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# Advantages of "Life Curve" Mobile Application: An Easier Alternate of Paper Partograph

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**Summary:**

***Background:*** *The WHO approved paper Partograph is a time tested tool for monitoring the progression of labour to reduce life-threatening complications during labour as well as maternal mortality and morbidity. However, inept manpower for recording and interpreting data, chance of retrograde plotting and limited scope of distance monitoring have become a significant barriers to use this tool. The 'Life Curve', an Android Apps, is put forward as an easier alternate of the paper partograph.*

***Objective:*** *To see the advantages of the 'life curve mobile application': an Android apps which support any Android operating system. It is a new tool based on WHO partograph to monitor the progression of labor with automatically generated interpretation. Early warning and alarm system is included here for creating an opportunity of early referral and intervention.*

***Method:*** *A cross sectional study was conducted in Department of Gynaecology and Obstetrics, Sir Salimullah Medical College & Mirford Hospital from December 2016 to May 2017 on 30 mothers admitted with labour pain. Labor and all other parameters were recorded and monitored by using "life curve" mobile application along with paper partograph. The research protocol including the ethical clearance was approved by Bangladesh Medical Research Council. It is part of the feasibility study of the "life Curve" mobile application.*

***Results:*** *Mean age of the subjects was 25.9±5.7 yrs, mean gestational age 39.6±.9 wks, and 83% had vaginal delivery. The apps is easy to fill up, automatically generates graph, interesting to work with, provides timely automated reminder to evaluate the parturient, generates digital color coded warning figures, sends automated text message to the supervisor in abnormal situation. The performance parameters were scored in a 1-5 scale. For comparing the advantages of using these two partographs, nine features were compared with a total score of 45. Total score for live curve has 42.7 and that for paper postograph was 19.52 the difference is highly significant (p=.001). The mean±SD score of life curve (4.74±.52) was statistically significantly higher than that of paper partograph (2.17±1.18): p<.0002.*

***Conclusions:*** *The life curve mobile application is found to be a easier tool for monitoring of labour with many advantages; and can be used as an alternative of paper partograph.*

***Key Word:*** *E parotograph, Mobile apps Paragraph, Life Curve Mobile Application,*

## Introduction :

On the average 230 women die per every 100,000 live births every year in developing countries.[1] Though Bangladesh has significant achievement in reducing maternal mortality ratio but there are about 194 maternal deaths per 1000 live births (BMMS 2010).[2] Obstructed labour is one major cause of maternal mortality and usually results from neglected prolonged labour.[2]

The partograph as a graphic assessment is recommended for routine monitoring of the first stage of labour to help the birth attendant identify abnormalities of labour including slow progress of

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labour and prevent prolonged labour and its complications. Originally called the Friedman's curve, the partograph was designed by Friedman in 1954 following a study on a large number of parturients in the USA[3]. It was further improved by Philpott and Castle who introduced the alert and action lines to facilitate interventions during labour[4]. Since then several types of partographs have been developed in various countries to suit local needs [5-7]. The utilisation of the partograph is considered one of the vital steps to ensuring high quality care of both the mother and the newborn during labour. Despite more than 50 years of training and investments in the partograph in low-resource settings, implementation rates and provider competencies remain still low. The reason of underutilization of partograph is the less efficient health care system rather than deficiencies in the tool itself. Several major challenges are identified for underutilization of Partograph. Overburdened health systems like Bangladesh are often unable to supply the administrative and organizational support needed for proper and consistent use of the partograph. Shortage of trained personnel who are competent in labor management and inadequate referral systems for women in labor who experience complications are obvious in low resource countries. Moreover, the tool itself may present difficulties for health providers because they lack the underlying knowledge and skills that it requires. Trainers and supervisors must recognize that, while the partograph appears to be simple, it assumes a foundation of knowledge and skills in assessment of labor, gathering of data, presentation and interpretation of data are also essential. Some of the challenges include a shortage of trained staff leading to increased workload, inadequate finances to pay for materials to print out paper partographs, lack of staff motivation or inadequate knowledge on how to correctly fill out and use the partograph, an overwhelming amount of paperwork and lack of supportive supervision. Because of these obstacles, health workers expressed enthusiasm about replacing the paper partograph with the digital one.

A number of digital partograph has been developed. These are mainly of three types:

**Tablets:**

This type are dedicated electronic handheld devices similar to tablets, specifically designed to support electronic partograms. The WHO partograph is made into a tab so that it can be filled up digitally and a tab may contain a number of partographs together.[8]

Jhpiego and the Johns Hopkins Center for Bioengineering Innovation and Design (JHU-CBID) have developed the ePartogram, a handheld device and software platform based on the current partogram recommended by the World Health Organization.[9]

**Partopen**

Here a paper partograph is used in combination with electronic digital pen. Heather Underwood of the University of Colorado, Boulder in the U.S. has developed and field test an interactive digital pen that works in conjunction with the partograph, a widely adopted labor monitoring graph, to validate data entered on the graph and provide alerts to health care workers regarding conditions that need additional observation or intervention.[10,11]

**Mobile Application or Apps**

It is a web application for wider range of devices with only a web browser is required. Through support from the CICF, Save the Children is piloting a project introducing digital partographs into health facilities in Bungoma County.[12] Another mobile apps mLabour has been developed and tested in India.[13]

**'Life Curve' mobile application**

To explore an easier, efficient and cost effective tool for monitoring of labour as an alternative of paper partograph the invention of "life curve mobile application" opened a new horizon. This is a mobile application by which health professionals can fill up the partograph easily. It contains all the essential parameters of monitoring labour along with keeping storage of information regarding multiple patients at a time. This application will analyze all the inputted data and draw a color pictogram accordingly. This pictogram demonstrate the condition of mother and baby by three colors: red, yellow and green: where red indicates 'critical', yellow 'necessity of close observation' and green 'safe condition'. Any critical condition of mother and or baby will generate an automated SMS which will be sent to desired

professionals (the person who is monitoring labour and the supervisor) instantly. This message provides information about the patient and her condition. An alarm system has been incorporated to remind the professionals to give timely input in partograph. This tool can identify problem of specific parameter which can be checked by touching pictorial view. Traditional graphical analysis can also be viewed by same manner. Scopes of a quick view of all the parameters are also available. To register the outcomes of the patient like caesarian section or further steps can be done by pressing stop notify option. By using mobile network the whole data can be sent to remote supervisor which made an opportunity to ensure more accountability and distant monitoring. The collected data in the distant monitor can be used to anlyse the usefulness of the partograph, working capacity of the heath service provides and can be used for research purpose.

Life curve" is mainly an Android apps which support any Android operating system from version 4.4(KitKat) or above. Programming language is Java and written in Android studio. And it keeps it's apps data in Firebase, a mobile and web application development platform.


**Fig.-1:** *Smart phone screen showing the Life curve app.*

The objective of this study is to find out the advantage of using life curve mobile application in comparison to paper partograph.

**Methodology:**

A cross sectional study was conducted in the Department of Gynaecology and Obstetrics, Sir Salimullah Medical College and Mitford Hospital (SSMC&MH) over a period of six months, from July to December 2016, on 30 pregnant patients admitted with labor pain. Non probability purposive consecutive sampling method was used to select sample population. Four doctor was trained on both the WHO partograph and Life Curve mobile apps. A structured data collection instrument was developed for data collection. Data were collected from the mothers who are in labor and parameters were recorded by using

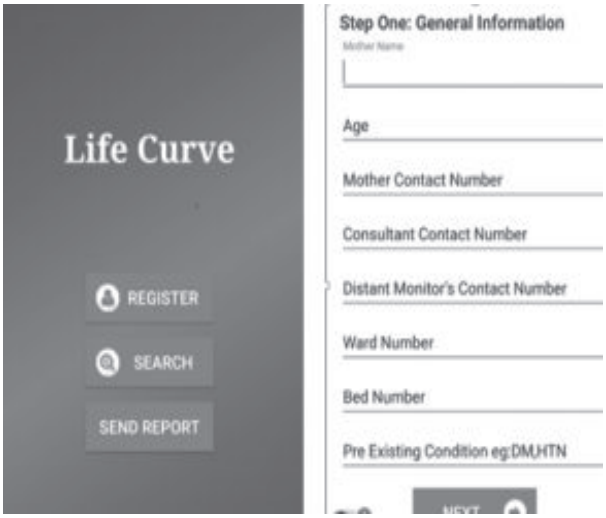


**Fig.-2:** *First page of the paragraph starting with registration of the Patient.*


**Fig.-3:** *Pictorial colour coded demonstration of condition of the mother and fetus in 'Life Curve' on the screen of the smart phone*

"life curve" mobile application along with paper Partograph. The questionnaires were used after verbal consent of the respondents. Socio-demographic characteristics were also be obtained. The users of partographs were interviewed to find out the problems and advantages of using both paper and e partograph.

Data were analyzed in SPSS 16 version. Collected data were sorted, cleaned, and analyzed by an experienced statistician. Data collectors / interviewers were adequately trained regarding the confidentiality & proper operating technique of this tool. Data were collected in a mobile application of an android mobile "Walton Primo F3i". The ethical clearance was obtained from Bangladesh Medical Council along with approval of study protocol.

**Results:**

The Socio-demographic features of the patients in labour and comparison of different components and features of both life curve mobile application partograph and WHO modified paper partograph were calculated and tabulated.

Table I shows the socio-demographic status and outcome of pregnancy of the study subjects. Mean age was 25.9± 5.7 yrs. Mean years of education was 3.5± 2.1 yrs. Average monthly income was around 1023 ±271 taka meaning they were from lower socio economic status. Mean parity was 1.73 ± 1.32 (range 0-5), mean gravidity was 2.86 ± 1.48 (range 1-7) ; mean gestational age was 39.63± .91 weeks. APGAR score of the baby at one minute was 8.93± .56 and at 5 min was (9.9± .41). All patients were admitted with spontaneous labour. Most of the pregnancies were uncomplicated. Only two patients presented with PROM, two with gestational hypertension, one with anaemia, one with pre-eclampsia & IUGR and one with severe pre-eclampsia. Normal vaginal delivery was 25 (76.7%), forceps delivery was 2(6.6%) and 5 (17%) were delivered by caesarean section (table-II).

For expressing different aspects of advantages of the modified WHO paper partograph and life curve mobile application a number of scoring systems were formulated. The users of partographs (trained doctors) were asked to respond to particular aspect on this scale (table-III).

**Table-I**

*Distribution of study subjects according to Demographic variables (n=30)*

| Variable | Mean | SD | Range |
|---|---|---|---|
| Age (In completed years) | 25.9 | 5.73 | 20-40 |
| Education (in years) | 3.5 | 2.13 | 0-7 |
| Monthly family income (Taka) | 1023.00 | 271.00 | 5000-20000 |
| Occupation, housewife | 100% | | |

**Table-II**

*Distribution of study subjects according to Obstetric and neonatal variables (n=30)*

| Variable | Mean | SD | Range |
|---|---|---|---|
| Para (no) | 1.73 | 1.32 | 0-5 |
| Gravida (no) | 2.86 | 1.48 | 1-7 |
| Gestational age (weeks) | 39.63 | .91 | 36-41 |
| Apgar score (1 min) | 8.93 | .56 | 7-10 |
| Apgar score (5 min) | 9.9 | .41 | 8-10 |
| Spontaneous labour | 100% | With: PROM-2, Gestational Hypertension-2, Anaemia-1, PE & IUGR 1, Severe PE-1. | |
| Mode of Delivery | NVD-23(76.7%)<br>Forceps-2(6.6%)<br>CS-5(16.7%) | Indication of CS:<br>Fetal distress=4<br>Persistent Occipito-posterior position=1 | |

**Table-III**

*Advantages of using life curve mobile application over Paper Partograph*

| SINO | Advantage | Score (Score=45) (Scale of 0, Poor/ not available-5,Best/ Always available) | | P Value* |
|---|---|---|---|---|
| | | Paper Partograph | Life curve mobile application | |
| 1 | Low-Cost Technology Solution | 3.16 | 3 | |
| 2 | Facilitates broader use | 3.58 | 5 | |
| 3 | Provides instant graphing of data | 3.58 | 5 | |
| 4. | Provides pictorial color coded figures | 1 | 5 | |
| 5 | Reminds providers when to record critical observations | 1 | 5 | |
| 6 | Provides indicators when complications arise | 3.06 | 5 | |
| 7 | Stores multiple patient data in one device | 1 | 5 | |
| 8 | Limits retrospective data entry after delivery | 1 | 4.12 | |
| 9 | Transmits data to off-site experts who can provide guidance and support | 1 | 5 | |
| | Total Score=45 | 19.52 | 42.7 | <.001 |
| | Mean±SD | 2.17±1.18 | 4.74±52 | <.0002 |

*Unpaired Student's t test

A five point scale was developed. '1' means "poor or not available" and '5' means "best or always available".

For comparing the advantages of using these two partograph nine features were compared with a total score of 45. The total score of life curve (42.7) was much higher than that of paper partograph (19.52), P<001 Mean+SD of life curve (4.74±.52) was statistically significantly higher than that of paper partograph (2.17±1.84), p value <.0002 (table-III)

The users felt that the cost of both the partographs are the same. The Life Curve facilitates broader use; and provides instant graphing of data in addition to the immediate production of pictorial color coded figures. It reminds providers when to record critical observations, and goes on providing reminder by warning sounds to perform the unfinished work. It provides immediate and spontaneous indicators when complications arise as soon an abnormal data is entered.

In this life curve mobile apps partograph / data of multiple patients can be stored in one device. It limits retrospective data entry after delivery: this was a major disadvantage of paper partograph. It transmits data to off-site experts who can provide guidance and support. In addition these data can be linked to a central/ distant sever, so that the data can be used for supervision, monitoring, quality control and research.

**Discussion:**

This innovative work was done to redefine and simplify partograph and to make it simple to learn, user friendly and reducing training time and cost. To make partograph more convenient the "Life Curve" is developed. It is an Android apps which support any Android operating system from version 4.4(KitKat) or above. Programming language is Java and written in Android studio. And it keeps it's apps data in Firebase, a mobile and web application development platform.

Main motivation for developing this application is to simplify partograph. For any healthcare professional it will only take 5-10 minutes to learn it. For new comer it is much easier than paper partograph to learn. Moreover newcomers (e.g. midwives) can work under active supervision of expert ones though he/she is miles away from delivery site. It will also keep it's records more organized way so that it will helpful in decision making more efficiently at both individual and organization level.

A cross sectional study was conducted in Department of Gynaecology and Obstetrics, Sir Salimullah Medical College & Mitford Hospital from December 2016 to May 2017 on 30 mothers admitted with labour pain and all other parameters were recorded and monitored by using "life curve" mobile application along with paper partograph to see its feasibility including the advantages.

Study shows that "Life Curve" is more frequently used than corresponding paper partograph and simpler to use. For healthcare professionals it is much easier to learn than paper partograph, distant monitoring of partograph by experts was possible, retrograde filling up was prevented, artificial intelligence interpreted partograph and helped in decision making.

"Life Curve" has potential to be a universally used partograph with promising future including centralized data management for better and efficient planning. A digital partograph will reduce the bulk of paperwork by summarizing data on the tab. It will also help to improve the system through timely referral and easy supervision.

The users felt that though apparently the cost of a smart phone or tab is higher, this app can be used by any health service provider in his or her own mobile phone. Otherwise a tab or a smart phone, which costs about bdt 2500.00 n( (USD 30) can be purchased for the labour room, which can be used for hundreds of partographs. The cost actually is for internet service, which is only necessary to warn the distant supervisor or to send data to the central server. These later two are optional. More than 87 percent households in Bangladesh own mobile phones, shows the survey conducted in 2013 by Bangladesh Bureau of Statistics. It also says 4.8 percent households have access to internet.[14] Bangladesh has seen a rapid growth in mobile handset market, especially in smartphone segment, since 2013. Of the total mobile phones, 30% are smartphones and the rest are basic phones.[15] So, use of smart phone health service providers is possible.

**Conclusions:**

The life curve mobile application is found to be a easier tool for monitoring of labour with many advantages; and can be used as an alternative of paper partograph.

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