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Original Research Article

Scaling up DAKSH intrapartum application: impact, challenges, and learning

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ABSTRACT

Background: DAKSH is an intrapartum monitoring application. It is easy to use, saves time and requires no interpretation skills. In spite of all these advantages, using a digital partograph alone will lead to less benefits to healthcare workers. So an application was developed which includes workflows for registering the patients during the intrapartum period by entering their investigation details, updating delivery/referral status and postpartum data until hospital discharge. The partograph is a major component of DAKSH. The main aim of this pilot was to simplify the use of partograph for better labour monitoring, which will help them in making early decisions for taking action for referral or intervention.
Methods: This was a cross-sectional study. Permission to conduct a pilot for one block for 1 year was given by the Karnataka government (2017-18). After the results from the pilot district model were tested out in one district of Karnataka (2019). The pilot phase includes the following components: pre-implementation phase, implementation phase, monitoring and evaluation, regular monitoring through the dashboard and monthly evaluation visit to each health centre. The pre-implementation process was the same for both the block and district levels.
Results: The few learnings learnt during the scaling up includes: the dual burden of work is considered as the main cause of not filling the partograph by staff nurses in DAKSH. Behavioural change was seen during the continuous visits while providing them with secondary training and motivation to use the application. The new kiosk provided with an inbuilt printer increased the printing of case sheets and partographs.
Conclusions: This study concluded that the DAKSH application was developed for labour monitoring in healthcare facilities. The application was developed after proper need validation and feedback from OBGYNs. Further modifications and changes were made in the application from various valid user feedbacks and issues faced during the pilot which improved the user experience and sustainability.

Keywords: Intrapartum, Maternal health, Monitoring, Partogram

INTRODUCTION

The World Health Organization estimates that 5,36,000 maternal deaths occur globally each year out of which 136,000 take place in India. The Maternal Mortality Ratios vary across the states, with the large North Indian states contributing to a large proportion of deaths. Uttar Pradesh and Rajasthan have high rates of fertility and maternal mortality. The geographical vastness and sociocultural diversity across India also contribute to this variation. The status of women is generally low in India. Female literacy is only 54%, and women lack the empowerment to make decisions, including the decision to use reproductive health services.[1]

Maternal health can be defined as the health of women during pregnancy, childbirth, and the postpartum period. Each stage should be a positive experience, ensuring women and their babies reach their full potential for health and well-being. Excessive blood loss, infection, high blood pressure, unsafe abortion, and obstructed labour are the most common direct causes of maternal

injury and death. Timely management by a skilled health professional can prevent most maternal deaths and make the difference between life and death for both the mother and the baby. Every pregnancy and birth is unique in itself.[2]

Maternal mortality is considered a key health indicator and the direct causes of maternal deaths are largely preventable and treatable. All women should have access to antenatal care in pregnancy, skilled care during childbirth, and weeks after childbirth.

The Government of India has now been focusing on initiatives to improve maternal health indicators. In the past two decades, much progress has been made in ending preventable maternal deaths, also the number of women and girls who die each year due to issues related to pregnancy and childbirth has dropped considerably.[3]

The majority of maternal deaths occur because of complications during the intrapartum period and postpartum period of pregnancy. Continuous monitoring during the intrapartum period aids in the early detection and management of any complications, which improves the delivery outcome. If partograph is used appropriately and timely, it helps in the early identification of any complications like fetal distress, obstructed labour and any other maternal problems.[4]

The partograph is established as the "gold standard" labour monitoring tool universally and is recommended by the World Health Organization for use in active labour.[5] A partogram or partograph is a graphical record of maternal and fetal data to assess progress during labour. Relevant measurements also include statistics such as cervical dilation, fetal heart rate, duration of labour and vital signs. The right use of the partograph can help in preventing and managing prolonged or obstructed labour and other serious complications like ruptured uterus, obstetric fistula and stillbirth.[6] Even though the partograph has been utilized for over four decades in obstetric practice, reports of obstructed labour and despite decades of training and investment, implementation rates and capacity to correctly use the partograph, its serious maternal and fetal sequelae have still questioned the efficacy of the partograph.[7]

Competent use of the partograph, especially using newer technologies, can save maternal and fetal lives by ensuring that labour is closely monitored. To address the challenges of using partograph, healthcare systems must establish an environment that supports its correct and continuous use. Health-care staff should be updated by providing training and asking them about the difficulties faced at their health centre, only then the real potential of this tool will be maximally utilized. [8]

Low use of the partograph is consistent with another study from southern India which reported partograph was used at 3.8% of births observed. Studies from other low income and high maternal mortality countries such as Ethiopia Ghana and Tanzania have also reported low knowledge and utilisation of the partograph. These findings indicate problems with pre-service education as well as with in-service training leading to poor competence and non-use of the partograph. The other two common reasons for not using the partograph routinely is staff shortages and the late arrival of women in labour. The issue of staff shortages is a long-standing challenge in many low-and middle-income countries including India.[9] Data across countries has shown that the utilization of partograph is poor despite preparing a tool that is simple and inexpensive for intrapartum monitoring of labour. The lack of preprinted partograph in the health institutions, being a general practitioner, poor knowledge and attitude towards partograph are a few reasons for not using partograph during labour. [10]

The ePartogram is a tablet-based application that is developed to improve care for women in labour by addressing challenges in partograph use. This application is designed to provide real-time decision support, improve data entry, and increase access to information for appropriate labour management. Regular and timely monitoring of maternal and fetal parameters during labour is very important to assess maternal and fetal well-being, normal labour, identifying complications and decision-making to address them in a timely manner. For the last few decades, the World Health Organization has recommended that, during labour, skilled birth attendants use the partograph as a tool to improve documentation of intrapartum maternal and fetal measurements, identify abnormalities, and inform appropriate labour management. So, the use of partograph is very important during labour.[11]

Strengthening service delivery and improving the quality of care during labour and delivery is essential for improving maternal and neonatal health. A WHO study demonstrates promising effects on care and labour outcomes when the partograph is implemented with a clear labour-management protocol. 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.[12] To address documented challenges, the electronic partograph is used on a tablet/mobile, with particular attention to improving ease and efficiency of real-time documentation, increasing visibility of labour management data to healthcare providers to help in decision-making. The electronic partograph is a clinical decision-support tool with algorithms that are based on WHO guidance for managing complications in pregnancy and childbirth.[13]

DAKSH is an intrapartum monitoring application. It is easy to use, saves time and requires no interpretation skills. In spite of all these advantages, using a digital partograph alone will lead to fewer benefits to healthcare workers. So an application was developed which includes

workflows for registering the patients during the intrapartum period by entering their investigation details, updating delivery/referral status and postpartum data until hospital discharge.

The partograph is a major component of DAKSH. It is generated when intrapartum parameters are entered resulting in easier and error-free usage. WHO has removed latent labour from the simplified partograph of WHO but DAKSH includes it to help in a more simplified manner to assist a health care worker throughout labour. This application provides alerts and alarms for a healthcare provider to measure parameters on time, obstructed and prolonged labour which aids in better decision making. This application is not just limited to one user who directly operates the application in one healthcare centre. There can also be 3 or more healthcare providers in a primary healthcare centre with one tablet given to each facility. The logging in option is there in the application for each healthcare facility with one single login. Also, the doctor's name of a particular setting will be included in the login, an SMS will be sent to the doctor with the condition of the patient. Features of the DAKSH application includes digital partograph, a complete end to end documentation, remote monitoring, digital case-sheet, calculating BISHOP and APGAR scores, ROBSON's classification, timely alarms, critical alert system, safe birth checklist, digital consent and referral feature. This application also consists of a dashboard which helps in real-time monitoring and analysis.

METHODS

It was a cross-sectional study.

Permission to conduct a pilot for one block for 1 year was given by the Karnataka government (2017-18). After the results from the pilot district model were tested out in one district of Karnataka (2019).

The pilot phase includes the following components- 1) pre-implementation phase; 2) implementation phase; 3) monitoring and evaluation, a) regular monitoring through the dashboard, b) monthly evaluation visit to each health centre

The pre-implementation process was the same for both the block and district levels.

Pre-implementation phase

During the visit health facility was analysed in terms of population it caters to, number of sub-centres under health facility, first referral unit available and its distance from the health centre, district hospital available and its distance. Staffing patterns were looked at in the matter of the available number of ANM's, ASHA workers, health workers, staff nurses and medical officers, other doctors available etc.

Health facility analysis was done through observations and interviews with various PHC staff like PHC administrators, staff nurses, lady health workers, ANM's, health education officers, medical officers (if available), lab technicians, pharmacists etc.

Following details were investigated- a) A deeper observation of antenatal care, childbirth procedure, immunization procedure, intrapartum care, referrals, management of complications, management of other obstetric emergencies etc. was made. b) Labour room, inpatient ward, laboratory, pharmacy etc. was looked in terms of availability of medical instruments/available emergency drugs/available blood tests etc. c) The referral procedure was investigated more deeply. Information about nearest FRU's (Government and private), availability of ambulances during day and night and time is taken for ambulances to reach health facilities, the functionality of hospital ambulances etc. was obtained. d) A depth understanding of current paperwork for the intrapartum period was obtained. This focused on how a patient is registered. Where the monitoring vitals values are written, how a referral/death of a patient is registered? How ambulance arrival timings are captured? Where and in which format data for reporting is written and reported? How postpartum data is managed? How is home delivery data/delivery on the way data captured? e) Staffing patterns and roles and responsibilities of each staff were understood. f) Also, data on the average number of childbirth and referrals during each month along with their referral reasons in the past year was obtained. g) Based on the number of childbirths and referrals, staff's willingness to take up new technology, accessibility of PHC and availability of internet networks, a health centre was chosen to conduct pilot trials.

Pavagada block

This intelligent labour monitoring tool was implemented in 1 taluk hospital, 2 community health centres, 4 Primary healthcare centres in various parts of Karnataka, India. The pre-implementation stage was completed in 5 primary health care centres, CHC's and one block hospital in Bangalore, India in the year 2017.Maternity ward application was used by many staff nurses, doctors. Administrators also used a dashboard.

For this pilot study, Pavagada block was selected. The hospital considered are listed in Table 1.

Table 1: Hospitals considered for pilot study.

Name of healthcare center	Type of health facility
GH-Pavagada	Block hospital
Tirumani	CHC
Y. N. Hosakote	CHC
K. T. Halli	PHC
Lingadahalli	PHC
Venkatapura	PHC
Mangalwada	PHC

Kalaburagi district

A pre-implementation visit was conducted in Kalaburagi (Gulbarga) District in Karnataka. This includes 1 Kalaburagi District hospital, 1 ESIC medical college, 6 taluk hospitals, 16 community health centres (CHC) and 36 primary health centres (PHC).

The list of health care centres is given in Table 2.

Table 2: List of health care centre in Kalaburgi district.

Type of health facility	Name of health facility	Taluk name
District hospital	Gulburga district hospital	Gulburga district hospital
PHC	Awarad B	
PHC	Dongaragaon	
PHC	Farhatabad	
PHC	Hiresavalgi	
PHC	Kamalapur	
PHC	Mahagaon	
PHC	Shrinivasasaradagi	
PHC	Taj nagar U-PHC	
District hospital	ESIC medical college	-
PHC	Gobbur (B)	Afzalpur taluk
PHC	Karajagi	
PHC	Mashal	
PHC	Revoor B	
CHC	D. Ganagapur	
CHC	Station Ganagapur	
Taluk hospital (TH)	Afzalpur taluk hospital	
PHC	Ambalagi	Aland taluk
PHC	Kadaganchi	
PHC	Korhalli	
CHC	Madanahippargi	
CHC	Narona	
CHC	Nimbarga	
TH	Aland taluk hospital	
PHC	Ainapur	Chincholi taluk
PHC	Chandankera	
PHC	Chimmanachood	
PHC	Kodli	
PHC	Nidgunda	
PHC	Ratkal	
PHC	Saleberranahalli	
PHC	Sulepet	
CHC	Gadakeshwar	
CHC	Kunchavaram	
TH	Chincholi taluk hospital	
PHC	Allur (K)	Chittapur taluk
PHC	Alahalli	
PHC	Kollur	
PHC	Korwar	
PHC	Nalvar- V	
PHC	Pethshirur	
PHC	Ravoor	
CHC	Gundagurthi	
CHC	Hebbal	
CHC	Kalagi	
CHC	Shahabad	
CHC	Wadi	

Continued.

Type of health facility	Name of health facility	Taluk name
TH	Chittapur taluk hospital	
PHC	Ganwar	Jewargi taluk
PHC	Ijeri	
PHC	Jeratagi	
PHC	Mandewal	
CHC	Nelogi	
CHC	Yadrami	
TH	Jewargi taluk hospital	
PHC	Kodla	Sedam taluk
PHC	Kolkunda	
CHC	Malkhed	
CHC	Mudhol	
TH	Sedam taluk hospital	

After pre-implementation, training and implementation were done as follows:

Training and implementation phase

After understanding the basics about the health facility staff involved in conducting childbirth such as staff nurses, ANM's and lady health workers were invited for a training programme at a convenient time and location (usually at the hospital) for them.

A training session was conducted for staff involved in conducting childbirth in presence of doctors (if available). As soon as the training was completed, the implementation was also done.

The implementation phase included training of staff nurses, doctors and administrators and past one-year data collection on childbirth, mortality, morbidity etc.

Training session involved

Participants were explained about our purpose of visit, their views on partograph, current delivery practices, knowledge regarding partograph, training on partograph and Skilled birth training information were obtained.

Basic handling of tablet- inserting sim cards, how to switch on-off the tablet, charging a tablet, basic safety measures to be taken etc. was explained to staff nurses. Since the application works in kiosk mode, staff was also informed regarding this and basic troubleshooting was explained in case the application exists in kiosk mode.

Staff nurses were given a demo of the application followed by two to three demo patients were entered by them to give them a feel of entering patient's data in a digital mode. Their queries were answered and feedback was heard. After all the staff nurses were comfortable handling a tablet and also the application they were given some virtual scenarios like a patient name Xyz, age 30, Hb 7, blood group O -ve, primi, membrane ruptured 1 hour before admission, amniotic fluid is meconium has to be admitted and based on alerts and alarms data has to be entered or decision to be made.

Each staff nurse had to enter 5 to 7 virtual scenarios depending upon available time. After this, a role-play was performed in which the trainer became a pregnant lady and the staff nurse had to decide the scenario, admit the patient and check parameters according to alarms and take decisions based on alerts. In between staff, nurses had the freedom to see her OPD patients, perform her paperwork etc. this was done to give them a virtual feel of how an application will remind them in form of alarms and alerts even though they are busy without patients and other OPD works.

Staff nurses were asked to practice more patients depending on their interests and available time. In some of the healthcare settings, childbirth was observed during the training phase. This was an additional benefit for staff nurses since it enabled them to register a real-time patient and to understand data monitoring alarms, alerts, referral procedures etc. for a pregnant woman. During this time staff nurses could also provide her feedback regarding real-time application usage.

At the end of the training session feedback from every staff nurse/staff involved in conducting childbirth was taken.

PHC admin's and medical officers (if available) were trained on viewing their PHC data on the dashboard and doctor's application. If any childbirth was being conducted during training, administrators were shown how they can view patient details, parameters being checked through the dashboard even if they are not in the hospital. They were also told about various other features of dashboard-like to check data on monthly basis, to extract abstracts for monthly reporting, to get print of patient records etc. medical officers were also informed about the message they get on their phones as soon as a patient is registered so that they are informed and can follow up wherever necessary. The medical officer's

feedback regarding the doctor's message was taken. Also, feedback about the dashboard was taken for improvisation.

Implementation

Implementation was done at each healthcare setting. The implementation was first done in taluk hospital and at hospitals under that taluk after that training was given. The same was followed for all the taluks. We tried to keep the difference between training and implementation, not more than 2-3 days.

Following activities were carried out during implementation:

The device was already sent to healthcare settings before implementation. The device setup was done at the appropriate place in the labour room.

Staff nurses who could not attend the training were also trained.

The entry of the last delivery was made into the application by the staff nurses and their queries were cleared. At some place's MOs were present.

Some healthcare settings could not come to training sessions. So, training for them was done at the hospital itself during implementation.

Posters were also placed in hospitals that were in the Kannada language.

Figure 1: Images of the tool; A) Pavagada block pilot kiosk with tablet, B) Kalaburagi district pilot kiosk with tablet and inbuilt printer.

Monitoring and evaluation

Regular monitoring was done on a daily basis through a dashboard. The healthcare settings were visited by field coordinators regularly after implementation.

RESULTS

Pavagada block

Data taken into analysis consideration for Pavagada block was for a period of one year (From September 2017-September 2018).

A total of 1614 patients got registered into DAKSH during this period.

Patients arriving at full cervical dilatation

Full cervical dilatation is considered "when a mother arrives at a healthcare centre with cervical dilatation 8 cm or more than 8 cm".

Out of 1614 mothers registered, around 45% (n=721) arrived at full cervical dilatation.

Data monitoring alarms

DAKSH provides alarms to ensure protocol adherence according to standard WHO protocol for active and latent stages of labour.

Analysis for data monitoring protocols was run for a total of 898 patients. Out of which analysis was generated for 736 patients. Data shows that 77 percent of mothers were provided labour monitoring according to standard protocols.

Complication alerts

The application provides various alerts in case of any complications to help staff nurses in decision making.

A total of 1282 alerts were generated by the application and out of that 17 mothers were referred.

Referral statistics

A total of 239 patients were referred using DAKSH. Out of that 219 mothers and 20 neonates were referred to a higher facility.

During the pilot study, the most common referral reasons for the mother were premature rupture of membrane, anaemia, cephalo pelvic disproportion etc. Other referral reasons include PIH, obstructed labour, PPH, retained placenta etc. The most common referrals of neonates were due to birth asphyxia and low birth weight.

Kalaburagi district

Data taken into analysis consideration for Kalaburagi District is for a period of 8 months (From April 2019-November 2019).

A total number of 17,475 were registered at healthcare facilities, out of them, 11689 (67%) patients got registered into DAKSH during this period.

Data monitoring alarms

Data shows that 56 percent of mothers were provided labour monitoring according to standard protocols.

Complication alerts

A total of 10025 alerts were generated by the application and out of that 17 mothers were referred.

Referral statistics

A total of 3324 patients were referred using DAKSH. During the pilot study, the most common referral reasons for mothers were amniotic fluid is meconium, blood pressure, anaemia etc. Other referral reasons include PIH, obstructed labour, premature rupture of membrane etc. The most common referrals of neonates were due to birth asphyxia and low birth weight.

Qualitative feedback was taken from staff nurses during the visits.

The application is very user friendly and alarms also helped during the busy schedule of staff nurses.

"*For a smartphone user this application is very easy to use and we can use it with almost negligible training*"

"*During busy OPD's alarms play a very important role to notify regarding the patients but sometimes these alarms are ignored by the staff nurses because of busy schedules*".

Table 3: Challenges faced at block level.

Challenges faced	Actions taken
Technical factors	
As the application was in the developmental stage, a lot of technical issues and bugs were faced, Update of the application was done manually	Update application feature was added for small bugs faced
Security concerns regarding the Application handover feature among the healthcare workers	A four-digit security pin was created for each staff member
Printing of case-sheet and partograph was not happening because of the lack of printers in the hospitals and they faced issues while taking out printouts from the dashboard	A new kiosk was designed in such a way that the printer was included in it for easy printing of case sheets and partographs directly by the application
Current alarms were not audible sometimes	The voice of alarms was then changed and the volume was kept on maximum with no option to reduce it
Social factors	
Due to lack of staff and dual burden, the referral feature was not used properly in district hospitals	The UI of the application was changed to make the application easier to use. They were trained to view monthly reports for their reporting purpose. Hospital administrators were trained to print case sheets and keep them for record keeping using dashboard
Behavioural issues for the use of the app were there	To overcome this, in every visit secondary training was provided to motivate them
Limited usage of DAKSH such as patient's being registered after the childbirth due to full dilatation while coming to the hospital	Emergency button was added, so that the entry of the women with full dilation can be entered in minimum time (in one click)

Table 4: Challenges faced in district level.

Challenges faced	Proposed action
Technical factors	
Consent forms were not used because the digital signature and thumb impression was disabled.	Will try to enable thumb impression and an option for printing consent form
In many Healthcare settings, papers were not provided for printing even after installation of the printers	The concerned department will be requested to provide papers
Few bugs and technical issues were found which were resolved by an automated update of the application	Automated update of the application
Social factors	
Behaviour and Interest regarding the device was the main challenge faced during the pilot	Will make a more robust training plan
Not Registering all entries and referrals were not followed properly due to the dual burden of work	In higher healthcare facilities where a load of delivery was high along with low patient staff nurse ratio. For this

Continued.

Challenges faced	Proposed action
	we can provide one tablet per bed to reduce the work
Poor device-related and clinical knowledge at some healthcare settings	Will make a more robust training plan along with some clinical training
Dashboard	
People on the post of administration like RCHO, DHO etc., were facing issues to see the data in real-time as the dashboard is only available in the web version and it is difficult for them to view it during travelling	A mobile application for the dashboard can be developed to overcome this. So that data can be seen in real-time to take early and real-time action based on statistics

There were some feedbacks given by the users which were incorporated in the district level model like consent form, doctor's note, postpartum monitoring and minor changes in the application.

Learnings

The dual burden of work is considered as the main cause of not filling the partograph by staff nurses in DAKSH.

Behavioural change was seen during the continuous visits while providing them with secondary training and motivation to use the application.

The new kiosk provided with an inbuilt printer increased the printing of case sheets and partographs.

DISCUSSION

DAKSH application was developed for labour monitoring in healthcare facilities. The application was developed after proper need validation and feedback from OBGYNs. Further modifications and changes were made in the application from various valid user feedbacks and issues faced during the pilot which improved the user experience and sustainability.

The aim of this pilot was to simplify the use of partograph for better labour monitoring, which will help them in making early decisions for taking action for referral or intervention. Along with the partograph the other feature includes complication alerts, referral system, antenatal history, laboratory investigations, postpartum monitoring, various scores like APGAR and all the important documents required from the time of admission till the discharge of the patient.

Feedback from users indicated that they were more comfortable with the use of new technology than paper. The pilot conducted in Pavagada block showed promising results towards labour monitoring by DAKSH and then it was scaled up to Kalaburagi district, which also showed probability to provide better labour monitoring, patient care and documentation which in turn will decrease the work burden.

It was seen that DAKSH was not used properly due to lack of staff and dual burden of work. This was seen in facilities with high delivery load or poor patient staff nurse ratio which resulted in less acceptance of referral cases. Dual work can be removed with the permission of the government to replace the pen filled case sheets with DAKSH filled printed case sheets.

CONCLUSION

More research can be conducted to build a more robust labour monitoring system that will remove the barriers for completion of partograph and documentation from the time of admission till the discharge.

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