of the second stage was extended, whilst the duration of pushing was reduced. No difference between IP and DP groups was found in the rate of postpartum haemorrhage, episiotomy, and severe perineal lacerations.
Lemos et al., 2017	20 RCTs (3694)	YES	Healthy pregnant women	-DP -IP	-Duration of the second stage -Duration of pushing -Perineal laceration (3rd or 4th degree) -Episiotomy -Postpartum haemorrhage -SVB -IB -CS -Fatigue after delivery	There was an increase in second stage duration of 56.40 min with the use of deferred pushing during labour. DP was associated with a reduction in the duration of pushing. There was no clear difference in the risk of perineal laceration (third and fourth degree) and episiotomy between IP or DP groups. A slight increase in spontaneous vaginal delivery was found in the DP group. No differences were found between both groups for ID, CS and maternal fatigue.
Tuuli et al., 2012	12 RCTs (3115)	Yes	Healthy pregnant women	-DP -IP	-SVB rates -IB rates -CS rates -Duration of the second stage -Duration of the active pushing -Maternal and neonatal outcomes	DP was not associated with a significant increase in spontaneous vaginal delivery. In the DP group the duration of the second stage was prolonged, whereas the duration of IP was shortened. No significant differences were found in outcomes of CS rates or instrumental delivery. Effects on maternal and neonatal outcomes remain uncertain.
Brancato et al., 2008	7 RCTs (2827)	YES	Healthy pregnant women	-DP -IP	-IB (forceps and vacuum) -SVB rates -CS rates -Episiotomies and lacerations -Maternal fatigue	DP increases a woman's chance of having a spontaneous vaginal birth, decreases risk of having an ID, and decreases pushing time. No differences were found in rates of caesarean births or episiotomies. IP resulted in longer time spent pushing
Menez-Orieux et al., 2005	8 RCTs (4732)	YES	Healthy pregnant women	-DP -IP	-Mode of delivery -Duration of second Stage -Maternal complications	The IP group showed a slightly higher relative risk for IB and CS. No significant data were found for postpartum haemorrhage and maternal fatigue.
Roberts et al., 2004	9 RCTs (3000)	YES	Healthy pregnant women	-DP -IP	-IB rates -CS rates -Duration of second Stage -Duration of pushing -Episiotomy, perineal laceration. -Postpartum haemorrhage -Satisfaction with labour care -Longer term outcomes including urinary or faecal incontinence and sexual problems	In the DP group there was a trend towards reductions in overall instrumental delivery and second-stage caesarean sections. However, the benefits come at the expense of an increase in the duration of the second stage of labour, attributable to an increase in passive phase. Regarding dyspareunia and urinary and faecal incontinence with DP use the data are insufficient to draw conclusions. No increased risk of postpartum haemorrhage was found in the DP group. Nulliparous women with DP were less likely to be fatigued than those in the IP group, but there was no difference in fatigue for multiparous women.

Notes: RCTs, randomised controlled trials; DP, delayed pushing; IP, immediate pushing; CS, caesarean section; SVB, spontaneous vaginal birth; IB, instrumental birth.

Table 2
Quality assessment scores (AMSTAR).

Review	1	2	3	4	5	6	7	8	9	10	11	12	13	Score
Szu et al., 2021	2	1	1	2	1	2	2	2	2	2	2	1	0	20
Di Mascio et al., 2020	2	2	1	1	2	2	2	2	2	2	2	2	2	24
Lemos et al., 2017	2	2	2	2	2	2	2	2	2	2	2	2	2	26
Tuuli et al., 2012	2	0	0	2	2	1	1	2	1	2	2	1	1	17
Brancato et al., 2008	1	1	2	2	0	1	0	0	0	2	2	2	1	14
Menez-Orieux et al., 2005	2	1	2	0	1	1	1	2	0	2	0	1	0	13
Roberts et al., 2004	2	2	1	1	2	1	1	2	0	1	2	1	0	16

Notes: 1. Explicitly described to allow replication; 2. Adequate number and range of databases; 3. Alternative searches; 4. Adequate range of key words; 5. Non-English-language papers included in the search; 6. Inclusion criteria explicitly described to allow replication; 7. Excludes reviews which do not adequately address inclusion and exclusion criteria; 8. Two independent reviewers assessing selection bias; 9. Quality assessment explicitly described to allow replication; 10. Meta-analysis conducted on only homogeneous data or limitations to homogeneity discussed; 11. Confidence intervals/effect sizes reported where possible; 12. Conclusions supported by the meta-analysis or other data analysis findings; 13. Conclusions address levels of evidence for each intervention/comparison.

1 h. Tuuli et al. (2012) found that delayed pushing was associated with increased duration of the second stage of labour by an average of nearly 1 h (n = 12, risk ratio (RR) = 56.92; 95 % CI 42.19 to 61.64; I^2 = 0 %). Di Mascio et al. (2020) found that delayed pushing was associated with increased duration of the second stage pushing (n = 8, MD = 46.17; 95 % CI 32.63 to 59.71; I^2 = 93 %). Finally, Lemos et al. (2017) found an increase in the second stage duration of 54.29 min with the use of delayed pushing during labour (n = 11, MD = 56.4; 95 % CI 42.05 to 70.76; I^2 = 91 %). In addition, Lemos et al. (2017) conducted a subgroup analysis by parity. They found a greater increase in time amongst nulliparous women (n = 10, MD = 56.12; 95 % CI 39.29 to 72.96; I^2 = 92 %) compared to multiparous women (n = 1, MD = 38.8; 95 % CI 29.16 to 48.44; I^2 not applicable).

In summary, all the assessed reviews concluded that delayed pushing increased the total time of the second stage of labour (between 40.9 min and 56.9 min). Despite this, an interesting result is that it seems that the duration of the delayed pushing may influence this result as a subgroup analysis found that if the delays lasted less than 1 h (compared to 1, 5, 2 or even 3 h of delay) the differences in the total duration in the second phase of labour seem to be not statistically significant. The certainty of the evidence for this outcome was moderate.

3.7. Duration of active pushing

Five systematic reviews assessed the duration of active pushing (Brancato et al., 2008; Di Mascio et al., 2020; Szu et al., 2021; Tuuli et al., 2012). Overall, Szu et al. (2021) found that delayed pushing significantly shortened the duration of active pushing in the second stage of labour compared to the immediate pushing group (n = 9, MD = −25.4; 95 % CI −37.0 to −13.9 min). The analysis by subgroups showed that delayed pushing significantly reduced the duration of active pushing in the second stage of labour compared to the immediate pushing group in Western countries (MD = 19.0; 95 % CI −35.2 to −2.7 min), as well as in Eastern countries (MD = 42.9; 95 % CI −47.1 to −38.7). Szu et al. (2021) also compared subgroup analyses of immediate pushing and different delayed pushing times delays. The main finding was that MA did not show significant differences in the duration of active pushing when the delayed pushing was delayed for 3 h (MD = −2.0; 95 % CI −30.4 to 26.4). However, results showed that the duration of active pushing was significantly shorter in the delayed pushing group in the 1-, 1.5-, and 2-h delayed groups. Tuuli et al. (2012) found that delayed pushing significantly shortened the duration of active pushing in the second stage of labour compared to the immediate pushing group (n = 12, RR = −21.98; 95 % CI −31.29 to −12.68; I^2 = 0 %). Di Mascio et al. (2020) found that delayed pushing significantly shortened the time of active pushing (n = 7, MD = −27.54; 95 % CI −43.04 to −12.04 min; I^2 = 96 %). Brancato et al. (2008) found that delayed pushing significantly shortened the duration of active pushing in the second stage of labour compared to the immediate pushing group (n = 6, MD = 0.19 h; 95 % CI −0.27 to −0.12). Lemos et al. (2017) concluded that compared to immediate pushing, delayed pushing was associated with a reduction of 19.05 min in the duration of pushing (n = 11, MD = −19.05, 95 % CI −32.27 to −5.83; I^2 = 95 %).

In brief, all the reviews concluded that delayed pushing decreased the duration of active pushing (between 11.4 min and 27.5 min). In addition, several subgroup analyses revealed that the duration of the active pushing phase was shortened in the delayed pushing group if pushing was delayed <3 h. The certainty of the evidence for this outcome was moderate.

3.8. Caesarean section

Six systematic reviews assessed the caesarean section rates (Brancato et al., 2008; Di Mascio et al., 2020; Lemos et al., 2017; Roberts et al., 2004; Szu et al., 2021; Tuuli et al., 2012). All systematic reviews showed similar results where no differences were found in the caesarean section ratio between immediate pushing and delayed pushing groups (Szu et al. (2021): n = 11, RR = 0.88; 95 % CI 0.72 to 1.08; I^2 = 0 %; Tuuli et al. (2012): n = 10, RR = 0.85; 95 % CI 0.63 to 1.14; I^2 = 0 %; Di Mascio et al. (2020): n = 11, RR = 0.89; 95 % CI 0.75 to 1.07; I^2 = 0 %; Lemos et al. (2017): n = 9, RR = 0.83; 95 % CI 0.63 to 1.05; I^2 = 0 %; Brancato et al. (2008): n = 7, RR = 0.80; 95 % CI 0.57 to 1.12; I^2 = 0 %; and Roberts et al. (2004): n = 7, RR = 0.77; 95 % CI 0.55 to 1.08; I^2 = 0 %).

In summary, no significant differences were found between delayed pushing and immediate pushing with regard to caesarean section with a limited quality of evidence.

Table 3
Risk of bias assessment in systematic reviews through ROBIS scale.

Study	Phase 2				Phase 3
	1. Study eligibility criteria	2. Identification and selection of studies	3. Data collection and study appraisal	4. Synthesis and findings	Risk of bias in the review
Szu et al., 2021	☺	☺	☺	☺	☺
Di Mascio et al., 2020	☺	☺	☺	☺	☺
Lemos et al., 2017	☺	☺	☺	☺	☺
Tuuli et al., 2012	☺	☹	?	☺	?
Brancato et al., 2008	☺	?	☹	?	☹
Menez-Orieux et al., 2005	☺	☹	☹	?	☹
Roberts et al., 2004	☺	☺	☺	☺	☺

☺, low risk; ☹, high risk; ?, unclear risk.

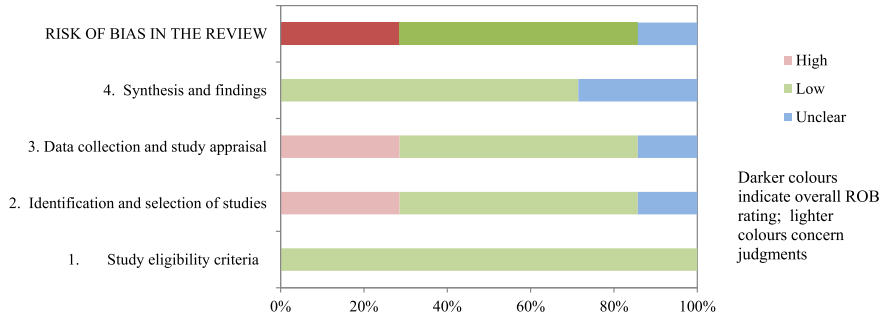

Fig. 2. Graphical representation for ROBIS results.

3.9. Instrumental vaginal birth

Six systematic reviews assessed the instrumental vaginal birth rates (Brancato et al., 2008; Di Mascio et al., 2020; Lemos et al., 2017; Roberts et al., 2004; Szu et al., 2021; Tuuli et al., 2012). Two different results were found for instrumental vaginal birth rates. On the one hand, there were no differences between the immediate and delayed pushing groups. This result was found in the reviews conducted by Tuuli et al. (2012) (n = 12, RR = 0.79; 95 % CI 0.76 to 1.06; I^2 = 0 %), Di Mascio et al. (2020) (n = 11, RR = 0.89; 95 % CI 0.73 to 1.08; I^2 = 47 %), Lemos et al. (2017) (n = 10, RR = 0.89; 95 % CI 0.74 to 1.07; I^2 = 46 %) and Roberts et al. (2004) (n = 9, RR = 0.92; 95 % CI 0.80 to 1.01; I^2 = 38 %). On the other hand, two systematic reviews found that women with delayed pushing had a lower risk of having an instrumental birth compared to women with immediate pushing (Brancato et al., 2008; Szu et al., 2021). In addition, Szu et al. (2021) also compared subgroup analyses of immediate pushing and different delayed pushing times delays. They found that only the 2-h delayed pushing group demonstrated a lower risk of instrumental vaginal birth (n = 4, RR = 0.8; 95 % CI 0.7 to 0.8; I^2 = 0 %).

The results regarding instrumental vaginal birth were mixed or contradictory because not all the reviews conclude in the same way. At least two of the six reviews analysed concluded that delayed pushing was associated with a lower rate of instrumentalisation of vaginal birth, although this result was not found in four of six reviews. The result is therefore contradictory with a limited quality of evidence.

3.10. Spontaneous vaginal birth

Five systematic reviews assessed the spontaneous vaginal birth rates (Brancato et al., 2008; Di Mascio et al., 2020; Lemos et al., 2017; Menez-Orieux et al., 2005; Tuuli et al., 2012). Tuuli et al. (2012) found that delayed pushing was associated with an increased rate of spontaneous vaginal birth compared with immediate pushing (n = 12, RR = 1.09; 95 % CI 1.03 to 1.15; I^2 = 0 %). Similar results were also found by Brancato et al. (2008) (n = 7, RR = 1.08; 95 % CI 1.01 to 1.15), Lemos et al. (2017) (n = 4, RR = 1.07; 95 % CI, 1.03 to 1.11; I^2 = 7 %), and Menez-Orieux et al. (2005) (n = 8, RR = 1.092). Finally, Di Mascio et al. (2020) found no differences between the immediate pushing and delayed pushing groups (n = 12, RR = 1.05; 95 % CI 1.00 to 1.10; I^2 = 31 %).

In brief, higher spontaneous vaginal birth rates seemed to be associated with the delayed pushing group at least four of five reviews assessed with a limited quality of evidence.

3.11. Fatigue score

Two systematic reviews assessed the fatigue score (Lemos et al., 2017; Szu et al., 2021). Fatigue was measured using two visual analogue scales (VAS), each a separate 100-mm vertical line. The first scale was anchored at one end by the words not tired at all and at the other end by extremely tired. The second scale was anchored at one end by the words extremely energetic and no energy at all at the other end. Szu et al. (2021) found that delayed pushing was related to a significantly lower fatigue score than immediate pushing (n = 3, MD = −0.67; 95 % CI −1.09 to −0.26; I^2 = 82 %). However, Lemos et al. (2017) found no significant differences between immediate pushing and delayed pushing groups in one study (n = 1, MD = −6.40; 95 % CI −21.00 to 8.20; I^2 not applicable).

The results regarding fatigue score were also contradictory because there is evidence suggesting that delayed pushing reduces fatigue levels, but also that there are no significant differences with regard to immediate pushing, although this result comes from only one study. The certainty of evidence for this outcome is also limited.

3.12. Perineal lacerations

Three systematic reviews assessed the perineal lacerations variable (Brancato et al., 2008; Lemos et al., 2017; Menez-Orieux et al., 2005). All these systematic reviews found no significant differences between immediate pushing and delayed pushing groups regarding the perineal lacerations rates (Lemos et al. (2017): n = 7, RR = 0.94; 95 % CI 0.78 to 1.14, Brancato et al. (2008): n = 7, RR = 0.88; 95 % CI 0.72 to 1.07, and Menez-Orieux et al. (2005) (n = 6, RR = 0.979).

Table 4
Summary of findings and quality of evidence (PAGAC).

Guidelines Advisory Committee Grading Criteria						Grade
Systematic review research questions	Applicability	Generalisability	Risk of bias or study limitations	Quantity and consistency of finding across studies	Magnitude and precision of effect	
Duration of the second stage of labour	Strong	Limited	Limited	Strong	Not applicable	Moderate
Duration of active pushing	Strong	Limited	Limited	Strong	Not applicable	Moderate
Caesarean section	Strong	Limited	Limited	Limited	Not applicable	Limited
Instrumental vaginal delivery	Strong	Limited	Limited	Limited	Not applicable	Limited
Spontaneous vaginal delivery	Strong	Limited	Limited	Limited	Not applicable	Limited
Fatigue score	Strong	Limited	Limited	Limited	Not applicable	Limited
Perineal lacerations	Strong	Limited	Limited	Limited	Not applicable	Limited
Postpartum haemorrhage	Strong	Limited	Limited	Limited	Not applicable	Limited
Rate of episiotomy	Strong	Limited	Limited	Limited	Not applicable	Limited

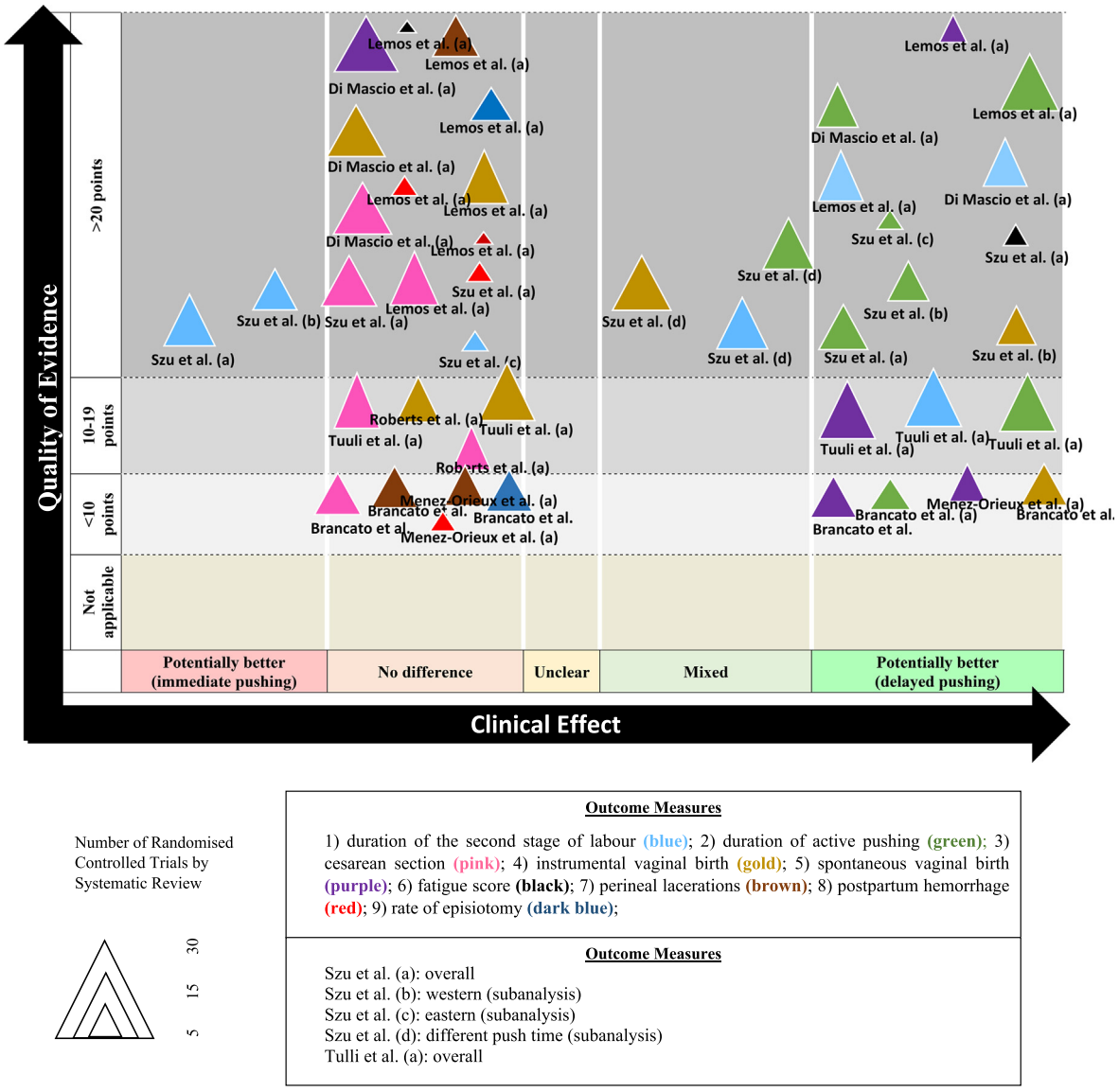

Fig. 3. Evidence map.

In summary, no significant differences were found between delayed pushing and immediate pushing regarding perineal lacerations with a limited quality of evidence.

3.13. Postpartum haemorrhage

A total of three systematic reviews assessed the postpartum haemorrhage variable (Lemos et al., 2017; Menez-Orieux et al., 2005; Szu et al., 2021). All these systematic reviews found no significant differences between immediate pushing and delayed pushing groups (Szu et al. (2021) (n = 3, MD = −44.9 ml; 95 % CI −99.4 to 9.5), Lemos et al. (2017) (n = 3, RR = 1.04; 95 % CI 0.86 to 1.26; I^2 = 0 %), and Menez-Orieux et al. (2005) (n = 3, RR = 1.043)).

In brief, no significant differences were found between delayed pushing and immediate pushing with regard to postpartum haemorrhage with a limited quality of evidence.

3.14. Rate of episiotomy

Two systematic reviews assessed the rate of episiotomy variable (Brancato et al., 2008; Lemos et al., 2017). Both systematic reviews found no significant differences between immediate pushing and delayed pushing groups regarding the rate of episiotomy variable. Lemos et al. (2017) (n = 5, RR = 0.95; 95 % CI 0.87 to 1.04; I^2 = 0 %), and Brancato et al. (2008) (n = 7, RR = 0.97; 95 % CI 0.88 to 1.06).

In summary, no significant differences were found between delayed pushing and immediate pushing with regard to the rate of episiotomy with a limited quality of evidence.

4. Discussion

The main aim of this review was to assess the available evidence regarding different maternal outcome measures with delayed pushing and immediate pushing in the second stage of labour in women receiving epidural analgesia.

The results are robust regarding the total duration of the second stage of labour, as well as the duration of the active pushing (Brancato et al., 2008; Di Mascio et al., 2020; Lemos et al., 2017; Menez-Orieux et al., 2005; Roberts et al., 2004; Szu et al., 2021; Tuuli et al., 2012). All the reviews concluded that delayed pushing increased the total time of the second stage of labour (between 40.9 min and 56.9 min), as well as that delayed pushing decreased the duration of active pushing (between 11.4 min and 27.5 min). In addition, several subgroup analyses revealed remarkable findings: the increase in the total time of the

second stage of labour seemed to occur with statistically significant differences when the delayed pushing group was delayed more than 1 h, and the duration of the active phase was shortened in the delayed pushing group if pushing was delayed <3 h.

Regarding the physiology of labour, Antsaklis et al. (2020) summarised what happens during the second stage of labour. They described that as the foetus begins to descend during a contraction, compression of the rectum and bladder occurs, triggering a reflex that results in a strong urge to push. The combination of involuntary intrauterine contractions and voluntary expulsive efforts mobilise the respiratory, abdominal, and perineal muscles (Antsaklis et al., 2020). As a result, the foetus emerges through the birth canal. Some researchers argue that letting a woman follow her own instincts about how and when to push may prevent perineal tears and thus reduce the possibility of future pelvic or genitourinary dysfunction, as delayed pushing allows for a slower and more controlled descent of the foetus, resulting in a gradual stretching of the perineal muscles (Schaffer et al., 2005). In addition, pushing when there is an irresistible urge causes less pressure to be applied to the anterior vaginal wall and the ligaments supporting the vaginal walls. The delayed pushing efforts that begin in the second stage of labour have low amplitude, do not match each uterine contraction, and vary in intensity. As the foetus continues its descent through the birth canal, the strength of the pushing efforts gradually increases (Thomson, 1995). In fact, the woman begins to push when the uterine contraction reaches a threshold pressure (approximately 30 mmHg) (Aldrich et al., 1995). When this threshold is reached, the woman starts pushing from a resting respiratory volume and usually performs a forced expiration during the effort. In general, when women in the second stage of labour are not asked to make immediate pushing efforts, a two-phase pattern of pushing efforts has been observed (Aderhold and Roberts, 1991). Throughout the first stage, the foetus descends passively, whilst in the second stage, as the foetal head reaches the perineum, contractional pushing efforts increase in terms of frequency and force. This physiological pattern activates Ferguson's reflex, where oxytocin release increases, labour increases naturally and pushing efforts are more efficient and less stressful for the woman (Fitzpatrick et al., 2002).

Interventions in the second stage of labour can potentially disrupt the physiologic process of labour and should be used judiciously (Kopas, 2014). The time frame between 1 and 3 h might represent the optimal time to allow foetal descent to enhance the pushing effectiveness and explain the differences in pushing time between delayed pushing and immediate pushing in women receiving epidural analgesia. Despite the duration of labour might be individualised in women not receiving epidural analgesia, time is relevant in women who use epidural analgesia, as this intervention reduces the bearing down reflex (Anim-Somuah et al., 2018) and this influences the maternal and foetal outcomes of childbirth.

Mixed results were found for maternal fatigue, as Szu et al. (2021) revealed a statistically significant difference between groups, whilst Lemos et al. (2017) did not. None of the six reviews considering the caesarean section rate as an outcome found differences between immediate pushing and delayed pushing groups (Brancato et al., 2008; Di Mascio et al., 2020; Lemos et al., 2017; Roberts et al., 2004; Szu et al., 2021; Tuuli et al., 2012). The postpartum haemorrhage rates were also similar between groups according to the three systematic reviews that considered this outcome measure (Lemos et al., 2017; Menez-Orieux et al., 2005; Szu et al., 2021).

Higher spontaneous vaginal birth rates seemed to be associated with the delayed pushing group (Brancato et al., 2008; Lemos et al., 2017; Menez-Orieux et al., 2005; Tuuli et al., 2012). One of the reviews performed a subgroup analysis and concluded that the optimal delayed pushing time to increase the spontaneous vaginal birth rate was 2 h (Szu et al., 2021). The reviews by Di Mascio et al. (2020) and by Szu et al. (2021) were considered to have a low risk of bias. They included a randomised controlled trial with the most extensive sample, involving 2414 women (Cahill et al., 2018). This randomised controlled trial and one of the reviews (Di Mascio et al., 2020) concluded there were no differences in spontaneous vaginal birth rates between immediate pushing and delayed pushing groups. However, Di Mascio et al.'s conclusions regarding the spontaneous vaginal birth rates were questioned by Simpson and Waring (2021), who, in line with Szu et al. (2020), pointed out that delayed pushing under 2 h could increase the spontaneous vaginal birth probability.

In addition, mixed results were found regarding the instrumental vaginal birth rates. Whilst five out of six systematic reviews did not find differences between immediate pushing and delayed pushing groups (Di Mascio et al., 2020; Lemos et al., 2017; Roberts et al., 2004; Tuuli et al., 2012), the subgroup analyses developed by Szu et al. (2021) revealed that up to 2 h of delayed pushing seemed to decrease instrumental vaginal birth rates. Expectable implications of the differences in the instrumental vaginal birth rates would be reductions in the perineal lacerations and episiotomy rates, not detected by the reviews considering these amongst the outcome measures (Brancato et al., 2008; Lemos et al., 2017; Menez-Orieux et al., 2005).

A reflection regarding medicalisation and humanisation of care is necessary (Clesse et al., 2018). In recent decades and mainly in high-income countries, there has been a substantial increase in the active management of childbirth to initiate, accelerate, terminate, regulate, or monitor the physiologic process, with the aim of improving labour outcomes for women and neonates. Although some outcomes have improved using medicalisation, interfering with the normal process of labour without medical justification is questioned because it may also have adverse effects on the woman and neonate (Romano and Lothian, 2008).

The results of this overview of systematic reviews could be generalisable to women receiving neuraxial analgesia during childbirth, but not to those with physiological and non-interventional childbirth.

4.1. Limitations

Amongst the limitations of this overview of systematic reviews, we detected five randomised controlled trials involving 2629 women that had been included in all the systematic reviews. This high duplicity index limited our possibilities of calculating a regression. Moreover, the heterogeneity in delimiting delayed pushing in time frames stands out. Some studies and reviews considered 1 h after complete dilation, whilst others extended it to 3 h. Another limitation, present not only in this but in most reviews, is that the outcome measures considered by the systematic reviews included do not fully coincide or have been expressed differently. The heterogeneity of techniques to administer neuraxial analgesia, the inclusion of women with and without induced labour and in different gestational ages should also be considered (Kopas, 2014).

4.2. Implications for practice and research

The results of this overview of systematic reviews suggest that delayed pushing is desirable to favour an increase in the spontaneous vaginal birth rates and a decrease in the active pushing time. However, the beginning of the pushing should not be postponed over 2 h because the delayed pushing does not seem to imply benefits anymore after that time. This recommendation aligns with the implications for practice described by Brancato et al. (2008) and Szu et al. (2021). One aspect to take into account is that delayed pushing does increase the duration of second-stage labour, and available reviews excluded women with significant medical complications, logic would likewise recommend immediate pushing in situations when expeditious birth is indicated (Kopas, 2014).

New randomised controlled trials are needed, using extensive and homogeneous samples with comparable administrations of neuraxial analgesia, in which the time frame to start delayed pushing is clearly

established, differentiating women with and without induced labour, and that include amongst their outcome measures all those relevant to facilitate decision-making in clinical practice: total duration of the second phase, duration of the active phase, mode of birth, including instrumentation rates and the modalities used, the risk of non-intact perineum (due to episiotomy or perineal lacerations), postpartum haemorrhage and fatigue. It would also be relevant to consider the medium and long-term effects, including manifestations of pelvic floor damage, incontinence, and dyspareunia.

5. Conclusion

This study shows that delayed pushing during the second stage of labour produces at least the same maternal outcomes as immediate pushing, although we note that delayed pushing produces an increase in the duration of the second stage of labour, a shorter duration of the active pushing and a tendency to increase spontaneous vaginal birth and also to reduce the instrumental vaginal birth rates and fatigue scores. This should be considered clinically.

CRediT authorship contribution statement

Paula Deusa-López: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Methodology, Investigation, Formal analysis, Conceptualization. **Ferran Cuenca-Martínez:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Vanessa Sánchez-Martínez:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Methodology, Investigation, Formal analysis. **Núria Sempere-Rubio:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijnurstu.2024.104693.

References

Abalos, E., Oladapo, O.T., Chamillard, M., Díaz, V., Pasquale, J., Bonet, M., Souza, J.P., Gülmezoglu, A.M., 2018. Duration of spontaneous labour in "low-risk" women with "normal" perinatal outcomes: a systematic review. Eur. J. Obstet. Gynecol. Reprod. Biol. 223, 123–132. https://doi.org/10.1016/j.ejogrb.2018.02.026.

Aderhold, K., Roberts, J., 1991. Phases of second stage labor *1Four descriptive case studies. J. Nurse Midwifery 36 (5), 267–275. https://doi.org/10.1016/0091-2182(91)90041-M.

Aldrich, C.J., D'Antona, D., Spencer, J.A.D., Wyatt, J.S., Peebles, D.M., Delpy, D.T., Reynolds, E. O.R., 1995. The effect of maternal pushing on fetal cerebral oxygenation and blood volume during the second stage of labour. BJOG 102 (6), 448–453. https://doi.org/10.1111/j.1471-0528.1995.tb11316.x.

Altman, M.R., Lydon-Rochelle, M.T., 2006. Prolonged second stage of labor and risk of adverse maternal and perinatal outcomes: a systematic review. Birth (Berkeley, Calif.) 33 (4), 315–322. https://doi.org/10.1111/j.1523-536X.2006.00129.x.

Anim-Somuah, M., Smyth, R.M., Cyna, A.M., Cuthbert, A., 2018. Epidural versus non-epidural or no analgesia for pain management in labour. Cochrane Database Syst. Rev. 5 (5), CD000331. https://doi.org/10.1002/14651858.CD000331.pub4.

Antsaklis, P., Papamichail, M., Theodora, M., Syndos, M., Daskalakis, G., Loutradis, D., 2020. Natural methods to assist delivery during the second stage of labour: part II: timing and type of pushing. Hellenic J. Obstet. Gynecol. 19 (1), 11–26. https://doi.org/10.33574/hjog.1925.

Araújo, A.E., Delgado, A., Maia, J.N., Lima Campos, S., Wanderley Souto Ferreira, C., Lemos, A., 2022. Efficacy of spontaneous pushing with pursed lips breathing compared with directed pushing in maternal and neonatal outcomes. J. Obstet. Gynaecol. 42 (5), 854–860. https://doi.org/10.1080/01443615.2021.1945016.

Barton, C.J., Webster, K.E., Menz, H.B., 2008. Evaluation of the scope and quality of systematic reviews on nonpharmacological conservative treatment for patellofemoral pain syndrome. J. Orthop. Sports Phys. Ther. 38 (9), 529–541. https://doi.org/10.2519/jospt.2008.2861.

Blanc-Petitjean, P., Saumier, S., Meunier, G., Sibiude, J., Mandelbrot, L., 2021. Prolongation of active second stage of labor: associated factors and perinatal outcomes. J. Gynecol. Obstet. Hum. Reprod. 50 (10), 102205. https://doi.org/10.1016/j.jogoh.2021.102205.

Borruto, F., Comparetto, C., Treisser, A., 2008. Prevention of cerebral palsy during labour: role of foetal lactate. Arch. Gynecol. Obstet. 278 (1), 17–22. https://doi.org/10.1007/s00404-007-0531-1.

Bougioukas, K.I., Liakos, A., Tsapas, A., Ntzani, E., Haidich, A.-B., 2018. Preferred reporting items for overviews of systematic reviews including harms checklist: a pilot tool to be used for balanced reporting of benefits and harms. J. Clin. Epidemiol. 93, 9–24. https://doi.org/10.1016/j.jclinepi.2017.10.002.

Brancato, R.M., Church, S., Stone, P.W., 2008. A meta-analysis of passive descent versus immediate pushing in nulliparous women with epidural analgesia in the second stage of labor. J. Obstet. Gynecol. Neonatal Nurs.: JOGNN 37 (1), 4–12. https://doi.org/10.1111/j.1552-6909.2007.00205.x.

Cahill, A.G., Srinivas, S.K., Tita, A.T.N., Caughey, A.B., Richter, H.E., Gregory, W.T., Liu, J., Woolfolk, C., Weinstein, D.L., Mathur, A.M., Macones, G.A., Tuuli, M.G., 2018. Effect of immediate vs delayed pushing on rates of spontaneous vaginal delivery among nulliparous women receiving neuraxial analgesia: a randomized clinical trial. JAMA 320 (14), 14. https://doi.org/10.1001/jama.2018.13986.

Callahan, E.C., Lim, S., George, R.B., 2022. Neuraxial labor analgesia: maintenance techniques. Best Pract. Res. Clin. Anaesthesiol. 36 (1), 17–30. https://doi.org/10.1016/j.bpa.2022.03.001.

Chau, A., Tsen, L., 2022. Neuraxial labor analgesia: initiation techniques. Best Pract. Res. Clin. Anaesthesiol. 36 (1), 3–15. https://doi.org/10.1016/j.bpa.2022.04.004.

Cheng, Y.W., Caughey, A.B., 2017. Defining and managing normal and abnormal second stage of labor. Obstet. Gynecol. Clin. N. Am. 44 (4), 547–566. https://doi.org/10.1016/j.ogc.2017.08.009.

Cheng, Y.W., Hopkins, L.M., Caughey, A.B., 2004. How long is too long: does a prolonged second stage of labor in nulliparous women affect maternal and neonatal outcomes? Am. J. Obstet. Gynecol. 191 (3), 933–938. https://doi.org/10.1016/j.ajog.2004.05.044.

Clesse, C., Lighezzolo-Alnot, J., De Lavergne, S., Hamlin, S., Scheffler, M., 2018. The evolution of birth medicalisation: a systematic review. Midwifery 66, 161–167. https://doi.org/10.1016/j.midw.2018.08.003.

Czech, I., Fuchs, P., Fuchs, A., Lorek, M., Tobolska-Lorek, D., Drosdzol-Cop, A., Sikora, J., 2018. Pharmacological and non-pharmacological methods of labour pain relief-establishment of effectiveness and comparison. Int. J. Environ. Res. Public Health 15 (12), 2792. https://doi.org/10.3390/ijerph15122792.

Di Mascio, D., Saccone, G., Bellussi, F., Al-Kouatly, H.B., Brunelli, R., Benedetti Panici, P., Liberati, M., D'Antonio, F., Berghella, V., 2020. Delayed versus immediate pushing in the second stage of labor in women with neuraxial analgesia: a systematic review and meta-analysis of randomized controlled trials. Am. J. Obstet. Gynecol. 223 (2), 189–203. https://doi.org/10.1016/j.ajog.2020.02.002.

Fitzpatrick, M., Harkin, R., McQuillan, K., O'Brien, C., O'Connell, P.R., O'Herlihy, C., 2002. A randomised clinical trial comparing the effects of delayed versus immediate pushing with epidural analgesia on mode of delivery and faecal continence. BJOG: Int. J. Obstet. Gynaecol. 109 (12), 1359–1365. https://doi.org/10.1046/j.1471-0528.2002.02109.x.

Fraser, W.D., Marcoux, S., Krauss, I., Douglas, J., Goulet, C., Boulvain, M., 2000. Multicenter, randomized, controlled trial of delayed pushing for nulliparous women in the second stage of labor with continuous epidural analgesia. The PEOPLE (Pushing Early or Pushing Late with Epidural) Study Group. Am. J. Obstet. Gynecol. 182 (5), 1165–1172. https://doi.org/10.1067/mob.2000.105197.

Gimovsky, A.C., Berghella, V., 2016. Prolonged second stage: what is the optimal length? Obstet. Gynecol. Surv. 71 (11), 667–674. https://doi.org/10.1097/OGX.0000000000000368.

Gitas, G., Proppe, L., Ertan, A.K., Baum, S., Rody, A., Kocaer, M., Dinas, K., Allahqoli, L., Laganà, A.S., Sotiriadis, A., Sommer, S., Alkatout, I., 2021. Influence of the second stage of labor on maternal and neonatal outcomes in vaginal births after caesarean section: a multicenter study in Germany. BMC Pregnancy Childbirth 21 (1), 356. https://doi.org/10.1186/s12884-021-03817-2.

Halliday, L., Nelson, S.M., Kearns, R.J., 2022. Epidural analgesia in labor: a narrative review. Int. J. Gynaecol. Obstet. 159 (2), 356–364. https://doi.org/10.1002/ijgo.14175.

Hansen, S., 2002. Active pushing versus passive fetal descent in the second stage of labor: a randomized controlled trial. Obstet. Gynecol. 99 (1), 29–34. https://doi.org/10.1016/S0029-7844(01)01642-8.

Hansen, S.L., Clark, S.L., Foster, J.C., 2002. Active pushing versus passive fetal descent in the second stage of labor: a randomized controlled trial. Obstet. Gynecol. 99 (1), 29–34. https://doi.org/10.1016/s0029-7844(01)01642-8.

Hutchison, J., Mahdy, H., Hutchison, J., 2023. Stages of labor. StatPearls. StatPearls Publishing. http://www.ncbi.nlm.nih.gov/books/NBK544290/.

Kimmich, N., Juhasova, J., Haslinger, C., Ochsenbein-Kölble, N., Zimmermann, R., 2018. Impact factors on fetal descent rates in the active phase of labor: a retrospective cohort study. J. Perinat. Med. 46 (6), 579–585. https://doi.org/10.1515/jpm-2017-0075.

Kopas, M.L., 2014. A review of evidence-based practices for management of the second stage of labor. J. Midwifery Womens Health 59 (3), 264–276. https://doi.org/10.1111/jmwh.12199.

Lemos, A., Amorim, M.M., Dornelas de Andrade, A., de Souza, A.I., Cabral Filho, J.E., Correia, J.B., 2017. Pushing/bearing down methods for the second stage of labour. Cochrane Database Syst. Rev. 3 (3), CD009124. https://doi.org/10.1002/14651858.CD009124.pub3.

Matta, P., Turner, J., Flatley, C., Kumar, S., 2019. Prolonged second stage of labour increases maternal morbidity but not neonatal morbidity. Aust. N. Z. J. Obstet. Gynaecol. 59 (4), 555–560. https://doi.org/10.1111/ajo.12935.

McHugh, M.L., 2012. Interrater reliability: the kappa statistic. Biochem. Med. 22 (3), 276–282.

Menez-Orieux, C., Linet, T., Philippe, H.-J., Boog, G., 2005. Delayed versus immediate pushing in the second stage of labor for nulliparous parturients with epidural analgesia: a meta-analysis of randomized trials. J. Gynecol. Obstet. Biol. Reprod. (Paris) 34 (5), 440–447. https://doi.org/10.1016/s0368-2315(05)82851-0.

Miake-Lye, I.M., Hempel, S., Shanman, R., Shekelle, P.G., 2016. What is an evidence map? A systematic review of published evidence maps and their definitions, methods, and products. Syst. Rev. 5, 28. https://doi.org/10.1186/s13643-016-0204-x.

Moher, D., Pham, B., Jones, A., Cook, D.J., Jadad, A.R., Moher, M., Tugwell, P., Klassen, T.P., 1998. Does quality of reports of randomised trials affect estimates of intervention efficacy reported in meta-analyses? Lancet (Lond., Engl.) 352 (9128), 609–613. https://doi.org/10.1016/S0140-6736(98)01085-X.

Pergialiotis, V., Bellos, I., Antsaklis, A., Papapanagiotou, A., Loutradis, D., Daskalakis, G., 2020. Maternal and neonatal outcomes following a prolonged second stage of labor: a meta-analysis of observational studies. Eur. J. Obstet. Gynecol. Reprod. Biol. 252, 62–69. https://doi.org/10.1016/j.ejogrb.2020.06.018.

Plunkett, B.A., Lin, A., Wong, C.A., Grobman, W.A., Peaceman, A.M., 2003. Management of the second stage of labor in nulliparas with continuous epidural analgesia. Obstet. Gynecol. 102 (1), 109–114. https://doi.org/10.1016/s0029-7844(03)00479-4.

Roberts, C.L., Torvaldsen, S., Cameron, C.A., Olive, E., 2004. Delayed versus early pushing in women with epidural analgesia: a systematic review and meta-analysis. BJOG: Int. J. Obstet. Gynaecol. 111 (12), 1333–1340. https://doi.org/10.1111/j.1471-0528.2004.00282.x.

Romano, A.M., Lothian, J.A., 2008. Promoting, protecting, and supporting normal birth: a look at the evidence. J. Obstet. Gynecol. Neonatal. Nurs. 37 (1), 94–105. https://doi.org/10.1111/j.1552-6909.2007.00210.x.

Salman, L., Shmueli, A., Aviram, A., Hiersch, L., Chen, R., Gabbay-Benzib, R., 2019. The association between neonatal head circumference and second stage duration. J. Matern. Fetal Neonatal. Med. 32 (24), 4086–4092. https://doi.org/10.1080/14767058.2018.1481386.

Schaffer, J.I., Bloom, S.L., Casey, B.M., McIntire, D.D., Nihira, M.A., Leveno, K.J., 2005. A randomized trial of the effects of coached vs uncoached maternal pushing during the second stage of labor on postpartum pelvic floor structure and function. Am. J. Obstet. Gynecol. 192 (5), 1692–1696. https://doi.org/10.1016/j.ajog.2004.11.043.

Seijmonsbergen-Schermers, A.E., van den Akker, T., Rydahl, E., Beeckman, K., Bogaerts, A., Binfa, L., Frith, L., Gross, M.M., Misselwitz, B., Hálfdánsdóttir, B., Daly, D., Corcoran, P., Calleja-Agius, J., Calleja, N., Gatt, M., Vika Nilsen, A.B., Declercq, E., Gissler, M., Heino, A., ... de Jonge, A., 2020. Variations in use of childbirth interventions in 13 high-income countries: a multinational cross-sectional study. PLoS Med. 17 (5), e1003103. https://doi.org/10.1371/journal.pmed.1003103.

Simpson, B., Waring, G.J., 2021. Regarding delayed vs immediate pushing in the second stage of labor in women with neuraxial analgesia: a systematic review and meta-analysis of randomized controlled trials. Am. J. Obstet. Gynecol. 225 (4), 468–469. https://doi.org/10.1016/j.ajog.2021.06.072.

Stone, P.W., 2002. Popping the (PICO) question in research and evidence-based practice. Appl. Nurs. Res.: ANR 15 (3), 197–198. https://doi.org/10.1053/apnr.2002.34181.

Szu, L.-T., Chou, P.-Y., Lin, P.-H., Chen, C., Lin, W.-L., Chen, K.-H., 2021. Comparison of maternal and fetal outcomes between delayed and immediate pushing in the second stage of vaginal delivery: systematic review and meta-analysis of randomized controlled trials. Arch. Gynecol. Obstet. 303 (2), 481–499. https://doi.org/10.1007/s00404-020-05814-w.

Thomson, A.M., 1995. Maternal behaviour during spontaneous and directed pushing in the second stage of labour. J. Adv. Nurs. 22 (6), 1027–1034. https://doi.org/10.1111/j.1365-2648.1995.tb03101.x.

Torres, A., Tennant, B., Ribeiro-Lucas, I., Vaux-Bjerke, A., Piercy, K., Bloodgood, B., 2018. Umbrella and systematic review methodology to support the 2018 physical activity guidelines advisory committee. J. Phys. Act. Health 15 (11), 805–810. https://doi.org/10.1123/jpah.2018-0372.

Tuuli, M.G., Frey, H.A., Odibo, A.O., Macones, G.A., Cahill, A.G., 2012. Immediate compared with delayed pushing in the second stage of labor: a systematic review and meta-analysis. Obstet. Gynecol. 120 (3), 660–668. https://doi.org/10.1097/AOG.0b013e3182639fae.

Vause, S., Congdon, H.M., Thornton, J.G., 1998. Immediate and delayed pushing in the second stage of labour for nulliparous women with epidural analgesia: a randomised controlled trial. Br. J. Obstet. Gynaecol. 105 (2), 186–188. https://doi.org/10.1111/j.1471-0528.1998.tb10050.x.

Whiting, P., Savović, J., Higgins, J.P.T., Caldwell, D.M., Reeves, B.C., Shea, B., Davies, P., Kleijnen, J., Churchill, R., ROBIS group, 2016. ROBIS: a new tool to assess risk of bias in systematic reviews was developed. J. Clin. Epidemiol. 69, 225–234. https://doi.org/10.1016/j.jclinepi.2015.06.005.

World Health Organization, 2018a. WHO recommendations: intrapartum care for a positive childbirth experience. World Health Organization https://apps.who.int/iris/handle/10665/260178.

World Health Organization, 2018b. WHO recommendations non-clinical interventions to reduce unnecessary caesarean sections. World Health Organization https://apps.who.int/iris/handle/10665/275377.

Yao, J., Roth, H., Anderson, D., Lu, H., Li, X., Baird, K., 2022. Benefits and risks of spontaneous pushing versus directed pushing during the second stage of labour among women without epidural analgesia: a systematic review and meta-analysis. Int. J. Nurs. Stud. 134, 104324. https://doi.org/10.1016/j.ijnurstu.2022.104324.

Yee, L.M., Sandoval, G., Bailit, J., Reddy, U.M., Wapner, R.J., Varner, M.W., Caritis, S.N., Prasad, M., Tita, A.T.N., Saade, G., Sorokin, Y., Rouse, D.J., Blackwell, S.C., Tolosa, J.E., Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) Maternal-Fetal Medicine Units (MFMU) Network, 2016. Maternal and neonatal outcomes with early compared with delayed pushing among nulliparous women. Obstet. Gynecol. 128 (5), 1039–1047. https://doi.org/10.1097/AOG.0000000000001683.

Yu, J., Chen, L., Wang, X., Li, X., 2022. Efficacy and safety analysis of phloroglucinol in combination with oxytocin for the induction of labor in women with term premature rupture of membranes (PROM). Comput. Math. Methods Med. 2022, 2617075. https://doi.org/10.1155/2022/2617075.

Zang, Y., Hu, Y., Lu, H., 2023. Effects of different techniques during the second stage of labour on reducing perineal laceration: an overview of systematic reviews. J. Clin. Nurs. 32 (7–8), 996–1013. https://doi.org/10.1111/jocn.16276.

Zipori, Y., Grunwald, O., Ginsberg, Y., Beloosesky, R., Weiner, Z., 2019. The impact of extending the second stage of labor to prevent primary cesarean delivery on maternal and neonatal outcomes. Am. J. Obstet. Gynecol. 220 (2), 191.e1–191.e7. https://doi.org/10.1016/j.ajog.2018.10.028.