Best Practice & Research Clinical Obstetrics and Gynaecology 67 (2020) 33–43

Contents lists available at ScienceDirect

Best Practice & Research Clinical Obstetrics and Gynaecology

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

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Use of the partograph - Current thinking

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Keywords:
Partograph
Partogram
Labour
Monitoring
Progress

A B S T R A C T

The partograph (sometimes called partogram) is a labour monitoring tool that is used in countries worldwide to enable early detection of complications, so that referral, action or closer observations can ensue. While the partograph has received global support, from health professionals, there are concerns that it has not reached its full potential in improving clinical outcomes. This has resulted in several variations of the tool and a plethora of studies aimed at exploring the barriers and facilitators to its use. In this chapter, we will discuss the history of the partograph, outlining how it has evolved over time. We will also suggest reasons why the tool may not be meeting the needs of all practitioners. In particular, we will explore partograph use as a complex intervention, suggesting that its success is likely to be dependent on multiple contextual factors.

Partograph history

The partograph/partogram allows a graphic overview of labour which aims to assess labour progression in order to enhance management of labour. The tool is accessible, and most often used in a pre-printed paper version, which makes it possible for the majority of birth attendants to use, regardless of access to sophisticated equipment like electronic monitoring programmes. Most partographs, in either paper or electronic format, include observations on both the mother's and the foetus' condition in addition to observations on labour progression presented by cervical dilatation and effacement, decent of the presenting part and characteristics of the contractions. Labour observations

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https://doi.org/10.1016/j.bpobgyn.2020.03.010
1521-6934/

according to the pre-defined expected progression, underlie the diagnosis of prolonged labour or labour dystocia [1].

The term 'partograph' is used equivalent to the term 'partogram' and both designations are to be found in the literature. In this chapter, the World Health Organisation (WHO) accepted term 'partograph' will be used.

The Friedman curve [2], which represents the basis for presenting labour progression graphically, was 'born' June 11, 1952 [3]. Not being allowed permission from his work to attend the birth of his first child at a nearby hospital, Dr Emanuel Friedman was stuck, on call, at Columbia Medical Centre. Being aware of the missing information about labour progress and frustrated as he was of being denied permission, he recorded the cervical dilatation in serial examinations in graphic form, for all women in the ward, throughout the night and found that progressive cervical dilatation formed a striking sigmoid curve. The results of his examinations that night formed the idea of dividing labour into the latent phase (with slow progress of cervical dilatation early in labour) and the active phase (with a more rapidly change in cervical dilatation as labour advanced) [2].

In 1954, Friedman presented a graphic analysis of labour including the first 100 women in a series of cases studied [2]. The cervical dilatation, mostly based on rectal examinations, were recorded in centimetres per hour throughout labour for the participants who were all primigravida at term, admitted to the hospital early in labour [2]. The results of the examinations formed a curve that became known as the cervicograph, and also called 'the Friedman Curve'. In 1955, Friedman published a second paper on labour progression including 500 women. He made an attempt to define the limits of normal primiparous labours by establishing a mean labour curve on the basis of statistical deviations from the mean cervical dilatation time curve [4]. According to the pattern of the cervicograph, Friedman divided labour in four phases of cervical dilatation; the first phase, called the latent phase, is characterised by softening and effacement of the cervix with slow dilatation in a linear fashion until approximately 2.5 cm of dilatation is reached (Fig. 1). The second phase is denoted as the acceleration period or acceleration phase and is marked by a rapid change in the slope of the curve with continual increasing dilatation. The third phase is called the phase of maximum slope and begins when the maximum slope is reached, the cervix dilates rapidly in a linear fashion. The fourth phase, also called the deceleration phase, begins when the cervix is fully dilated and is characterised by a change in slope like phase two, and the progress again slows [2,4].

Based on the cervicograph, derived from Friedman's work, Philpott developed a partograph. The partograph intended to increase the efficiency of midwives in an African labour clinic as there was lack

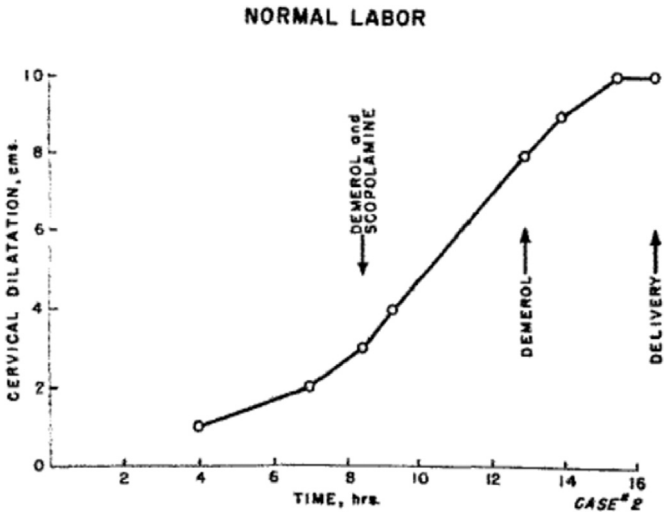

Fig. 1. Normal labor curve (Friedman 1954).

of access of medical doctors. The aim of the use of the partograph was to identify abnormal progress of labour. Apart from the monitoring of cervical dilatation, the partograph included observations of necessary intrapartum details [5].

After a prospective study of 624 Zimbabwean (then Rhodesia) primigravidae, an alert line to detect abnormal labour was added to the partograph [6]. The alert line expecting a cervical dilatation of 1 cm per hour is a modification of the mean rate of cervical dilatation in the slowest 10% of the included women in Philpot's study. The main aim of including an alert line on to the partograph was to identify slow progress of labour and enable transfer of slow progressing women to the hospital where active management could be offered within 4 h of crossing the alert line [6]. The partograph could then work as an early warning screening tool. Even though Philpott intended to apply the alert line directly on Friedman's curve, his findings challenged him in doing so. This was partly because onset of labour was complicated to define and partly because the maximum slope that Friedman described was steeper than found in Philpott's study. The alert line was found to be most useful if applied at a cervical dilatation of at least 3 cm [6].

Parallel, and 4 h to the right of the alert line, a second line called the action line, was drawn on to the partograph [7]. The intention of including this line was to allow active management of labour to avoid unnecessary caesarean sections. Philpott found that almost 11% of the included women in his study [7] crossed the action line, and concluded that identifying women crossing the action line allowed proper management of labour and reduced the risk of caesarean sections, the incidence of prolonged labour and perinatal mortality rate [7].

After introducing the partograph to England, the British gynaecologist, John Studd, made some alterations to the original tool [8]. The alert and action lines were replaced with a nomogram taking into account the women's cervical dilatation on admission. The nomogram is a plastic template with five different values of cervical dilatation and thereby five slopes that can be added as appropriate to the partograph to guide the expected dilatation.

As the Philpott's 4-hour action line was considered to be too long to initiate active management, labour dystocia was diagnosed if progress exceeded 2 h to the right of the nomogram [8].

In 1994, the WHO revised and approved the partograph (Fig. 2) and recommended it to be used in all labour wards [9] as part of the Safe Motherhood Initiative to reduce maternal and foetal mortality. The revision and recommendation were based on results from a multicentre study of the partograph, including more than 35,000 women. The study showed that the use of the partograph in the management of labour reduced the risk of prolonged labours, augmentation, caesarean sections and intrapartum stillbirths [9]. The WHO partograph, with complementary guidelines, is used worldwide today.

The Labour Scale, which is a modified version of the WHO partograph, in that the alert and action lines are replaced by a scale of cervical dilatation, is shown to minimise the diagnosis of labour dystocia without increasing the risk of mother or foetus in a small study [10].

Adaptions of the partograph have been done to cope with challenges in using the partograph also to make it more simple and user-friendly [1], still the revisions were based on Friedman's labour curve from 1953. In 2010, Zhang et al. presented a new labour curve based on a contemporary cohort of more than 27,000 nulliparous women. The Zhang curve differed from the Friedman curve in that labour progressed more slowly, especially before reaching 6 cm of cervical dilatation [11] (Fig. 3). Zhang's guideline for assessing labour progression is dynamic, allowing more time from one integer centimetre to the next early in labour and shorter time intervals as labour advances [11].

Neal et al. [12] found, in accordance with Zhang's findings [11], that labour progresses more slowly early in labour and that the previous expected progression might be too stringent.

In the WHO recommendations, 'Intrapartum care for a positive childbirth experience' [13], the Guideline Development Group (GDG) agreed not to recommend using the 1-cm/hour threshold and alert line to assess labour progress (recommendations 7 and 8). A diagnostic test accuracy of the 1 cm/h threshold based on a systematic review of more than 17,000 women [14], showed that the threshold of 1 cm/h is suboptimal for identifying women with risk of adverse birth outcome (ABO). In addition to a risk of false negative findings, the risk of false positive findings could lead to unnecessary labour interventions that might even be potentially harmful [14].

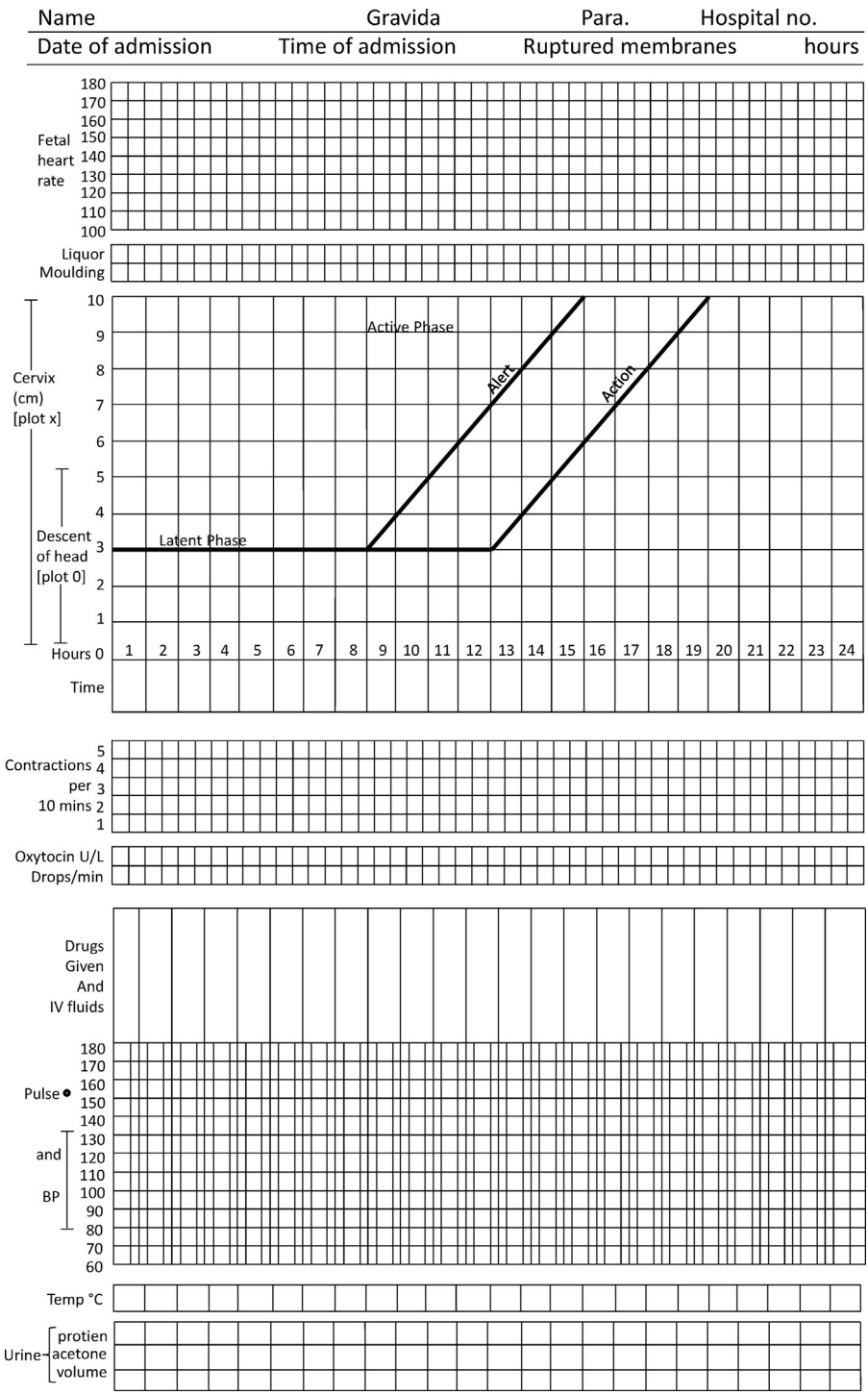

Fig. 2. The WHO partograph (WHO 1994).

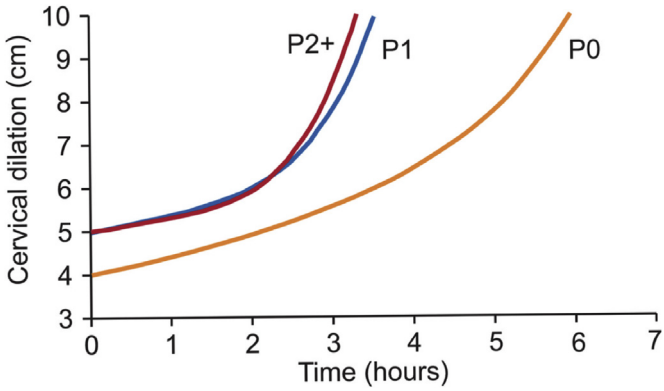

Fig. 3. Average labor curves by parity in singleton term pregnancies with spontaneous onset of labor, vaginal delivery, and normal neonatal outcomes (Zhang 2010).

The GDG identified the development of a labour progression monitoring tool, especially measured by cervical dilatation, as a research priority [13]. The WHO is working on an evidence-based review of the current partograph design including an electronic decision support tool that will include evidence-based clinical algorithms, customised labour curves and models to facilitate the implementation of the 2018 WHO recommendations for intrapartum care [17].

Advantages and disadvantages of partograph use

Even though the partograph was initially developed for use in developing countries and rural settings, the partograph is central to labour care today and is used by obstetricians and midwives worldwide in different settings [15]. The advantages and disadvantages of the partograph are being discussed and investigated, both if it should be used and if so, which is the preferred design [1].

The partograph provides a pictorial presentation of labour and gives a good overview of labour progression. Besides an assessment of the cervical dilatation, it includes observations on effacement, decent of the presenting part and strengths and duration of uterine contractions. Additionally, foetal and maternal conditions are being documented onto the partograph. Foetal observations include the foetal heart rate, position of the baby and presenting part. Maternal observations include baseline information (e.g. age, parity, blood group), vital signs (blood pressure, pulse, temperature), medications (including pain control) and fluid balance. The partograph is accessible for most health care workers in maternity care as it comes in paper and electronic versions [1,15]. Other reported advantages include its usefulness during handover at shift changes to promote continuity of care and as a tool for teaching student midwives about labour progress [16].

To use the partograph as intended, to identify risk and to act or intervene when needed, one is reliant on skilled midwives and obstetricians with knowledge of how to use the tool, and capacity to act in accordance with required interventions [17]. In a review of qualitative evidence, birth attendants in low-resource settings reported inadequate training in using the partograph, which led to lack of confidence in using the tool [18]. Health providers have also reported the retrospective completion of partographs, due to fear of litigation [16]. The partograph is used incorrectly in many settings, but even if used correctly, birth attendants report challenges in initiating proper labour management and necessary interventions due to lack of access to resources [16]. In a high-income setting study, researcher found that 42.6% of low-risk women who were treated with oxytocin for augmenting contractions did not meet the criteria for labour dystocia despite that the partograph was used to identify dystocia [19]. It is worth noting that investigating whether birth attendants adhere to the partograph in use is challenging.

Even if the partograph is used as intended, the standardised labour progression monitoring tool leaves little room for individual assessment and personalised management of labour. There is evidence

that labour progression patterns differ from Friedman's curve today, still the expected 1 cm/h is used as standard expected progression in most settings [17]. The use of the partograph shows no unambiguously positive effect on outcome for the mother nor the foetus, but represent the only alternative for labour progression monitoring to day [17]. One could question if it is possible, or at all meaningful to adhere to a median labour curve for all women, being aware of the complexity of labouring curves, including long labours with positive outcomes.

The lack of resources and knowledge would represent a challenge if care pathways were to be used in labour care, as care pathways also are complex, generate numerous consequences for midwifery practice and represent a standardisation of care [20].

Personalised labour progression monitoring and care could be a possibility in high-resource settings by developing electronic monitoring programmes designed with artificial intelligence (AI) techniques and machine learning in the future [17].

Impact of partograph on outcomes

Despite being used for many years, the evidence that use of a partograph, to support labour management, improves clinical outcomes is limited. The most influential evidence was that obtained from the WHO's prospective non-randomised study in South East Asia [9]; it was following this study that the partograph was considered to have universal application. The study, which introduced the partograph in stages, claimed that use of the partograph for labour management of labour, reduced the number of labours lasting more than 18 h (from 6.4% to 3.4%), the number of women requiring labour augmentations (20.7%–9.1%), emergency caesarean sections (from 9.9% to 8.3%) and intrapartum stillbirths (from 0.5% to 0.3%). Although the study had several strengths, including recruiting over 35,000 women across eight sites, it was criticised for its focus on the partograph as the sole intervention, when in actual fact it was a complex intervention that included training of health professionals, the introduction of a new labour protocol and a WHO consultant in attendance [21]. The WHO study was also limited by its design; as an observational study, it was not incorporated into the Cochrane review [1].

The latest Cochrane review [1], which explored the use of the partograph for labouring women at term, had two objectives; the first was to assess whether partograph use improved outcomes and the second was to assess which partograph design was preferable. The review found 11 studies which met the inclusion criteria; three which compared partograph with no partograph and eight comparing different designs. In the three studies [22–24], comparing partograph with no partograph, there was no evidence to suggest that standard use of the partograph was favourable to no partograph. Similarly, the eight studies [25–32] exploring different partograph designs failed to provide evidence that favoured one over the others. Perhaps the most convincing study was that which compared a partograph with and without a latent phase depicted on the chart [25]. This study demonstrated that caesarean section and oxytocin augmentation rates were higher when the partograph which included a latent phase was used (RR 2.45, 95% CI 1.72–3.50; and RR 2.18, 95% CI 1.67–2.83, respectively), resulting in the removal of the latent phase from WHO partographs.

Findings from the Cochrane review [1] were inconclusive, raising doubts regarding whether the partograph should be used as part of routine care. It also had insufficient evidence to suggest which design is the most effective, if it is to be used. The findings may reflect the methodological limitations of the included studies [1], particularly the narrow focus of the studies; partograph use is a complex intervention and its introduction alone may not result in improved outcomes. It may also suggest that the outcomes reported were insufficient to provide a comprehensive picture of the impact. There was inconsistency in reported outcomes with only caesarean section and Apgar score being reported in all trials. Additionally, trials failed to report on important clinical outcomes, such as serious maternal morbidity, maternal mortality, stillbirths, neonatal deaths and severe neonatal morbidity. Furthermore, none of the studies assessed longer term outcomes, such as obstetric fistula.

A more recent systematic review [33], which included 37 studies; 5 randomised and 32 observational, concluded that the partograph is associated with improved perinatal outcomes and should be used in low-income settings as part of labour surveillance. This review, which included WHO's study

[9], emphasises the importance of the partograph being used as part of a package of supportive care. It also acknowledged the importance of careful implementation.

Nevertheless, the question regarding optimum design of the partograph remains; a question which has received more prominence since Zhang questioned the pattern of labour progression in 2010 [11], but has been supported by others [34]. Zhang suggested that labour takes more than 6 h to progress from 4 to 5 cm and over 3 h to progress from 5 to 6 cm of dilation. Before 6 cm, nulliparous and multiparous progressed similarly, but, after this, labour accelerated much faster in multiparas, suggesting a different partograph may be favourable. A cluster randomised controlled trial [35], conducted in Norway, including 7277 women and 14 clusters compared the modified WHO partograph with Zhang's guidelines and failed to show any differences in the primary outcome, caesarean section rate. Interestingly, it appeared that the focus on labour monitoring during the study resulted in a reduction in caesarean sections in the control (26.5%) and intervention (37.8%) groups when compared with pre-study rates. This reinforces the notion that the partograph is a complex intervention that relies on multiple facets to improve outcomes.

Health provider views

There is a plethora of papers reporting health professional's views on partograph use, from high- and low-income settings. These papers mainly report views from midwives or nurse-midwives, with a few reporting opinions of students, obstetrician, managers, allied health professionals and clinical officers. The majority of published papers are based on studies conducted in low-income settings.

Interestingly, the literature suggests that the partograph is well supported by health professionals, who generally talked positively about the tool [16]. However, despite this, the majority of papers report that it is often used incorrectly or not used at all. In Bedwell et al.'s [16] realist review, she found wide variations in use from 8% to 80%, concluding that viewing the partograph positively does not automatically guarantee an increase of use in practice. Others [36] have suggested that having a positive attitude coupled with in-service partograph training increased its utilisation. In this study, conducted in Ethiopia, the types of health institutions and profession were significantly associated with knowledge of the partograph; midwives being the most knowledgeable**.**

A number of consistent challenges of using the partograph have been reported by health providers. In low-income settings, these include increased workload, lack of knowledge, insufficient training, unavailability of the partograph, lack of guidance or policy and its inability to support women admitted in advanced labour [16,37–39]. Students and midwives have also expressed their view that the partograph is too complicated and they lack clinical mentorship and supervision [38].

In high-income settings, there have been different concerns regarding the partograph removing the autonomy of practitioners and preventing the delivery of individualised care [21].

Women's views of the partograph

Much is said about health worker's view of the partograph, less is known about women's view of using the partograph [16]. When investigating women's experience with birth care according to routine interventions, the use of the partograph is rarely included [40]. In a realist review of the partograph, the authors found no data related to women's satisfaction with labour and birth care in relation to partograph use [16]. It is suggested that both too short and too long labours are associated with low satisfaction [41,42], but this does not necessarily relate to labour progress assessment tools. The Cochrane review of partographs for nulliparous women reports maternal satisfaction in three studies when comparing different partograph designs; findings were similar across the intervention arms. This is perhaps unsurprising as most women are unlikely to have an in-depth knowledge of the partograph and are more likely to report on the impact of partograph-triggered interventions and subsequent outcomes as opposed to the partograph per se.

Most women want a physiological labour and birth without technological or pharmacological interventions and they want to be involved in active decision-making if interventions are necessary. They value safety and psychosocial wellbeing equally [43]. Downe et al. found that women who were able to ‘go with the flow’ rather than being restricted to standardised time limits were more likely to report a

positive childbirth experience [43]. This suggests that, in the absence of complications, greater flexibility in the parameters included on the partograph is warranted.

In the light of improving care and enhancing care models, user involvement is necessary and important, nevertheless not often taken into account when it comes to maternal health, especially in low-resource settings [17]. In high-income countries, focus on the feedback of the care receivers has been emphasised when improving health systems and care [17].

Environmental and contextual challenges

Given the juxtaposition between health providers' verbally supporting the partograph and failing to use it as intended [16], it is important to explore the wider context in which it is used. Given the individuality of each woman and the vast variation in labouring environments, it is unsurprising that the universality of the partograph has been disputed by some [21, 39, 44].

In a realist review (16) which identified 92 studies, 'an enabling environment' was considered pivotal to successful partograph use. This review identified five main domains of an enabling environment: health worker acceptability, health system support, effective referral systems, human resources and health provider competence. This review also found that the partograph was more likely to be used in urban, tertiary facilities and by professionally qualified health providers who had been trained in partograph use. Although not unexpected, it is disappointing that the rural areas, which are most likely to benefit from partograph use, through early detection of abnormalities, struggled with it the most.

The social context has also been offered as an important element which can foster or hinder partograph use [39]. In particular, the culture of the organisation and how it values the partograph can have an impact [45]. Clinical leadership is another influential factor, with negative role models and a theory-practice gap acting as barriers to use [46]; this makes it particularly difficult for students, who may feel unable to provide practice based on what they have been taught.

In appreciation of the training deficits in low-income settings, a number of interventions have been developed aimed at increasing and improving partograph use. These training interventions have been prompted by the inefficiencies of traditional didactic teaching in many educational institutions, which do not support interactive learning and the lack of continual professional development (CPD) for qualified health providers. One training intervention was a CDROM [38], developed by WHO, which enabled students and health professionals to practice partograph plotting, using online case scenarios. This intervention was tested in a before-and-after quasi-experiment, in Kenya; statistically significant improvements were observed in post-test scores.

A further intervention was an educational board game [47], called 'Progression', which was developed with input from LAMRN [48] midwives from six different countries in sub-Saharan Africa. The impact of the game, which can be seen in Fig. 4, was tested in Malawi, Tanzania and Kenya. Findings

Fig. 4. 'Progression', the partograph game.

demonstrated improvements in partograph recordings and interpretations following game playing. This latter point is particularly important as it appears that many health professionals use the partograph for record keeping only, not for decision-making as intended.

Conclusion

Although often described as a 'simple' tool for monitoring labour, the partograph is a complex intervention that requires an enabling environment and effective implementation. Unfortunately, in many cases, neither the environment nor the process of implementation has enabled the partograph to reach its full potential. There remains a debate about whether the partograph should be used routinely for all women as the evidence related to clinical outcomes is inconclusive. However, other benefits of using the partograph during labour and birth have been reported with no published accounts of it doing any harm. The optimum design of the chart has not been established but there is potential for a more 'woman-centred' chart, which incorporates the recommendations and evidence outlined in the Intrapartum Care Guidelines [13] and promotes individualised care. Any new chart needs to be rigorously tested and effectively implemented if it is to reach its full potential. Future research should focus on effective implementation of labour monitoring tools, as the chart on its own is unlikely to have any impact. Training interventions show some promise, however, would need to be part of clear implementation strategies which address locally identified barriers to partograph use.

Declaration of Competing Interest

Both authors have published studies that have been included in this chapter.

Practice points

- As the evidence for existing partographs is inconclusive, in terms of clinical outcomes, facilities should adhere to national or local policies to guide partograph use.
- Health facilities should audit partographs to identify any barriers to use and to determine the most effective plans to overcome them.
- Labour monitoring tools should only be used following introduction of a comprehensive implementation strategy, which includes training of all health care providers and an easily accessible guideline for use.

Research agenda

- To evaluate labour monitoring tools to determine acceptability, usability and effectiveness.
- To assess the most effective implementation strategies for successful introduction of labour monitoring tools.
- To assess the impact of labour monitoring tools on long-term outcomes.
- To explore the impact of labour monitoring tools on women's experiences.

Acknowledgements

The two authors were supported, in time, by their employing institutions; the University of Manchester and Østfold Hospital Trust. We thank Oslo Metropolitan University for funding for reproducing the figures. We also thank the internal reviewers for their valuable feedback on this chapter.

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