

# A Comparative Study of e-Partogram with Conventional Partogram

<sup>1</sup>Priyanka H Krishnaswamy, <sup>2</sup>Padmalatha Venkatraman, <sup>3</sup>Achal Shetty

## ABSTRACT

**Introduction:** Obstructed labor remains an important cause of not only maternal death but also short- and long-term disability. Even though the partogram serves to assist in effective monitoring of the progress of labor and the condition of the mother and baby, its use in developing countries is limited.

**Aim:** To compare the reliability of mobile application-based e-partogram for feto-maternal monitoring in labor with the conventional World Health Organization (WHO) partogram.

**Setting:** A total of 40 patients in the delivery suite at Rangadore Memorial Hospital, Shankarapuram, Bengaluru.

**Design:** A randomized controlled trial.

**Materials and methods:** Study population was randomized into two groups of 20 patients each. Labor events, delivery, and baby details were randomly filled either in the modified WHO partogram or in the e-partogram app.

**Outcome measures:** The primary outcomes analyzed were regularity of monitoring of maternal and fetal parameters, consultant supervision of labor, and retrospective filling of data. Secondary outcomes studied were the mode of delivery, blood loss up to 24 hours of delivery, 1 and 5 minutes neonatal APGAR score.

**Statistical analysis used:** Averages and proportions were calculated for the study and appropriate statistical tests like chi-square test, Fisher's exact test, Z-test, and Levene's test for equality of variances were done using MiniTab version 16.

**Results:** The regularity of monitoring maternal parameters (p-value of 0.001) and consultant supervision (p-value of 0.000) was significantly higher using the e-partogram compared with those whose labor was monitored using the paper partogram. Retrospective filling of the partogram was higher in the modified WHO (on-paper) partogram (p-value of 0.000). The secondary outcomes – mode of delivery, blood loss up to 24 hours of delivery, 1 and 5 minutes neonatal APGAR score – were not significantly different between the two groups (p-value > 0.05).

**Conclusion:** The e-partogram can provide safe births by increasing the quality and regularity of important observations

on the progress of labor and early detection of problems by consultants, which can lead to better decision-making and earlier referrals. It also makes remote monitoring of labor possible, promotes logical human resource allocation, supports record-keeping, and is thus a pragmatic way to reduce both maternal and newborn mortality and morbidity.

**Keywords:** Comparison, Conventional partogram, e-Partogram.

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## INTRODUCTION

Each year, 210 million women become pregnant, of whom 20 million will experience pregnancy-related illness and 500,000 will die as a result of the complications of pregnancy or childbirth.<sup>1</sup> Obstructed labor comprises one of the five major causes of maternal mortality and morbidity in developing countries.<sup>2,3</sup> The number of maternal deaths as a result of obstructed labor and/or rupture of the uterus varies between 4 and 70% of all maternal deaths, amounting to a maternal mortality rate as high as 410/100,000 live births.<sup>4</sup> Early detection of abnormal progress and prevention of prolonged labor can significantly reduce it.<sup>5</sup>

The partogram is a single sheet of paper where all information related to labor is obtained. It is an inexpensive tool that provides a continuous pictorial overview of labor. It is a practical device in a busy labor room with limited personnel to predict deviation from normal progress of labor so that proper intervention can be done on time. It serves as an "early warning system" and assists in early decision on transfer, augmentation, and termination of labor. It increases the quality and regularity of all observations on the fetus and the mother in labor, and aids early recognition of problems with either.<sup>6</sup> It also facilitates handover and responsibility and accountability of the person conducting labor.<sup>7</sup>

The use of modified World Health Organization (WHO) partograph significantly improves the maternal and neonatal outcome of labor, thus recommending the use of WHO partograph in all maternity units.<sup>8</sup> The Cochrane review in 2009, however, states that further trial evidence is required to establish the efficacy of partogram

<sup>1</sup>Registrar, <sup>2</sup>Lead Consultant, <sup>3</sup>Research Officer

<sup>1,2</sup>Department of Obstetrics and Gynecology, Rangadore Memorial Hospital, Bengaluru, Karnataka, India

<sup>3</sup>Department of Rural Unit of Health and Social Affair, Christian Medical College and Hospital, Vellore, Tamil Nadu, India

**Corresponding Author:** Priyanka H Krishnaswamy, Registrar Department of Obstetrics and Gynecology, Rangadore Memorial Hospital, Bengaluru, Karnataka, India, Phone: +918026983300 e-mail: priyanextdoor@yahoo.com

use and does not recommend routine use of the partogram as part of standard labor management and care.<sup>9</sup>

There are numerous difficulties encountered with the WHO modified paper partogram. The use of the paper partogram is low and inconsistent, especially in developing countries, with an approximate 20% of them being filled retrospectively. Lack of availability of partograms, negative perceptions and attitudes toward the partogram, high client volume and low staffing at facilities also contribute to this. Lack of training, lack of time taken to interpret findings, and little supervision related to partogram use lead to delayed or nonrecognition of abnormalities in the partogram.

e-Partogram, designed by Blue Crimson, is an application that works on an android/apple Operating System and downloadable on any mobile or tablet. It is based on modified WHO partograph with easy data entry and automatic plotting on respective graphs. It is color coded with alerts for high-risk features and reminders. It also limits retrospective data entry with the ability to manage multiple patients and telecommunication for remote support.

We, therefore, conducted a randomized controlled trial to compare the reliability of mobile application-based e-partogram for feto-maternal monitoring in labor with the conventional WHO partogram.

## MATERIALS AND METHODS

We conducted a randomized controlled study of 40 women in labor at the delivery suite of Rangadore Memorial Hospital, Shankarapuram, Bengaluru, Karnataka, India during the month of September 2015.

### Clinical Management and Data Collection

Participants were randomly assigned in a 1:1 ratio by lottery method at the time of qualifying to enroll in the study. Hospital staff and participants were all aware of the study being conducted and an informed consent was taken from the patient.

### Ethical Approval

We obtained approval from the Hospital and Departmental Clinical Research Committee before starting this study.

### Study Population and Setting

Forty women in labor with a single live intrauterine pregnancy of gestational age of >36 weeks were randomized into two groups of 20 patients each.

The inclusion criteria were women with a pregnancy over 36 weeks of gestation, in active labor. The exclusion criteria were women with any medical comorbidity like

anemia, renal or cardiac disease, asthma, and women on anticoagulant therapy.

Informed consent was obtained for the study, and the gestational age was assessed by her last menstrual period and ultrasonography.

Monitoring using either paper partogram or e-partogram was started when the woman was in active labor at 4 cm of cervical dilatation, irrespective of being in spontaneous or induced labor. The initial parameters noted in either group were patient details: Name, age, period of gestation, obstetric score, identification number, risk factors, and time of rupture of membranes were noted.

During labor the monitoring of fetal heart rate on paper or e-partogram was done every 30 minutes in 1st stage of labor (up to full dilatation) and every 15 minutes in 2nd stage of labor (up to delivery of the baby). Maternal pulse, blood pressure, temperature, uterine contractions, oxytocin drops/minute and units, urine albumin, acetone, volume were monitored every half an hour. Cervical dilatation, descent of the head color of liquor, and molding were monitored every 4 hours in 1st stage and every 2 hours in 2nd stage. Drugs and fluids administered were noted as and when administered during labor (Fig. 1).

Baby details, such as number of babies born, mode of delivery of the baby – spontaneous, instrumental, or caesarean delivery – were recorded (Fig. 2). Time and date of delivery, sex and weight of baby, neonatal APGAR score at 1 and 5 minutes were recorded, and blood loss was estimated by a combination of direct and visual estimation of blood loss up to 24 hours postdelivery.

The regularity of monitoring of all parameters according to protocol and consistency of monitoring of

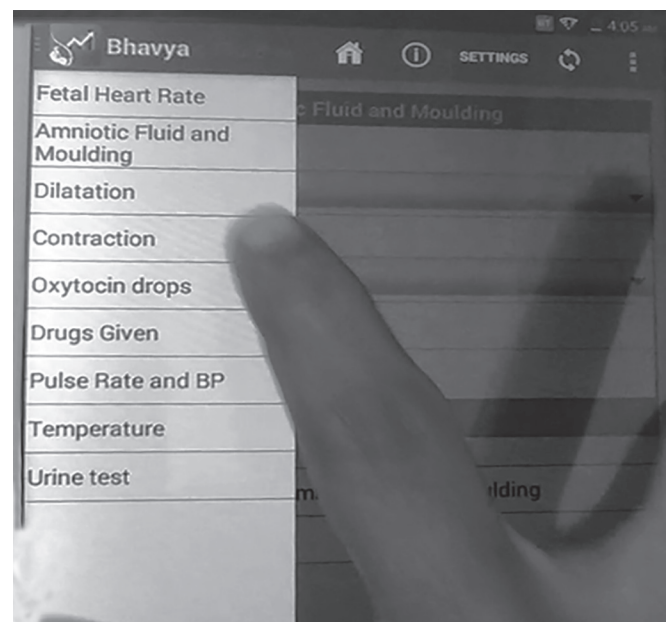


Fig. 1: Delivery details in e-partogram app

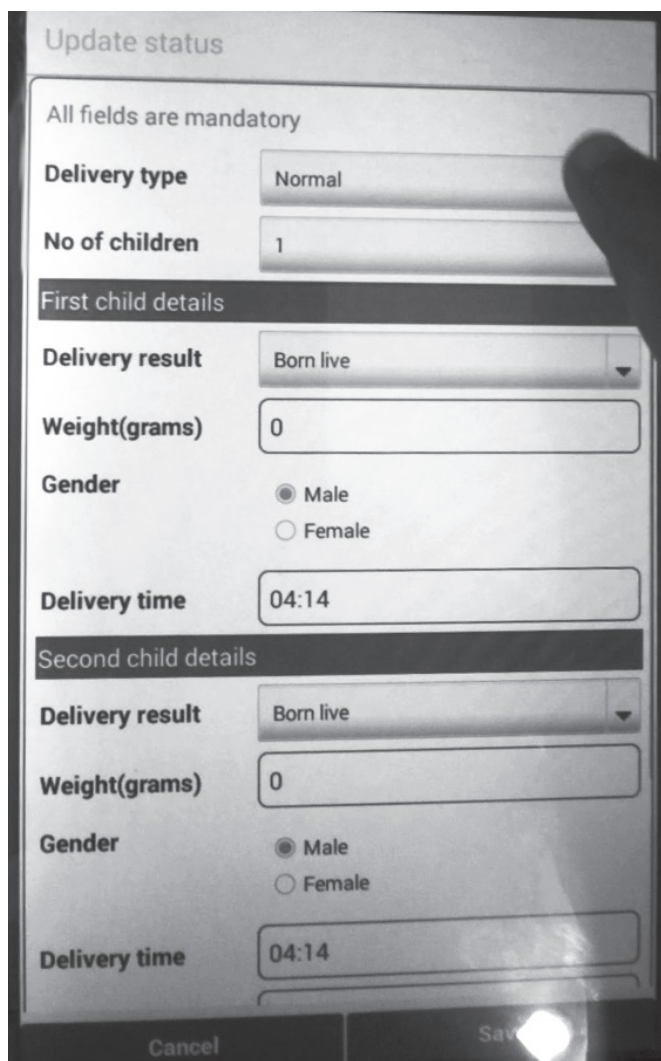


Fig. 2: Delivery details in e-partogram app

these parameters till the end of labor was noted. Consultant supervision of the labor in this study was considered to be present if the partogram was seen by the consultant at least three times during the labor until delivery.

Patient was monitored in hospital up to 48 hours after delivery in the postnatal ward. They were provided with an emergency contact number to contact in case of excessive bleeding, pain abdomen, or a sustained fever of more than 100°F as per hospital protocol. Patient and partner were counseled for a suitable contraceptive method after delivery.

**Statistical Analysis**

Averages and proportions were calculated for the study and appropriate statistical tests like chi-square test, Fisher’s exact test, Z-test, and Levene’s test for equality of variances were done using MiniTab version 16.

**Study Outcomes**

The primary outcomes analyzed were regularity and consistency of monitoring of maternal and fetal

parameters and consultant supervision of labor. Secondary outcomes studied were the mode of delivery, primary postpartum hemorrhage, 1 and 5 minutes neonatal APGAR score.

**RESULTS**

**Study Group**

Demographic characteristics between both the groups (Table 1) were analyzed with respect to age, patients admitted in labor, and for induction of labor, with or without medical comorbidities, and color of liquor. The differences in the obstetric score (Table 2) and period of gestation (Table 3) of women in both groups were not found to be significant, i.e., p-value of > 0.5.

*Regularity of Monitoring (Table 4)*

With the e-partogram, the regular monitoring of parameters was seen in 18 women out of the 20, while 8 with whom labor was monitored regularly with the paper

Table 1: Demographics of the study population

Characteristics	e-Partogram	Paper partogram	Stat values	p-value
Age	26.65	26.1	0.174	0.727
In labor	13	15	0.731	0.49
For induction of labor	7	5		
Medical history	6	5	0.723	1
No medical history	14	15		
Clear liquor	13	15	0.476 <sup>a</sup>	0.49
Meconium-stained liquor	7	5		

Table 2: Obstetric score of women in both groups

Gravida	e-Partogram	Paper partogram	Fisher's exact	p-value
1	8	9	1	>0.05
2	7	7		
3	4	3		
4	1	1		

Para	e-Partogram	Paper partogram	Fisher's exact	p-value
0	14	16	1	>0.05
1	4	3		
2	2	1		

Table 3: Period of gestation of pregnancies in both groups

Period of gestation	e-Partogram	Paper partogram	Fisher's exact	p-value
36–36+6	2	2	1	>0.05
37–37+6	3	3		
38–38+6	3	2		
39–39+6	5	6		
40–40+6	7	7		

**Table 4:** Regularity, consultant supervision, and retrospective filling of partograms in both groups

	Regularity	Consultant supervision	Retrospective filling
Paper	8	7	16
e-Partogram	18	18	0
Chi-square	10.989 <sup>a</sup>	12.907	26.667
p-value	0.001	0.000	0.000

partogram. The chi-square value was 10.989 (p-value was 0.001).

#### Consultant Supervision (Table 4)

With the e-partogram, consultant monitoring of labor (partogram seen by the consultant at least three times during labor) was seen in 18 women out of the 20, while 7 women had their partogram supervised by the consultant according to set criteria with the paper partogram. e-Partogram could be accessed online on any device by logging into the website, while the paper partogram was in the notes of the patient. The chi-square value was 12.907 (p-value was 0.000).

#### Retrospective Filling (Table 4)

With the paper partogram, parameters were filled retrospectively in 16 women out of the 20, while none of them with the e-partogram had retrospectively. The e-partogram does not permit retrospective filling of parameters and alerts health care providers to check parameters. The chi-square value was 26.667 (p-value was 0.000).

#### Mode of Delivery (Table 5)

Of the 20 women, 14 with their labors were monitored using the paper partogram and 15 of the 20 women with the e-partogram had a normal vaginal delivery. Two women of both groups had a forceps delivery and 2 women had a vacuum delivery. Two women with their labor monitored using the e-partogram and 1 woman with her labor monitored using paper partogram had a cesarean section (Fisher's exact of 1 and p-value > 0.05).

#### Blood Loss (Table 6)

Using a combination of direct and visual assessment, the average blood loss was 405 mL with the e-partogram and was 395 mL with the paper partogram (Levene's test for equality of variances value of 0.175 and p-value of 0.678).

#### Neonatal APGAR Scores (Table 6)

The average neonatal APGAR score at 1 minute was 7 in women whose labor were monitored using both paper

**Table 5:** Mode of delivery of women in both groups

Mode of delivery	e-Partogram	Paper partogram	Fisher's exact	p-value
Normal vaginal delivery	14	15	1	>0.05
Forceps	2	2		
Vacuum	2	2		
Low segment cesarean section	2	1		

**Table 6:** Blood loss and 1 and 5 minutes neonatal APGAR score in both groups

	e-Partogram	Paper partogram	Stat values	p-value
Blood loss	405 mL	395 mL	0.175	0.678
APGAR score – 1 minute	7	7	-0.854	0.393
APGAR score – 5 minutes	9	9	-0.395	0.693

and e-partogram (z value of -0.854 and p-value of 0.393), while the average score at 5 minutes was 9 in both groups (z value of -0.395 and p-value of 0.693).

## DISCUSSION

### Main Findings

The primary outcomes, which were regularity of monitoring maternal parameters (p-value of 0.001) and consultant supervision (p-value of 0.000), were significantly higher using the e-partogram compared with those whose labor was monitored using the paper partogram. Retrospective filling of the partogram was higher in the modified WHO (on paper) partogram (p-value of 0.000). The secondary outcomes – mode of delivery, blood loss up to 24 hours of delivery, 1 and 5 minutes neonatal APGAR score – were not significantly different between the two groups (p-value > 0.05).

### Strengths and Weaknesses of the Study

The major strength of this trial was that this was the first study of this nature conducted using the mobile-based application. The limitations to this study were that this was a small study conducted in a tertiary hospital. Large multicentric studies with a mixed ethnic population would be of value in this field. Another limitation to the current study may be that the outcomes evaluated were all immediate with no long-term follow-up.

Disadvantages with the mobile-based application are that it needs basic knowledge of computers and mobile phones, internet access for transfer, and access of data. It also needs a mobile/tablet compatible with 2G and with Android/iOS.

No studies of this nature have been done previously. Jhpiego and the Johns Hopkins Center for Bioengineering Innovation and Design (JHU-CBID) are designing and conducting field-testing for an e-partogram.<sup>10</sup> PartoPen project was used to increase the effectiveness of the partogram using an interactive digital pen with custom software in use in Nairobi, Kenya.<sup>11,12</sup>

### Interpretation

Before applying the results to other populations and settings, several factors have to be considered. Overall, the study population was very homogeneous and the study aimed to only include healthy women with no a priori risks.

### CONCLUSION

There are numerous advantages in using the mobile-based application. It is a single platform to store multiple patient data with automatic plotting of observations into a graph. It limits retroactive data entry after delivery, which is a common error observed with paper partograms. It has indicators to indicate high-risk status and complications and reminders to measure and record critical observations. Most importantly, it allows for telecommunication with offsite experts for guidance and support and serves as a permanent record.

### AUTHORS CONTRIBUTION

All authors had full access to the data in the study and take responsibility for the integrity of the data and accuracy of the data analysis. All authors reviewed and approved the final version of the paper.

### DETAILS OF ETHICS APPROVAL

The study was approved by Rangadore Memorial Hospital Ethical Committee.

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### REFERENCES

1. McCarthy M. What's going on at the World Health Organization? *Lancet* 2002 Oct 12;360(9340):1108-1110.
2. Mahler H. The safe motherhood initiative: a call to action. *Lancet* 1987 Mar 21;1(8534):668-670.
3. World Health Organization. Maternal mortality ratios and rates – a tabulation of available information. 3rd ed. Geneva: WHO; 1991.
4. World Health Organization Maternal Health and Safe Motherhood Programme. World Health Organization partogram in management of labour. *Lancet* 1994 Jun 4; 343(8910):1399-1404.
5. Maternal Mortality Rates – A Tabulation of Available Information. 2nd ed. WHO Document FHE/86-3.
6. Mathews JE, Rajaratnam A, George A, Mathai M. Comparison of two World Health Organization (WHO) partograms. *Int J Gynecol Obstet* 2007 Feb;96(2):147-150.
7. WHO partogram cuts complications of labor and childbirth. *Safe Mother* 1994 Jul-Oct;(15):10.
8. Tayade S, Jadhao P. The impact of use of modified who partogram on maternal and perinatal outcome. *Int J Biomed Adv Res* 2012;03(04):256-260.
9. Lavender T, Hart A, Smyth RM. Effect of partogram use on outcomes for women in spontaneous labour at term (review). *The Cochrane Collaboration*. John Wiley & Sons, Ltd.; London, UK, 2013.
10. Addressing Labor Complications: A Low-Cost Solution for a Persistent Global Health Challenge (no date). Available from: [http://www.jhpiego.org/files/%20ERCO-new-infosheets/3-How-We-Do-It/2-Innovations/Low-Cost%20Solutions/LaborComplicationsLowCostSolutions\\_withmast.pdf](http://www.jhpiego.org/files/%20ERCO-new-infosheets/3-How-We-Do-It/2-Innovations/Low-Cost%20Solutions/LaborComplicationsLowCostSolutions_withmast.pdf).
11. Underwood H, Sterling SR, Bennett JK. The design and implementation of the PartoPen maternal health monitoring system. *ACM DEV'13*. 2013.
12. Underwood H. PartoPen: enhancing the partogram with digital pen technology. *Proceedings of CHI EA'12, CHI'12 Extended Abstracts on Human Factors in Computing Systems*, Austin, TX; 2012. p. 1393-1398.