Journal of
Health & Medical Informatics

Rinkoo et al., J Health Med Informat 2019, 10:3

Research Article Open Access

From Guidelines to Practice: Assessing the Implementation Fidelity of Partograph Use for Monitoring Labour in Primary Healthcare Settings in India Using a Tablet-Based Mobile Application

Arvind Vashishta Rinkoo[1]*, Anand Kumar Panjiyar[1], Dinesh Songara[1], Arnika Sharma[1], Priyanka Singh[2], Meenakshi Pareek[1], Satyaban Sahu[1], Rajesh Ranjan Singh[1] and Rakesh Kumar Srivastava[1]

[1]*The Wadhwani Initiative for Sustainable Healthcare (WISH), New Delhi, India*
[2]*Janitri Innovations Private Limited, Bangalore, India*

Abstract

This prospective study uses a tablet-based mobile application (digital partograph named DAKSH) to assess the implementation fidelity of partograph use for monitoring labour in primary healthcare settings in Rajasthan, India. As DAKSH does not allow filling of data retrospectively, only real-time information can be used for generating the partograph using this application. Two algorithms were developed to feed each of the data points for seven fetal and maternal parameters into the research instrument. In this study, percentage of data points captured in real-time for fetal heart rate, status of membranes and colour of amniotic fluid, uterine contractions (frequency and duration), maternal pulse, cervical dilatation, maternal blood pressure, and maternal temperature were 29.63%, 35.32%, 29.36%, 29.45%, 55.06%, 42.51%, and 42.71%, respectively. Notably, implementation fidelity was lowest for capturing real-time information pertaining to uterine contractions (frequency and duration), maternal pulse, and fetal heart rate. KEYAR, a second-generation e-partograph developed by JANITRI Innovations Private Limited, may significantly contribute towards increasing implementation fidelity in terms of continuous real-time intrapartum monitoring of these three parameters.

Keywords: Partograph; Implementation fidelity; Labour monitoring; Primary healthcare; India

Introduction

The partograph (also known as partogram) is a pre-printed paper form on which labour observations are recorded. It provides a graphic overview of labour, and alerts midwives and healthcare workers to deviations in maternal or fetal well-being and labour progress [1]. The partograph is recommended by the World Health Organization (WHO) as a tool to identify maternal or fetal distress, and abnormalities in the progress of labour that require further action, including female genital fistula, postpartum haemorrhage, sepsis, uterine rupture and its sequelae in case of mothers, and death, anoxia, and infections in case of infants [2]. In addition, the information on the partograph can be used to reassure the woman and her family about appropriate progress in labour, or explain abnormalities and potential interventions. A multicenter WHO study demonstrated promising effects on care and labour outcome when partograph is implemented with a clear labour management protocol [3].

Despite robust evidence on the benefits of partograph completion, challenges to the adoption of this labour tool have been well-recognized in primary healthcare settings in low and middle-income countries such as India [4]. Understandably, real-time use of partograph in primary healthcare settings is abysmally low, with partographs often generated retrospectively only for the sake of compliance with extant guidelines [5,6]. Though knowledge in the use of partograph promotes confidence, shortens the length of labour, and reduces caesarean section rate and intrapartum stillbirths, the commitment to its real-time use in providing the desired effects is lacking in developing countries. Irrespective of how knowledgeable obstetric caregivers are regarding the partograph, its use in documentation of the labour monitoring parameters during labour in real-time is often a challenge in primary healthcare settings [7]. Factors contributing to suboptimal partograph use for monitoring active phase of first stage of labour in primary health centres (PHCs) include lack of availability of partographs at the last-mile, ambiguous labour management guidelines, paucity of supportive supervision of healthcare workers related to partograph use, wrong perceptions about the partograph and its value in labour management, and inadequate institutional and individual commitment to partograph use [8].

The degree to which an intervention is implemented as intended is termed as 'implementation fidelity', and its study is important to determine why and how an intervention works, and possibilities of improved outcomes from its use [9]. As per the framework proposed by Carroll et al, implementation fidelity is measured by the extent to which the implementers adhere to the intervention as intended by the designers. The strength of this framework lies in its ability to draw pragmatic solutions to improve outcomes from the intervention by consideration of the moderating factors and components essential to improve implementation [10]. Partographs are supposed to document in real-time the graphic recordings of the progress of labour and condition of mother and foetus during the active phase of first stage of labour. In fact, extant guidelines in India recommend that partograph be generated using real-time information in at least 90% deliveries in labour rooms [11]. Unfortunately, evidence corroborates that the paper partographs are mostly completed retrospectively only for the sake of compliance with the extant guidelines, and are seldom used as decision-making tools using real-time information, as originally intended [9].

***Corresponding author:** Dr. Arvind Vashishta Rinkoo, The Wadhwani Initiative for Sustainable Healthcare (WISH), Building No. 24 (3rd floor), Okhla Industrial Estate, Phase-III, New Delhi-110020, India, Tel: +919540318991; E-mail: arinkoo@ wishfoundationindia.org

Received August 01, 2019; **Accepted** August 25, 2019; **Published** September 05, 2019

Citation: Rinkoo AV, Panjiyar AK, Songara D, Sharma A, Singh P, et al. (2019) From Guidelines to Practice: Assessing the Implementation Fidelity of Partograph Use for Monitoring Labour in Primary Healthcare Settings in India Using a Tablet-Based Mobile Application. J Health Med Informat 10: 334.

This study uses a tablet-based mobile application (digital partograph named DAKSH) to assess the implementation fidelity of partograph use for monitoring labour in primary healthcare settings in Rajasthan, India. As DAKSH does not allow filling of data retrospectively, only real-time information can be used for generating the partograph using this application. Thus, in this study, implementation fidelity has been assessed by calculating the percentage of data points for various fetal and maternal parameters, as per the extant guidelines of Government of India, captured by the general nurse midwives (GNMs) for generating the partograph in pre-identified PHCs.

Methodology

Study setting

This prospective study was conducted in the state of Rajasthan, India. Four rural PHCs were included in this study. These PHCs situated in villages Bahrawdakalaan, Bhadoti, Bikarni, and Mandwa are run by Wadhwani Initiative for Sustainable Healthcare (WISH), a nongovernment organization, under a public private partnership model with the Government of Rajasthan. PHCs Bahrawdakalaan and Bhadoti are located in district Sawai Madhopur, and PHCs Bikarni and Mandwa are located in tribal areas of district Udaipur in the state of Rajasthan. The study was prospectively conducted from March 2018 to May 2019 for duration of 15 months.

All deliveries conducted in these four rural PHCs during the afore-mentioned period of 15 months were considered for inclusion in this prospective study. As the objective of the study was to assess the implementation fidelity of partograph use for monitoring active phase of first stage of labour, inclusion criteria were availability of DAKSH for generating digital partograph (one application was made available to each of the four PHCs and one instrument was used as a standby), a cervical dilation of 4 cm to 8 cm (both 4 cm and 8 cm included) at the time of registration in the DAKSH application, and uncomplicated pregnancy based on current clinical condition and past history.

Data collection and analysis

GNMs and medical officers conducting deliveries in each of the four rural PHCs were trained to generate digital partographs using DAKSH application.

A research instrument was developed to capture the study data. Apart from capturing general data pertaining to mother and baby, total number of data points for specific fetal and maternal parameters, as per the extant guidelines of Government of India, fed into the DAKSH application by the concerned GNM for generating the paper partograph were recorded in the research instrument. As DAKSH does not allow filling of any data retrospectively, this information was used to assess the implementation fidelity of partograph use by calculating the percentage of data points for various fetal and maternal parameters captured by the attending GNM for completing the partograph in real-time.

As per the guidelines on the "simplified partograph" endorsed by the Government of India, fetal heart rate (FHR), status of membranes and colour of amniotic fluid, uterine contractions (frequency and duration), and maternal pulse are to be recorded every half an hour whereas cervical dilatation, maternal blood pressure, and maternal temperature are to be recorded every four hours during active phase of the first stage of labour [12]. Data points pertaining to these seven fetal and maternal parameters were used in this study, keeping the objective of the study in mind. An algorithm (Table 1) was developed to feed each of the data points for all these seven parameters into the research instrument.

DAKSH

DAKSH is a tablet-based mobile application that generates digital partograph (Figure 1). It has been developed by JANITRI Innovations Private Limited. It has several benefits over paper partograph including easy to use and time-saving in primary healthcare settings (intrapartum data has to be simply fed into the application-no need of plotting the graphs per se) and no requirement of special interpretation skills (all

Algorithm ONE (for parameters to be recorded after every 30 minutes from the time of registration in DAKSH till the time of delivery):
Maternal Pulse* (at the time of registration in DAKSH):
If no pulse is taken, indicate no data (ND)
If datum has been recorded, indicate the same (along with time)
Maternal Pulse* (after every 30 minutes from the time of registration in DAKSH till the time of delivery i.e., till we get an NA):
If no pulse is taken, indicate no data (ND)
If delivery has occurred before the stipulated time interval, indicate not applicable (NA) and stop the process of data recording after that particular time interval
If datum has been recorded, indicate the same (along with time)
***Repeat this process of data capturing for:**
⇨ Uterine Contractions [frequency along with duration]
⇨ Fetal Heart Rate [FHR]
⇨ Amniotic Fluid [membranes intact (I)/clear (C)/meconium-stained (M)/bloodstained (B)]
Algorithm TWO (for parameters to be recorded after every four hours from the time of registration in DAKSH till the time of delivery):
Maternal Temperature** (at the time of registration in DAKSH):
If no temperature is taken, indicate no data (ND)
If datum has been recorded, indicate the same (along with time)
Maternal Temperature** (after every four hours from the time of registration in DAKSH till the time of delivery i.e., till we get an NA):
If no temperature is taken, indicate no data (ND)
If delivery has occurred before the stipulated time interval, indicate not applicable (NA) and stop the process of data recording after that particular time interval
If datum has been recorded, indicate the same (along with time)
** **Repeat this process of data capturing for:**
⇨ Maternal Blood Pressure [systolic/diastolic]
⇨ Cervical Dilatation

Table 1: Depicting the algorithms that were developed to feed each of the data points for seven fetal and maternal parameters into the research instrument.

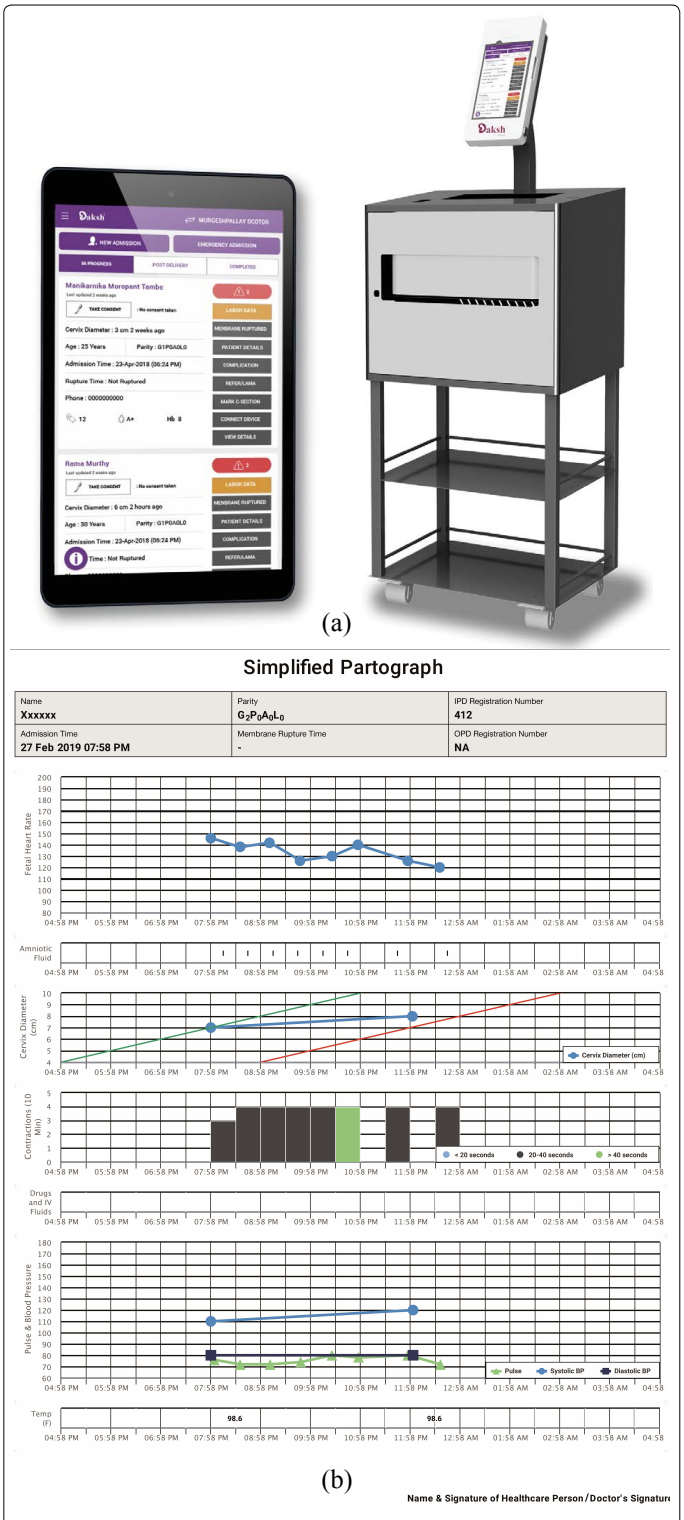

Figure 1 (a and b): The DAKSH application and the "simplified partograph" generated using this application.

interpretations such as crossing of the alert line, fetal distress, etc. are automatically made available by the application by generating different alerts). In fact, DAKSH is an intelligent holistic labour monitoring application consisting of five different workflows: registration, intrapartum record measurement, record of investigations, delivery records, and intrapartum and postpartum referral features.

Ethical Considerations

The institutional ethical committee of LEHS|WISH approved this study (WISH/IEC/2018/1-6). Written informed consent was taken from all the subjects before enrolling them in this study. Those who did not give written informed consent were excluded from this study.

All the extant guidelines of Government of India pertaining to "simplified partograph" were followed during this study. Based on the interpretation of the partograph findings (these interpretations were automatically generated by DAKSH), all high-risk subjects (plotting on the partograph moving to the right side of the alert line, FHR less than 120 beats/min or more than 160 beats/min, etc.) were promptly referred to the first referral unit (FRU).

Results

A total of 251 deliveries were monitored by GNMs (under guidance of medical officers) using the DAKSH application at the four designated rural PHCs (two of these PHCs are situated in tribal areas) during the study period of 15 months between March 2018 and May 2019 (Table 2). Out of these, 69 deliveries occurred at PHC Bahrawdakalaan, 35 at PHC Bhadoti, 13 at PHC Bikarni, and 134 at PHC Mandwa. The mean maternal age was 25.81 years (range: 18-38 years) and the mean maternal weight was 53.88 kg (range: 38-70 kg). The mean maternal haemoglobin level and mean gestational age were 9.38 g/dL (range: 7-12 g/dL) and 37.66 weeks (range: 30-39 weeks), respectively. The average birth weight and the average APGAR score of the new-borns were 2.74 kg (range: 1.70-3.70 kg) and 9.30 (range: 7-10), respectively.

The percentage of data points for various fetal and maternal parameters captured by GNMs at the four designated rural PHCs for generating partograph using the DAKSH application are depicted in Table 3. Extant guidelines in India recommend that partograph be generated using real-time information in at least 90% deliveries in labour rooms [11]. However, in this study, percentage of data points captured in real-time for FHR, status of membranes and colour of amniotic fluid, uterine contractions (frequency and duration), maternal pulse, cervical dilatation, maternal blood pressure, and maternal temperature were 29.63%, 35.32%, 29.36%, 29.45%, 55.06%, 42.51%, and 42.71%, respectively. Notably, implementation fidelity was lowest for capturing real-time information pertaining to uterine contractions (frequency and duration), maternal pulse, and FHR. Out of a total of 251 deliveries, all data points for various fetal and maternal parameters were captured in only four deliveries (two at PHC Bahrawdakalaan, and one each at PHC Bikarni and PHC Mandwa). Thus, in this study, complete paper partographs were generated using real-time information in only 1.60% deliveries.

Discussion

There is substantial evidence to show that partograph, if used as intended, can be effectively employed to bring down maternal and neonatal mortality in developing countries [13-15]. Understandably, extant guidelines in India recommend that partograph be generated using real-time information in at least 90% deliveries in labour rooms [11]. However, our study shows that implementation fidelity of partograph use in primary healthcare settings in Rajasthan, India is abysmally low. This study corroborates the existing evidence that paper partographs are mostly completed retrospectively only for the sake of

Parameter	PHC Bahrawdakalaan	PHC Bhadoti	PHC Bikarni	PHC Mandwa	All Four PHCs
Number of deliveries monitored	69	35	13	134	251
Mean maternal age in years (95% CI)	24.74 ± 3.42 (23.92-25.56)	24.63 ± 2.68 (23.71-25.55)	26.69 ± 3.64 (24.49-28.89)	26.59 ± 4.28 (25.86-27.32)	25.81 ± 3.92 (25.33-26.30)
Mean maternal weight in kg (95% CI)	51.97 ± 5.33 (50.68-53.26)	61.40 ± 6.46 (59.18-63.62)	51.00 ± 2.89 (49.26-52.74)	52.13 ± 3.11 (51.29-52.97)	53.88 ± 6.16 (52.95-54.81)
Mean maternal haemoglobin in g/dL (95% CI)	9.18 ± 0.87 (8.96-9.39)	9.68 ± 0.70 (9.44-9.92)	9.29 ± 1.22 (8.55-10.03)	9.42 ± 0.80 (9.28-9.57)	9.38 ± 0.84 (9.28-9.49)
Mean gestational age in weeks (95% CI)	37.68 ± 0.63 (37.53-37.83)	38.43 ± 5.20 (36.64-40.22)	36.62 ± 1.39 (35.78-37.45)	37.55 ± 1.66 (37.27-37.84)	37.66 ± 2.34 (37.37-37.95)
Mean parity (95% CI)	0.94 ± 0.97 (0.71-1.17)	0.60 ± 1.26 (0.17-1.03)	2.46 ± 1.76 (1.40-3.53)	2.56 ± 2.15 (2.19-2.93)	1.84 ± 1.95 (1.59-2.08)
Mean gravida (95% CI)	2.00 ± 1.02 (1.76-2.24)	1.63 ± 1.26 (1.19-2.06)	3.46 ± 1.76 (2.40-4.53)	3.57 ± 2.14 (3.20-3.93)	2.86 ± 1.95 (2.62-3.10)
Average birth weight in kg (95% CI)	2.80 ± 0.41 (2.70-2.90)	2.80 ± 0.50 (2.63-2.98)	2.79 ± 0.49 (2.49-3.08)	2.69 ± 0.37 (2.63-2.76)	2.74 ± 0.41 (2.69-2.79)
Average APGAR score (95% CI)	9.74 ± 0.53 (9.61-9.87)	9.17 ± 0.66 (8.94-9.40)	9.15 ± 1.21 (8.42-9.89)	9.12 ± 0.94 (8.96-9.28)	9.30 ± 0.87 (9.19-9.41)
CI: Confidence Interval; all continuous variables are expressed as mean ± standard deviation; PHC: Primary Health Centre					

Table 2: Showing details of deliveries monitored at the four designated rural primary health centres using the DAKSH application during the study period of fifteen months.

Parameter		PHC Bahrawdakalaan	PHC Bhadoti	PHC Bikarni	PHC Mandwa	All Four PHCs
Parameters to be recorded every half an hour during active phase of first stage of labour						
Fetal heart rate (FHR)	Data points that should have been captured	261	144	43	676	1124
	Data points that were actually captured	123	31	15	164	333
	Percentage of data points captured	47.13%	21.53%	34.88%	24.26%	29.63%
Status of membranes and colour of amniotic fluid	Data points that should have been captured	261	144	43	676	1124
	Data points that were actually captured	124	31	19	223	397
	Percentage of data points captured	47.51%	21.53%	44.19%	32.99%	35.32%
Uterine contractions (frequency and duration)	Data points that should have been captured	261	144	43	676	1124
	Data points that were actually captured	120	31	15	164	330
	Percentage of data points captured	45.98%	21.53%	34.88%	24.26%	29.36%
Maternal pulse	Data points that should have been captured	261	144	43	676	1124
	Data points that were actually captured	121	31	15	164	331
	Percentage of data points captured	46.36%	21.53%	34.88%	24.26%	29.45%
Parameters to be recorded every four hours during active phase of first stage of labour						
Cervical dilatation	Data points that should have been captured	138	57	20	279	494
	Data points that were actually captured	72	22	8	170	272
	Percentage of data points captured	52.17%	38.59%	40.00%	60.93%	55.06%
Maternal blood pressure	Data points that should have been captured	138	57	20	279	494
	Data points that were actually captured	70	18	7	115	210
	Percentage of data points captured	50.72%	31.58%	35.00%	41.22%	42.51%
Maternal temperature	Data points that should have been captured	138	57	20	279	494
	Data points that were actually captured	68	19	8	116	211
	Percentage of data points captured	49.28%	33.33%	40.00%	41.58%	42.71%

Table 3: Showing percentage of data points for various fetal and maternal parameters captured by general nurse midwives at the four designated rural primary health centres for generating Partograph using the DAKSH application.

compliance with the extant guidelines, and are seldom used as decision-making tools using real-time information, as originally intended [9].

As per the guidelines on "simplified partograph" endorsed by the Ministry of Health and Family Welfare-Government of India, FHR, status of membranes and colour of amniotic fluid, uterine contractions (frequency and duration), and maternal pulse are to be recorded every half an hour whereas cervical dilatation, maternal blood pressure, and maternal temperature are to be recorded every four hours during active phase of the first stage of labour [12]. Out of these seven fetal and maternal parameters, notably, the implementation fidelity in our study was lowest for capturing real-time information pertaining to uterine contractions-frequency and duration (29.36%), maternal pulse (29.45%), and FHR (29.63%).

These results are particularly alarming given the fact that all these three parameters-uterine contractions (frequency and duration), maternal pulse, and FHR-are to be recorded every half an hour during active phase of the first stage of labour. Increasing uterine contractions (intensity, frequency, and duration) indicate adequate progress in labour. Uterine activity may be assumed to be adequate if progress in labor, as defined by progressive cervical dilatation and descent, is occurring. Failure to progress in labor may be due to inadequate uterine contractions. On the other hand, excessive uterine activity, as in

abruptio placentae, may cause inadequate placental perfusion, and thus give rise to fetal hypoxia and acidosis. Besides, whenever it is necessary to induce or augment labor, the caregiver must be aware of uterine activity, as overstimulation could lead to fetal compromise or even uterine rupture [16]. Likewise, continuous monitoring of maternal pulse and FHR is imperative to timely detect intrapartum fetal and maternal distress.

KEYAR, a second-generation e-partograph developed by JANITRI Innovations Private Limited, may significantly contribute towards increasing implementation fidelity in terms of real-time intrapartum monitoring of three parameters namely, uterine contractions (frequency and duration), maternal pulse, and FHR. KEYAR is an affordable, easy to use, and portable labour monitoring device for continuous monitoring of FHR, uterine contractions (frequency and duration), and maternal pulse during intrapartum period in low resource settings. The device automatically monitors all these three parameters in real-time, feeds the data into an e-application to generate partograph, analyses the pattern, and gives colour-coded/sound alerts if foetus or mother is in distress. The analyses are easily interpretable by a low-skilled health worker. Use of KEYAR in primary healthcare settings at the last-mile in developing countries can substantially improve the quality of intrapartum fetal and maternal monitoring.

Disclaimer

The opinions or views expressed in this article are solely those of the authors and do not necessarily express the views or opinions of the organization to which the authors are affiliated.

Conflict of Interest

The authors declare no conflict of interest.

Acknowledgement

The KEYAR project is supported by funds from The Lemelson Foundation (grant award number 18-01464).

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