



Review article

Delayed cord clamping practice at birth: A narrative review of literature

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ABSTRACT

Background: Anaemia in infants is a major public health concern particularly in low and middle-income countries. Delayed cord clamping (DCC) has been advocated as a strategy to decrease iron deficiency anaemia in infants because of the benefits that come with placental transfusion. Despite the documented benefits of delayed cord clamping in preventing anaemia the current practices of delayed cord clamping by midwives and obstetricians across countries and in different contexts is unclear. This narrative review assesses the literature on delayed cord clamping practices published from 2013 to February 2022, in order to examine current practice in birth units globally, and with a focus in low and middle-income countries (LMICs).

Method: A search of four bibliographic databases Medline, Scopus (Elsevier), ProQuest, CINAHL and two network and search engines, Wiley and Google Scholar, was undertaken from 2013 to February 2022 using key terms related to delayed cord clamping and immediate cord clamping. A snowball method as well as backward and forward reference checking was also undertaken.

Results: The search strategy identified 10 studies on umbilical cord clamping practices by midwives and obstetricians. Only two studies were conducted in low and middle-income countries.

Conclusion: Despite the potential benefits of DCC in reducing anaemia, particularly in low and middle-income countries where the burden of anaemia is a public health concern, there is a paucity of literature on current DCC practices by obstetricians and midwives. Research to establish current DCC practices in these countries is needed to address this gap in the literature.

Introduction

Context of the narrative review

The usual practice of umbilical cord clamping has been to immediately clamp and cut the cord at birth so that the baby can be passed to the mother while awaiting the birth of the placenta. Especially in Zambia, where there is a large workload for the available midwives, with the current in-labour midwife-to-woman ratio of 1:10, immediate cord clamping (ICC) has proven to be quicker than delayed cord clamping (DCC) because the midwife has to conclude the delivery as soon as possible and move on to the next woman. However, even in busy working environments, new evidence has emerged that ICC deprives the newborn baby of a small volume of blood transfused from the placenta that may have an important effect on several haematological parameters as well as physiological and adaptive processes. The haematological effect of DCC has been shown to be a cheap and cost-effective way to reduce infant and early childhood iron deficiency anaemia which is a

public health concern in many low and middle-income countries, Zambia inclusive (World Health Organization, 2013a).

WHO has recommended the implementation of DCC for placental transfusion in low and middle-income countries (LMIC) for the reduction of infant anaemia (World Health Organization, 2013a). In Zambia, the Ministry of Health has put DCC on the national agenda. However, its implementation and uptake by midwives and obstetricians have been very slow. Many midwives and nurses have undergone additional training in helping mothers survive and helping babies' breathe, all of which have a focus on DCC (Ersdal et al., 2017). The current study on DCC by this researcher developed after winning the 2015 Sanofi Espoir Foundation midwife for life award, for implementation of DCC in seven midwifery schools across Zambia. I was a first year Masters student at the University of Cape Town at the time of the award. Being a Nurse Midwife Specialist, who is passionate about seeing the change in practice for the improvement of the quality of care, implementation of evidence-based practices in women and newborn care is her personal goal. From my own curiosity, I had observed that many midwives were

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still practicing ICC despite the strong recommendation from World Health Organization to shift the practice to DCC for reduction of iron deficiency anaemia among infants. Therefore, when the call for proposals was announced, I took advantage of the call, which led to my winning the award for implementation of DCC.

I implemented the education sessions in eight institutions which included seven midwifery schools and the University Teaching Hospital in Lusaka in March 2016 (Mwamba, 2015). My target populations for the education sessions, were student midwives, student nurses, practising midwives, practicing nurses, midwife educators, tutors and clinical- instructors. The objective of the education session was to increase the number of midwives with up to date knowledge on placental transfusion. The findings of the education sessions were that majority of participants were knowledgeable enough on the timing of cord clamping. However, they had concerns with the evidence in many of the studies. They attributed there not practising DCC to lack of local evidence to support the relationship of ICC with infant anaemia, the issue of increasing mother to child transmission (MTCT) of Human Immunodeficiency Virus (HIV) and other risks associated with DCC like polycythaemia and jaundice. In the past, during midwifery training in Zambia, we were taught to clamp and cut the cord immediately for prevention of hypothermia and MTCT of HIV because we were implementing Option A and B of prevention of mother to child transmission (PMTCT). Furthermore, as midwives, we have learnt that too much blood in the newborn baby increases haemolysis which contributes to jaundice (Sellers, 2018).

The findings from the education sessions prompted me to undertake further research on the topic hence this literature review, which was to inform the doctoral degree. My initial plan was to conduct a comparative retrospective study, which would have determined the relationship between the timing of cord clamping and the development of infant anaemia at the University Teaching Hospital (UTH) in Zambia. It would have been a before and after the implementation of DCC in which I would have reviewed patient files of patients who were admitted to UTH Children Hospital with a diagnosis of anaemia in the years before the implementation of DCC (2014 and 2015) and the years after DCC (2017 and 2018).

The first step I undertook in trying to answer the concerns that my education session participants had was conducting a narrative literature search whose objective was to gather information on DCC. The education session participants' first concern was on the lack of local evidence to support the relationship of DCC with improved haematological outcomes for reduction of infant anaemia. Many studies have shown that the benefits of DCC outweigh the risks for many newborn outcomes, which include haematological outcomes. Among the identified studies; one was done in Zambia (P. van Rhee, de Moor, Eschbach, de Grooth, & Brabin, 2007; P. F. van Rhee, Gruschke, & Brabin, 2006). This study recommended the practice of DCC for reduction of infant anaemia in comparison with ICC. These researchers have recommended a delay of 30 to 60 s in stable babies, whereas, in most randomized controlled trials, the recommended time be from 30 to 180 s, with optimal transfusion taking place at 180 s (Fogarty et al., 2017; Hutton & Hassan, 2007; Wyllie et al., 2015). Subsequently, there have been current recommendations to shift the timing of cord clamping from "immediate" to "delayed cord clamping of about 60 to 180 s" in mature and premature babies (World Health Organization, 2013a, 2015a). A recent systematic review of DCC has confirmed the participant's concern on Polycythaemia and jaundice systematic review. However, the increase was not associated with morbidity (Fogarty et al., 2017). With regards to HIV, there is no evidence on the risk associated to placental transfusion, especially in this era where most countries in Africa have implemented Option B + prevention of mother to child transmission (PMTCT). In Option B+, all women within the childbearing age are put on lifelong Antiretroviral (ARV) treatment when diagnosed with HIV. Also, all pregnant women undergo screening at first antenatal booking, and lifelong ARV treatment commenced at the diagnosis without any delay

by the attending midwife or obstetrician. Option B + with adherence reduces the risk of mother to child transmission (MTCT) of HIV by reducing the viral load Fasawe (Fasawe et al., 2013). Therefore, our emphasis as Midwives and Obstetricians should be on adherence to treatment for reduction of the viral load as we embrace DCC in practice. However, not much is known for many LMIC, Zambia inclusive, with regards to the current practice of umbilical cord clamping. There has been scanty information on the practice of DCC in LMICs therefore, this narrative review assessed the literature on delayed cord clamping practices published from 2013 to February 2022, in order to examine current practice in birth units globally, and with a focus in low and middle-income countries (LMICs).

Background

For the last several years there has been an increasing focus on the importance of delayed cord clamping at birth for reduction of anaemia (1). Anaemia affects approximately 293 million preschool age children globally, with 68 % of these cases in low and middle-income countries (LMICs). Anaemia in children results in increased morbidity and mortality. The morbidity associated with anaemia is costly because of the prolonged hospital stays and increased mortality associated with the disease [1,2]. Midwives and obstetricians have an important role to play in reducing anaemia in children, by embracing cost effective preventive measures, a primary-one of which is delayed umbilical cord clamping at birth [3].

Umbilical cord clamping is a procedure performed on all babies to separate them from the placenta within the first few minutes after birth [4]. The usual practice of umbilical cord clamping has been 'Immediate Cord Clamping' (ICC) defined as clamping within one minute of birth, which is included in guidelines taught for active management of the third stage of labour in midwifery programs [4]. In recent years, there is mounting evidence that delaying cord clamping for 180 s is associated with reduction of anaemia in infants because of the benefits that come with placental transfusion [3].

Placental transfusion

Placental transfusion is the process by which an extra amount of blood from the placenta flows to the newborn at birth through the intact umbilical vein [5,6]. During pregnancy the placenta connects to the fetus for gaseous exchange, nutrition and excretion [4]. The placenta transports oxygen in the blood from the maternal circulation through the umbilical vein to the fetal circulation, whereas umbilical arteries transport this blood from the fetus to the placenta [7–9]. At birth, the baby is separated from the placenta and it is at this point where placental transfusion has been found to increase Haemoglobin (Hb) levels; higher Hb enhances arterial oxygen content, cardiac output and improves oxygen delivery to the tissues [5,6].

Studies have demonstrated that the placental transfusion that occurs during DCC can increase the iron stores of young infants by over 50 % at six months of age, and reduce by 61 % the rate of anaemia requiring blood transfusion in children [3]. Delayed cord clamping increases the levels of haemoglobin, white blood cells, red blood cells and plasma in the baby, all of which are important for reduction of anaemia [10]. For example, a 3.5 kg newborn will have approximately 290mls of blood volume at birth that is equivalent to 80–85mls per kg body weight [11]. During the physiological process of placental transfusion, approximately 15 to 40mls of blood is transfused into the newborn via the umbilical blood vessel, which results in the addition of about 10 to 50 % of blood volume to the newborn, with a resulting increase in the red cell mass of 25 to 60 % [9,10,12–16]. Researchers have suggested that placental transfusion provides up to 75 mg of iron in the infant's first six months of life, with additional benefits including a reduction in the chances of developing necrotising enterocolitis [17].

A Cochrane Review published in 2014 recommended DCC in healthy

term neonates where access to phototherapy for the treatment of jaundice is available [18]. Cochrane Reviews published in 2012 and 2017 recommended DCC in preterm neonates for reduction in neonates needing a blood transfusion and reduction in morbidity [10,19]. The strong evidence for the benefits of DCC in healthy neonates has informed the development of best practice guidelines for the timing of cord clamping by the World Health Organisation [20]. However, while there are some studies that report cord clamping practices within individual countries [21] an overview of cord clamping practices globally is not currently available. This study addresses the gap by reviewing the published research on delayed cord clamping practices in birth units globally with a focus on LMICs.

Search question

What is known about the current cord clamping practices of midwives and obstetricians globally?

Method

Narrative review of the literature

A narrative review of literature has been chosen to help ascertain what has been published on DCC practices. A narrative review was selected as the most appropriate method to provide a wider choice for synthesis of evidence because there are few studies on the practice of delayed cord clamping globally. A search of four bibliographic databases Scopus (Elsevier), ProQuest (24 databases), EBSCOhost CINAHL and web of science, Wiley was undertaken using the key terms of DCC and ICC and their alternatives (Delayed cord clamping, practice, midwives, obstetricians). The key terms were identified using population, intervention, comparison and outcome (PICO). The search timeframe was up

to 2020 in order to capture studies that were conducted after the 2013, World Health Organisation recommendation of the change in practice from ICC to DCC.

The search identified a total of 2745 studies that were reduced to 2721 after the removal 24 duplicates, and 2708 after the application of exclusion criteria to non-English studies and studies that did not focus on umbilical cord clamping practices by midwives and obstetricians. Studies that focused on umbilical cord blood, cord milking, outcomes of randomised controlled trials on DCC and where the full article could not be accessed were also excluded. A hand search of references (snowball, forward and backward citations) followed, and yielded 247 additional references, which were screened for inclusion. One review was a summary of two studies (already included) [22]. The total articles to be included in this review will be 10.

The quality of the included studies was assessed using the Joanna Briggs Institute (JBI) critical appraisal checklist for analytical cross sectional studies [23]. The PRISMA Flowchart (Fig. 1) provide details of the records identified in each database and how these were screened for eligibility.

The implementation of delayed cord clamping

The aim of the literature review was to review studies undertaken globally, on the implementation of delayed cord clamping published from 2013 to August 2021, in order to examine current practices in birth units globally, and with a focus on low and middle-income countries (LMICs).

Overview of types of studies on umbilical cord clamping practice

There were ten studies identified that met this aim (Table 1). Of the ten studies, eight were cross sectional [24–31] and two were

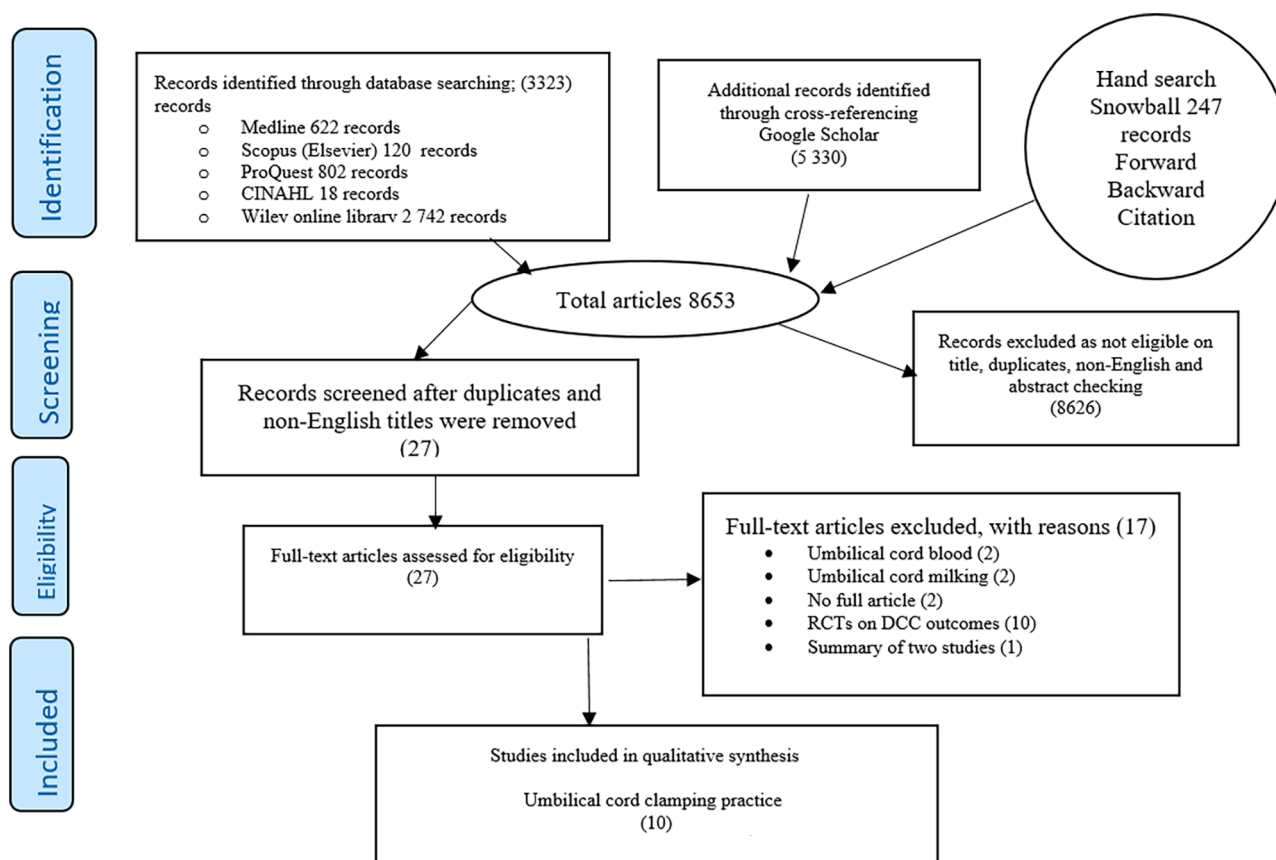


Fig. 1. PRISMA flow diagram of literature reviews and included studies.

Table 1

Current umbilical cord clamping practices included studies.

First author, year	Study design	Aim	Location	Population
Payne 2021	Survey	To assess current practice of timing of cord clamping for both stable and unstable preterm infants in LMICs.	Bahrain Ghana India Kenya Malawi Nigeria Pakistan Rwanda Uganda Zambia	70 (55 Obstetricians, 10 Midwives, 3 Neonatologists, 1 Paediatrician 1 General Doctor)
Leslie 2020	Cross sectional survey	To learn how midwives today manage the umbilical cord at birth.	USA	5306 Midwives
Leslie 2018	Cross sectional survey	Describe current umbilical cord clamping practices by obstetricians	USA	500 Obstetricians
Madhavanprabhakaran 2018	Cross sectional survey	Investigate umbilical cord clamping practices of maternity care providers in Oman	Oman	175 (107 Obstetricians, 68 Midwives)
Nelin 2018	Observational study.	Identify current umbilical cord clamping practices and factors determining the timing of clamping in a low resource setting.	Nepal	138 infants
Ibrahim 2017	Cross sectional survey	Investigate current umbilical cord clamping practices of health professionals in Saudi Arabia	Saudi Arabia	157 (75 Midwives, 82 Obstetricians)
Boere 2015	Cross sectional survey	Investigate if guidelines for UCC were followed and what the national practice entails.	Netherlands	1120 (500 Midwives, 620 Obstetricians)
Afshari 2013	Cross sectional survey	Provide information on policies for management of third stage of labour in Iran.	Iran	129 Maternity units across Iran
Hutton 2013	Observational Study	Investigate actual cord clamping time in Canada.	Canada	100 (13 Midwives, 46 Obstetricians, 41 Family Physicians)
Lundberg 2013	Cross sectional survey	Investigate routines and practices for umbilical cord clamping of neonates.	Norway	Maternity units (52)

observational [32,33].*Aims of included studies*

Nine of the studies investigated umbilical cord clamping practices [24–29,31–34]. One study by Afshari focused on only on umbilical cord clamping policies [26].

Location of included studies

Each of the studies was conducted in a different country including: Canada [33,35]; Iran [26]; Netherlands [31]; Norway [29]; Nepal [32]; Oman [27]; the USA [28]; Saudi Arabia, Bahrain, Ghana, India, Kenya, Malawi, Nigeria, Pakistan, Rwanda, Uganda and Zambia [25].

Population of included studies

The participants in the reviewed studies included obstetricians (n = 1600) in eight of the studies [24,25,27,28,31,33] and midwives (n = 6861) in five of the studies practices [24–29,31–34]. Family physicians, general doctors, neonatologists and paediatricians (n = 120) were included in studies undertaken in Canada by Hutton et al (2013), LMICs by Payne (2021) and two studies conducted in Iran and Norway focused on the staff of maternity units (n = 181) [26,29].

Delayed cord clamping practice in included studies

The practice of delayed cord clamping was reported to be more likely in uncomplicated vaginal term and preterm births [25,27–29,31–33]. Midwives and family physicians were more likely to practise delayed cord clamping than obstetricians [24,25,27,31,33].

Delayed cord clamping timing in included studies

Timing of delayed cord clamping differed in all the studies and ranged from 30 s to the cessation of cord pulsation. In the two studies that were conducted in the USA, timing was set at between 30 s and more than 60 s in one study and at more than 60 s in the other [28,30]. The studies in Nepal, Bahrain, Ghana, India, Kenya, Malawi, Nigeria, Pakistan, Rwanda, Uganda, Zambia and Saudi Arabia had delayed cord clamping timing defined at greater than 60 s [24,25,32]. In studies that were conducted in Iran, Netherlands, Norway, Oman and Canada, timing of delayed cord clamping was defined from 120 s to cessation of umbilical cord pulsation [26,27,31,33].

Availability of cord clamping protocols

The following studies included cord clamping protocols, which were either immediate cord clamping or delayed cord clamping [24–26,28,29,31,32].

Quality of included studies

The quality of the included studies was assessed using the Joanna Briggs Institute (JBI) critical appraisal checklist for analytical cross sectional studies [23]. The JBI checklist has a total of eight quality assessment parameters, which focus on the following: 1) **Criteria for inclusion**, 2) **Description of the study subjects/setting**, 3) **Exposure measurement**, 4) **Objective standard criteria for measurements**, 5) **Identification of confounding factors**, 6) **Strategies to deal with confounding factors**, 7) **Reliability of measured outcomes** and 8) **Appropriateness of the statistical analysis**. Of the eight JBI criteria, the 10 studies included in this review met six of the above highlighted parameters. The remaining two were not applicable as they were addressing confounding which is usually in experimental studies. The

above six parameters evaluated the objective, inclusion, exposure, study setting, results and analysis. All the 10 studies met the six JBI criteria.

Limitations of included studies

The identified limitations were a low response rate [25,28], use of convenience sampling [24,25], small sample size [25,32], old studies and not all maternity units responded to all the questions, which may affect generalisability [33]. One study was conducted between 2006 and 2007, therefore the practice may have changed since this time [33].

Key findings from the included studies

The practice of delayed cord clamping in both term and preterm infants was less than 50 % among most of the clinicians [24,26,27,32,33,36]. However, in two studies conducted in Canada, 66 % of midwives (N = 143) reported practising delayed cord clamping in term infants although their practice in preterm infants was only 38 % of the time. In the latest study undertaken in ten LMICs, delayed cord clamping was reported in 60 % of the 70 participants. In the study conducted in Netherlands, delayed cord clamping was mainly practised with women having uncomplicated births [31]. Midwives and family physicians were more likely to practise delayed cord clamping than obstetricians [33].

Variations in umbilical cord clamping guidelines were identified and only a few maternity units had guidelines [24,25,27,29,33]. Of the nine studies, only three were conducted in LMICs (Iran, Nepal, Bahrain, Ghana, India, Kenya, Malawi, Nigeria, Pakistan, Rwanda, Uganda and Zambia), therefore there is a need for more studies in LMICs to determine their delayed cord clamping practice rates [25,26,32]. The study that was conducted in Zambia had a very small sample of two midwives and three obstetricians, therefore there is need for more studies in Zambia.

Discussion

Following the establishment of the evidence of benefits of delayed cord clamping in many randomised controlled trials, there has been a strong recommendation by the World Health Organization for a shift in practice [1]. The recommended shift is from immediate cord clamping to delayed cord clamping especially in low and middle-income countries, where the burden of anaemia is very high [10,37–39]. However, uptake of the practice has been slow in many countries because of the barriers that come with the implementation of a new practice and associated risks of delayed cord clamping like polycythaemia and jaundice [10,37–40]. Polycythaemia and jaundice develop because of increased haemolysis from the higher haemoglobin (above 18mmols/dl) levels at birth, which exerts too much pressure on the liver [41]. This is a physiological process, which may occur with or without the practice of delayed cord clamping at birth because of the initiation of adult circulation [41]. This means that the above risks are physiological and may not require treatment, therefore it can be deduced that the benefits of delayed cord clamping outweigh the risks [10,19,39]. Therefore, the WHO calls for midwives and obstetricians to embrace delayed cord clamping as a cost-effective measure to reduce the lifetime risk of anaemia.

Despite the evidence many midwives and obstetricians persist with immediate cord clamping [24–26,31–33,35]. This could be attributed to the absence of protocols on delayed cord clamping and previous training, which emphasised immediate clamping and cutting of the umbilical cord [4,40]. Delayed cord clamping was more often used by midwives than obstetricians, because its use was more likely to occur during uncomplicated vaginal births, which were usually managed by midwives in all nine studies. Although a majority of participants in the studies included in this review indicated some knowledge of delayed cord clamping, their knowledge did not translate into daily practice as

most of them were still practising immediate cord clamping, which could be attributed to lack of protocols on delayed cord clamping in many facilities [40]. The difference between practice and knowledge levels of these practitioners may be attributed to the fact that knowledge alone does not equate to actual practice, as people may be knowledgeable enough but may not be putting their acquired information into practice [24,33,42]. The studies have also indicated the importance of guidelines on the implementation of delayed cord clamping, because guidelines may influence change [24,28,32,33]. Only three studies were conducted in LMICs where the burden of anaemia is a major public health concern.

Strengths and limitation of the review

The strength of the review was that four (three Supervisors and the Doctoral Candidate) people looked at the eligible articles on current umbilical cord clamping practices, whose differences about whether to include articles were resolved collectively as a team through a discussion. The limitation was that, for systematic reviews, three people examined the included reviews whereas only one reviewer looked at the excluded studies; she may have excluded some articles that should have been included.

Conclusion

There is a gap in the literature on what is known about current umbilical cord clamping practices especially in LMICs. In order to improve practice and adherence to guidelines, it is essential to understand what current practices are. Despite the potential benefits of delayed cord clamping in reducing anaemia, particularly in low and middle-income countries where the burden of anaemia is a public health concern, there is a paucity of literature on current delayed cord clamping practices by obstetricians and midwives. Research to establish current delayed cord clamping practices in these countries is needed to address this gap in the literature.

Implication for midwifery and obstetric practice

More studies are needed to ascertain umbilical cord clamping practice rate in low and middle income countries where iron deficiency anaemia is a major public health concern.

Key points

Information about delayed cord clamping seem to have spread across the reviewed countries.

Delayed cord clamping is likely to be practiced in uncomplicated births and most likely by midwives in comparison to obstetricians.

Delayed cord clamping guidelines have been recommended as enablers in the implementation of delayed cord clamping.

Variations in the timing of delayed cord clamping have been noted.

There is scanty information on the practice of delayed cord clamping in low and middle income countries.

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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