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The effectiveness and usability of electronic partograph for obstetric care: A systematic review

La efectividad y la utilidad del partograma electrónico para la atención obstétrica: Una revisión sistemática

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SUMMARY

Introduction: *Partograph is an instrument used to monitor and prevent labor complications. Unfortunately, a large number of situations where there is limited awareness of how to use a partograph as a labor monitoring tool. One of the efforts made is to develop partographs in the form of electronic partograph (e-partograph) applications. This review aims to analyze the effectiveness and usability of electronic partograph for obstetric care.*
Methods: *This study conducted a systematic review of journals using three academic databases (Science Direct, PubMed, and Google Scholar) with a publication range from 2016 to 2022. Furthermore, the subjects in this study were skilled birth attendants (SBAs) and obstetric care providers. Inclusion criteria in the literature study were using electronic-based partographs in monitoring. The journal-reviewed guidelines used Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA).*
Results: *This study found 13 studies exploring the e-partograph in the last six years (2016-2022). Most of the results reviewed the effectiveness of using e-partographs compared to paper partographs. In addition, the e-partograph has shown another advantage. There was a reminder system when filling in data by the SBA. It could identify if the labor process were normal or required further treatment. Using an e-partograph could effectively save time and was easy to use. SBA was easy to accept and apply.*
Conclusion: *The use of e-partograph gives better final results than paper partograph. E-partograph is able to maintain normal delivery and reduce the incidence of cesarean section and prolonged labor. Although the e-partograph was designed to provide benefits for its users, there was an audio and visual reminder system that could be used to detect complications during childbirth.*

Keywords: *Electronic, health care, obstetric, partograph*

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RESUMEN

Introducción: *El partograma es un instrumento utilizado para monitorear y prevenir complicaciones del parto. Desafortunadamente, existe una gran cantidad de situaciones en las que existe una conciencia limitada sobre cómo utilizar un partograma como herramienta de control del trabajo de parto. Uno de los esfuerzos realizados es desarrollar partogramas*

en forma de aplicaciones de partograma electrónico (e-partograph). Esta revisión tiene como objetivo analizar la efectividad y la utilidad del partograma electrónico para la atención obstétrica.
Métodos: *Este estudio realizó una revisión sistemática de revistas utilizando tres bases de datos académicas (Science Direct, PubMed y Google Scholar) con un rango de publicación de 2016 a 2022. Además, los sujetos de este estudio fueron parteras calificadas (SBA) y atención obstétrica. proveedores Los criterios de inclusión en el estudio de la literatura fueron el uso de partogramas electrónicos en la monitorización. Las pautas revisadas por revistas utilizaron Elementos de informes preferidos para revisión sistemática y metanálisis (PRISMA).*
Resultados: *Este estudio encontró 13 estudios que exploran el e-partograph en los últimos seis años (2016-2022). La mayoría de los resultados revisaron la efectividad del uso de partogramas electrónicos en comparación con los partogramas en papel. Además, el e-partograph ha mostrado otra ventaja. Había un sistema de recordatorio al completar los datos por parte de la SBA. Podría identificar si el proceso de parto fue normal o requirió tratamiento adicional. El uso de un e-partograph podría ahorrar tiempo de manera efectiva y fue fácil de usar. SBA fue fácil de aceptar y aplicar.*
Conclusión: *El uso del e-partograma da mejores resultados finales que el partograma en papel. E-partograph es capaz de mantener un parto normal y reducir la incidencia de cesárea y trabajo de parto prolongado. Aunque el e-partograph fue diseñado para brindar beneficios a sus usuarios, había un sistema de recordatorio de audio y visual que podía usarse para detectar complicaciones durante el parto.*

Palabras clave: *Electrónica, atención a la salud, obstétrica, partograma*

INTRODUCTION

Infections, prolonged labor, bleeding, and other complications after childbirth have perished 303 000 women in 2015 (1-4). Moreover, long labor directly results in 6-10 % of maternal and infant mortality and morbidity. One of the efforts to prevent the occurrence of morbidity and mortality in mothers and babies during childbirth is by monitoring labor and handling fast and appropriate actions (1,5-7). Therefore, the World Health Organization (WHO) advocates a partograph to observe during labor (1).

Skilled birth attendants utilize partographs to record significant developments during labor. This partograph sheet was created to gather and record all pertinent data over 12 hours, beginning with the start of contractions and ending with the delivery of the baby. This partograph helps staff members decide when labor is moving normally and when they should be equipped to step in (8-12).

However, the effectiveness of using a partograph in monitoring labor is not optimal currently. This is related to the attitude of health workers who still lack knowledge of paper partographs. Furthermore, to overcome this challenge, many researchers have improved partographs (1,13). One of the efforts is to develop partographs in the form of applications (electronic partographs). An electronic version of the paper-based partograph that automatically plots labor and delivery trends is called an e-partograph. It has alarm systems installed to notify Provider Health Care staff of the upcoming examination schedule in case of danger. In addition, the development of this partograph is based on an android tablet concerning the partograph issued by WHO to make it easier for officers to monitor and document childbirth (3,5). Therefore, the e-partograph improves efficiency in filling patients' information during labor and childbirth, allows Primary health care (PHC) workers to seek and receive real-time professional support, and reduces time to accessing lifesaving care, even after normal work hours.

On the other hand, as new electronic partograph innovations are increasingly being tested and implemented in situations with limited capacity, it is critical to carefully assess what has been accomplished to inform implementers and policymakers on the effectiveness of technology in evidence-based practice.

METHODS

Study Design

This Systematic Review follows the guidelines of the Statement of Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) (14). In addition, the data has completed a review on the journal using three academic databases, including PubMed, Science Direct, and Google Scholar.

Inclusion and Exclusion Criteria

The inclusion criteria for this systematic review have been determined using population, intervention, comparison, outcomes, and study design (PICOS). Furthermore, the population in this study were skilled birth attendants and obstetric care providers who provided childbirth services and used electronic-based partographs in monitoring them. This study was also including grey literature. Moreover, the exclusion criteria, such as labor monitoring using paper partographs.

Search Strategy

This literature search used articles in English from PubMed, Science Direct, and Google Scholar from 2016 to 2022. The literature used the keywords "partograph", "electronic", and "obstetric". The literature found there were 182 articles filtered using the keywords above. The articles were then narrowed down and identified based on the PICOS and obtained as many as 109 articles that could be included in the article screening process. In the meantime, at the article screening stage, according to the suitability of the article based on the abstract, there were 150 articles. Then a feasibility selection was carried out based on the whole discussion's essence and scope in the article. It was found that 16 articles could be made for further selection, namely as many as 13 articles included in the inclusion and 3 articles excluded.

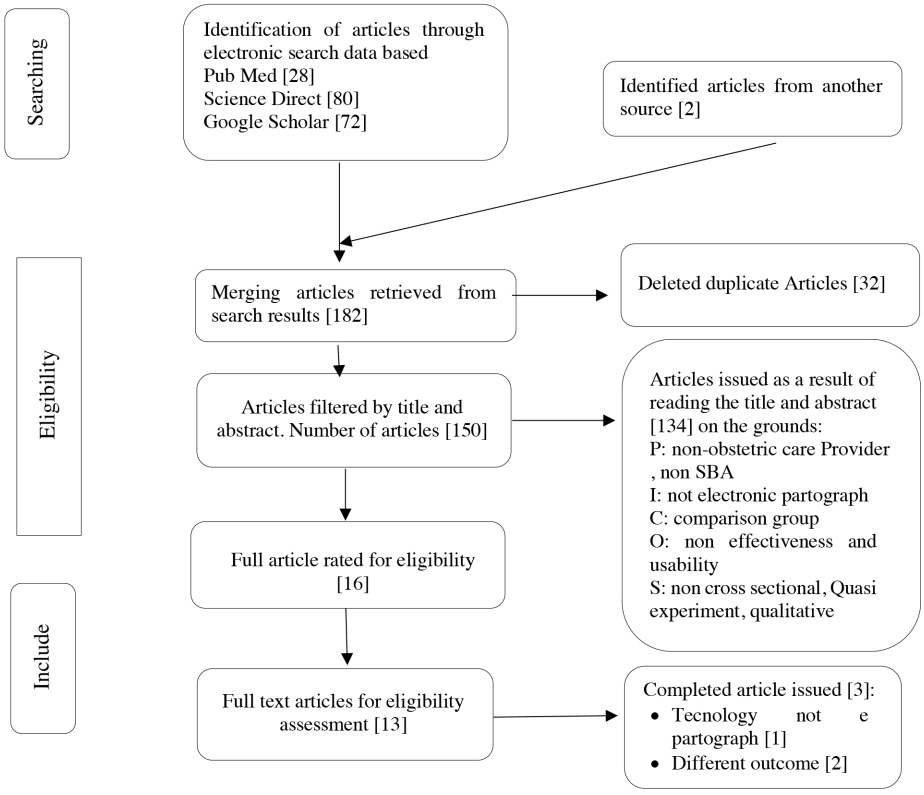

Figure 1. Steps for selecting articles are illustrated in the PRISMA flowchart.

Quality Assessment

The outcomes from the electronic search data-based articles were gathered, identified, and then exported to a Microsoft Excel spreadsheet. The filtered and qualified publications were evaluated, and three writers independently extracted data (WMN, YB, and RBU). Additionally, any

differences of opinion among the three authors (WMN, YB, and RBU) about the findings of the three reviewers were resolved through discussion and consensus. Additionally, each study's comparability, methodology (including sampling approach, response rate, and study representativeness), and outcomes were analyzed using Joanna Briggs Institute (JBI) tools. For cross-sectional, quasi-experimental, and qualitative investigations, the JBI was used to rate the methodological soundness of a study and assess the degree to which potential biases in its design and analysis had been addressed. Therefore, all articles assigned a JBI score of 50 % or more could be considered a "good" low-risk study.

RESULTS

Overview of Included Studies

The thirteen studies have been reviewed, and all labor monitoring used application-based partographs. However, the use of the term was different from one another. For example, "Life Curve", mLabor, PrasavGraph, Digital Partograph, and Intrapartum Monitoring Mobile Application (DAKSH) are android-based mobile applications (8,15,16), one of the terms for the tools used for childbirth monitoring with various gadgets that may be accessed using a smartphone or tablet or other devices (e-partograph) (1,8,17-19). digital partograph is some of the tools used based on android and Word Electric Browser (WEB), and some other names such as Web-Based Partograph and midwifery documentation use web-based (20,21).

Furthermore, these studies were conducted in five countries: India, Indonesia, Kenya, Tanzania, and Northwest Ethiopia. Because of concluding the results of the articles, it showed that users of this application-based partograph varied. For example, in Indonesia, the users of the partograph application were midwives, midwifery students, and researchers; in contrast to other countries for the life Curve [India] application, m labor used by doctors during childbirth monitoring, DAKSH is used by nurses; e used by Skilled Birth Attendant (SBA): Doctor, Nurse, Midwife. e partograph was used by SBA (doctors, midwives, nurses) and Staff nurses and medical officers. E-partograph is used by Obstetric care providers (certified midwife, nurse, Health Officers, Integrated Emergency Obstetrics, and Surgery & Medical Doctors who tend to the woman's needs throughout birth and delivery). Accordingly, to make the analysis more comprehensible, we used the research and the numerous publications in which they were reported. As a result, the findings were presented in a narrative form.

Comparing The Efficacy of e-Phartograph and paper Partograph

The use of the partograph is an important step in ensuring the high-quality care provided to mothers and newborns during labor. Further, developing an application-based partograph aims to improve care during labor by overcoming the challenge of the low use of paper partographs (8,15,22). Additionally, from the results of the analysis of the articles carried out, there was an increase in labor outcomes based on monitoring using an application-based partograph (e-partograph) compared to a paper partograph. Thus, in labor monitoring using the Life Curve Mobile application, measuring performance parameters are assessed on a scale of 1-5 with a total score of 45. Therefore, the results revealed that the Life Curve scored 42.7 compared to the paper partograph, which scored 19.52. This demonstrates that the difference ($p=0.001$) is highly significant.

On the other hand, the paper partograph (2.17 ± 1.18) was statistically significantly lower than the average-SD life curve ($4.74\pm.52$): $p=0.0002$. These findings showed that the use of a life curve mobile application improved SBA's efficiency in providing delivery care (15). In addition, this is in line with the results of other studies, which showed that using an e-partograph was easier to maintain normal labor and take action. However, on the other hand, e-partograph usage during delivery could complicate things for the mother and fetus, according to the examination of the article's data. In turn, the use of the e-Partograph results in a result of 56 % (95 % CI= 27 % -73 %), a tendency away from cesarean sections [43 %to 37 % at Jessore Hospital and from 36 percent to 25 % in Kushtia Hospital] and away from preterm labor compared to the use of the paper partograph (1,17).

Table 1. Overview of Included Studies.

Nº	Authos	Year	Countries	Name Application	User	Study Design	Score of JBI (%)
1	Begum et al.	2017	India	Life curve	Doctor	Cross-sectional	75
2	Sanghvi et al.	2017	Kenya	E-partogram	Skill birth attendant (SBA): doctor, nurse, midwife	Mixed-method, quasi-experimental	89
3	Rahman et al.	2019	India	E-partograph	SBA (doctor, nurse, midwife)	Quasi-experimental	100
4	Schweers et al.	2016	India	M-labor	Doctor	Qualitative	50
5	Singh et al.	2016	India	Prasav graph	Doctor	Qualitative	50
6	Juwita et al.	2019	Indonesia	Midwifery documentation use web-based	Midwives	Cross-sectional	50
7	Singh et al.	2021	India	E-partograph	Staff nurses and medical officers	Cross-sectional	75
8	Litwin et al.	2018	Tanzania	E-partograph	SBA	Qualitative	50
9	Tandiallo et al.	2019	Indonesia	Web-based partograph	Researcher	Quasi-experimental	100
10	Tadesse et al.	2019	Northwest Ethiopia	E-partograph	Prenatal care providers (midwife, nurse, health officers, doctor)	Cross-sectional	100
11	Ulfa et al.	2020	Indonesia	Digital partograph	Midwife students	Cross-sectional	50
12	Singh et al.	2019	India	Digital Partograph and Intrapartum Monitoring Mobile Application	Nurses	Cross-sectional	88
13	Ningrum et al.	2019	Indonesia	Digital partograph	Midwife	Qualitative	70

The results of the article analysis explained the reasons for developing this application-based partograph to solve various problems that arise when using paper partographs, one of which was the very low use of paper partographs (23). From the results that could be seen, the use of e-partographs revealed that the frequency of recording appears to be higher on web-based partographs, which is 26 (86.7 %), compared to the speed of recording using conventional methods, which is 25 (83.3 %) (20), the majority of SBA (87 %-91 %) completed Partograph filling (2), WEB-based partographs were faster in recording contractions, oxytocin, and delivery p-value 0.0001 ($P<0.05$) (21). Therefore, these results indicated that the e-partograph was more effective in maintaining normal delivery, preventing complications during labor, and increasing use during labor monitoring.

Advantages of e Partograph with paper Partograph

Partograph is an instrument to track record the progression of labor. The key parameters in the partograph are the progression of labor (cervical dilating, contractions, and descent of the bottom portion), maternal health (systolic pressure, pulse, and temperature), and fetal condition (fetal heart rate, amniotic fluid, and moulage). In monitoring the paper partograph, the filling and interpretation depend on the person filling it out. In e-partograph, several advantages could be felt when using it. Moreover, the partograph application (e-partograph) was developed in the form of a mobile phone or tablet based on android with a web-based computer device, with the advantages made by each developer. One of the benefits of using a partograph is making decisions when monitoring labor, whether this delivery can be assisted or action is needed (23,24). The e-partograph has several advantages over the paper partograph in some system applications, which are made by adding notification features in the form of audio and visual warnings, which show the charging time and complications that occur in mothers and babies. This notification system helps users to determine what decisions and actions to take.

In some applications, there are other advantages, such as storing data filled in and graphs appearing according to the data filled in with varying display results. In addition, this partograph program has made use of a "delay-tolerant framework," making it usable even in unfavorable internet network circumstances (25), and some can even be used without using the internet network (23). This shows that the e-partograph has other benefits compared to the paper partograph. Throughout the labor and delivery process, several inventors have concentrated on low-cost digital solutions to address problems with the paper partograph, improve care quality, enhance documentation, and facilitate decision-making (19).

Acceptance of e-Partograph Among Health Workers

Application development on partographs aims to make it easier for users to fill in partographs. Most SBAs agree that the e-partograph greatly simplifies filling and increases its use, but it should be a concern for obstetric services with a high rate of delivery cases. It takes a lot of trained SBA to be more optimal in their utilization (17). Almost all SBA (93 %) showed confidence and comfort in using e-Partograph. SBA gave a positive impression and felt efficient and easy to use. The SBA expresses faith in their capacity to comprehend and take action on the reminders and cautions provided in the e-partograph. The SBA's behaviour in relation to filling out the partograph changes while using the e-partograph (8,26).

DISCUSSION

Digital partographs are designed to solve various problems arising from paper partographs (23). Many researchers are developing partograph applications in various countries in the world, but all of them have different effectiveness, advantages, and levels of acceptance.

Based on Sanghvi et al. (2017), using the e-partograph application has higher effectiveness than using the paper partograph (23). It was determined that using an electronic partograph reduced the likelihood of a complicated fetal outcome by 56 % (95 % CI = 27 % - 73 %) compared to a conventional partograph. The practitioner uses partographs to a much greater

Table 2. Summary of Selected Studies.

Nº	App Name	Description	Outcome	Results
1	Life Curve	Android-based application, equipped with colors that appear on the screen to describe the condition of the mother and children	The utilization of the life curve	The overall results for the paper partograph (19.52) and the Live Curve (42.7) are significantly different from one another (p.001). However, the average SD score for the life curve is remarkably higher (4.74±.52) than for paper partographs (2.17±1.18): p.0002.
2	e-partogram	Application based on android tablet, there is an audio and visual reminder system when it comes to doing the next check and in case of complications	The utilization of e-Partogram to maintain normal delivery	There are 842 active phase maternity customers using e-Partograms and data from 1,042 clients observed using paper partograms. The e-partograms usage was 56 percent (95 %t CI= 27 % -73 percent) with fewer chances of fetal outcomes problems than paper partographs.
3	e-partograph	Tablet, smartphone, or computer-based applications. A system emits a red signal if it shows complications during labor. The application can store data both locally and remotely in a central database.	The evaluation of partograph applications' viability and efficiency	Labor monitoring used paper partographs to identify 42% of long hours worked; during phase 2, monitoring with e-partographs showed just 29% of long hours worked. Similar outcomes were seen at Jessore DH, where paper partographs lowered lengthy labor rates from 30% to 7%.
4	m-labor	A mobile application refers to the WHO partograph. The display on the screen is not boring and minimizes filling errors.	The use of m-labor in documenting partographs	m-labor lets professionals use a reminder system, emergency decision support, and assistance for the entire patient lifecycle, from admission to referral, which is all included in labor.
5	PrasavGraph	The program is built on android and was created using a delay-tolerant architecture, allowing it to function even with unreliable internet connections.	PrasavGraph application for childbirth monitoring	It is easy to use on a smartphone, so it is hoped that the partograph will be easier to use in the delivery process of health workers in the peripheral area, which is still very low until now.
6	Midwifery Documentation Use Web Based	The application web-based	Recording Speed	The frequency of recording appeared to be higher on web-based partographs, namely 26 (86.7%), compared to the speed of recording using conventional methods, which was 25 (83.3%)
7	e-partograph	The tablet-based partograph application used is named DAKSH. The app allows the integration of several features, such as alerts and alarms, to improve the user experience.	The use and acceptance	Tablet-based partographs were preferable to paper-based ones since they saved time and were simple to use. It offers a reminder option, which is helpful for healthcare professionals.
8	e-partograph	Partograph app for Android tablets, with a focus on enhancing the simplicity and effectiveness of real-time documentation	The feasibility and use of e partograph	Most SBA (87–91%) completed the ePartogram by registering the client, making the first and subsequent observations, and using the screen on the first shift.
9	Web-Based Partograph	Computer-based partographs with the use of internet networks	The utilization of web-based partographs	The WEB-based partographs were quicker for documenting contractions, oxytocin levels, and delivery processes. In addition, the accuracy of internet-based partographs in earlier detection, which showed a p-value of 0.000 (0.05), and emergency detection, which has a p-value of 0.014, can be used to compare their use to that of conventional partographs (0.05).
10	e-partograph	Partograph in mobile phone	Mobile phone usage for e-Partograph	205 smartphone owners (or 46% of them) used e-partograph. Healthcare with a positive attitude toward Partograph (AOR = 2.76.95% C.I: 1.49-5.09) and education in linked fields (AOR = 7.63.95% C.)
11	Digital Partograph	web-based partograph design	Utilizing digital partographs as a teaching tool	The signification of the p-value displayed 0,0001 < 0.05, meaning that electronic partographs as a medium of education are very effective for developing partographic filling of students' skills.
12	Digital Partograph and Intrapartum Monitoring Mobile Ap-plication	The tablet-based DAKSH application. Real-time labor monitoring, fundamental decision-making help with better warnings, and logging are all app features.	The utilization of DAKSH	Around 463 births were observed at the hospital, of which 91.56 % (n=424) were registered in the application.
13	Digital Partograph	Android-based partographs, real-time recording, there is a notification system in case of labor difficulties can be accessed on the play store	The use of digital partographs, behaviour change, stakeholder support	The study results show that the Google Playstore's digital partograph application can already be used to track the progress of births. Midwives are behaving differently when using digital partographs as a result of their accessibility.

extent to adhere to typical labor observations (17). Rahman et al. in 2019 made the same claim, explaining that the facility-based cesarean section rate is trending downward in both institutions, dropping from 43 % in Jessore to 37 % and from 36 % to 25 % at Kushtia Hospital in Banglades (16). Similar outcomes were shown in Jessore, Bangladesh, where the percentage of protracted labor was lowered from 30 % of long labor recorded by e-partograph to 7 % with paper partographs. Most health professionals finished filling out the e-Partogram: registering patients, first and subsequent observations, and utilizing screens easily on the first shift; the usage of the e Partogram to monitor 103 births in 84 shifts; the fifth shift reported a rise to 100 % (8,16). In terms of recording, the use of e-partographs is reported to be more effective when compared to paper partographs, as stated by Ahmad et al., 2019 that the study results revealed that the frequency of recording appears to be higher on web-based partographs, which 26 (86.7 %) compared to recording speed using conventional methods that are equal to 25 (83.3 %) (25). The previous research revealed that for recording contractions, oxytocin, and births, an internet-based partograph was easier to use than a traditional partograph (21).

Additionally, the early detection precision of the web-based partograph has a p-value of 0.0001 (0.05), and its accuracy in emergency detection is 0.014 (0.05), indicating that it differs from conventional partographs. The referral process' p-value, however, is 1 000 (>0.05), indicating that there is no distinction between the use of WEB-based partographs and traditional partographs (25). Study on the digital partograph is a highly effective learning tool for acquiring partographic knowledge, according to research on the effectiveness of the e-partograph as a teaching aid for students. Based on Begum et al., 2020, the e-partograph application has the advantages of being easier to fill out, automatically generating graphs, more interesting to work with, providing timely automatic reminders to evaluate mothers in labor, generating digital color-coded warning numbers, and sending automatic text messages to supervisors in situations abnormal (20). Singh et al., 2019 also showed that e-partographs are easy to use on smartphones, so it is hoped that partographs will be easier to use in the delivery process by health workers in the periphery, which is still very low (22). Research on the advantages of the e-partograph was also carried out by Ningrum et al., 2019, and it demonstrated that the digital partograph's information system complied with the demands for system excellence, information excellence, and user satisfaction (26). Digital partographs have been useful for clinical decision-making, tracking the course of labor, documenting, keeping tabs on the health of the mother and fetus, and gaining support from involved people for such applications. Several studies have also assessed the level of acceptance of e-partographs by health workers. Nursing and medical professionals concluded that tablet-based partographs are superior to paper-based partographs because they are quicker and simpler to use (24). Research by Litwin et al. (2018) showed that almost all health workers (93 %) Health professionals reported a positive opinion of the e-Partogram and believed that it was effective and simple to use (8). Additionally, they showed trust in their ability to understand and respond to these e-reminders partograph's throughout the fifth shift (8,19). The level of acceptance of e-partographs in terms of cellphone ownership for application installation, from the survey results, it was found that 205 (46 %) were eager to use cell phones for e-Partographs (19).

CONCLUSION

Most studies showed that the development of an application-based partograph aimed to facilitate the process of monitoring labour. With the e-partograph, the result of delivery was better than with the paper partograph. E-partograph maintained normal delivery and reduced the incidence of caesarean section and prolonged labour. In addition, the e-partograph provided the advantage that there was an audio and visual reminder system that could be used to detect complications during childbirth. Furthermore, all data was stored and could be accessed again to make the documentation system easier. The level of SBA acceptance of the e-partograph was excellent, as evidenced by the higher use of the e-partograph compared to the paper partograph.

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