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mLabour: Design and evaluation of a mobile partograph and labor ward management application

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Abstract

This work describes the design and preliminary evaluation of mLabour, a mobile application that aims to reduce death and injury in childbirth. mLabour incorporates a digital partograph and workflows to support labor ward management. This digital application reduces some of the barriers that prevent the partograph, a paper tool that has been shown to improve labor outcomes, from being fully utilized. We discuss design tradeoffs made during implementation, largely driven by prototype testing with labor ward nurses. We then discuss the results of a preliminary study of the application's usage, which suggests that mLabour has promise as a tool to improve patient care.

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1. Introduction

Annually, direct obstetric causes result in 210,000 maternal deaths during pregnancy, childbirth, and the post-partum period [3]. Prolonged and obstructed labor ranks high among these causes. In India, this accounts for at least five percent of maternal deaths, and it is doubtless involved in more cases where obstructed and prolonged labor occurred but was not listed as the proximate cause of death [5, 6].

The partograph, a paper tool for recording clinical data during childbirth, has demonstrated a reduction in obstructed labor when used to track patients [9]. Endorsed by the World Health Organization (WHO), the partograph is a single-page set of graphs and tables of measurements to be filled out during labor. The tool provides a standard structure for the most relevant patient data, and its graphs visualize the progression of labor, making prolonged labor more apparent.

Despite being a powerful tool, the partograph's complexity can be difficult to fill out and to interpret. The WHO in 2008 released a simplified version of the partograph. (see Appendix A). In 2011, Engender Health's Fistula Care and Maternal Health Task Force named the partograph's complexity a major barrier to its usage [5, 6]. The task force's report also discussed facility-level challenges such as high staff turnover and insufficient supervision. More broadly, gaps in the health system - such as protocols that do not involve the partograph, and the limited availability of emergency care during childbirth - prevent the partograph from being used effectively [2]. While improving the partograph itself will not address these larger forces, it could make significant inroads into the complexity problem. mLabour joins other recent efforts [7] to modernize the partograph and increase its effectiveness.

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2. mLabour, a mobile partograph and labor ward management application

A digital partograph could improve on its paper counterpart in several ways:

- Efficiency: Graphs could be generated by the application, rather than plotted by hand.
- Error reduction: Necessary measurements could be required, and all measurements could be validated against expected ranges.
- Usability: A digital device could incorporate color, animation, and sound, presenting opportunities to better present data and more strongly emphasize abnormal conditions.

Even with these advantages, a digital partograph, like the paper partograph, would provide limited value if used in isolation. We developed a mobile application, named mLabour, which wraps a digital partograph in a set of workflows for registering, updating, and resolving maternal cases. This work builds on a paper published during an earlier period of mLabour's development, which describes the formative research and early prototype testing in greater detail [4]. This work adds a discussion of design tradeoffs made during the process and of the results of a preliminary study of the mLabour application.

2.1. A mobile partograph

The partograph is a core component of mLabour. It is generated as the user enters exam measurements, eliminating tedious and error-prone manual graphing. It appears before every exam and is accessible at all times, one tap away from the application's main work screen.

2.2. A labor management tool

mLabour's primary work screen is a list of patients, which automatically refreshes every minute, sorted by priority - a calculation based on how soon the next exam is due, whether or not the patient has a high-risk history, whether or not the patient has been flagged by staff as needing extra attention, and if the patient's labor is progressing at a dangerously slow rate. Each patient's most critical demographic and clinical information is summarized on a tile, with icons representing unusual situations: emergency situation during labor, high risk history, overdue exam, or manual flag set by a user (see Figure 1).

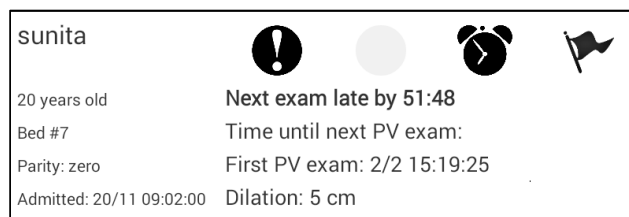


Fig. 1. Summary tile for a sample patient

The application contains four primary workflows:

- Registration: The patient is added to the application. This form includes identifying data, an obstetric history, and a screening for high risk factors.
- Record Measurements: Quantitative measurements taken during an exam. This form powers the partograph. This workflow also includes deciding when to next check on the patient, which sets an alarm.
- Notes and Flags: These act as a fallback for information not captured in the more structured Record Measurements form. Here, a user can add or remove a tag indicating that the patient needs special attention. A free text field captures the details of the situation.
- Post-labor resolution: The application includes one form to record a delivery and another to document a patient transfer to another doctor or facility. Resolved cases are removed from the main list of active patients but retained on the device until explicitly closed.

A handful of secondary workflows, such as the ability to update registration information, support these core workflows. In addition to the data entry and partograph generation, the application's ability to ring an alarm when a patient is overdue for an exam was a major piece of functionality.

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