International Scientific Journal of Engineering and Management (ISJEM) ISSN: 2583-6129
Volume: 05 Issue: 05 | May – 2026 DOI:10.55041/ISJEM07342
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata

Maatrisakhi: An AI-Based Maternal and Child Healthcare Companion for ASHA Workers

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ABSTRACT

Maternal and child healthcare continues to face significant challenges, particularly in rural and semi-urban regions where access to timely medical services and expert guidance is limited. Frontline healthcare workers, such as ASHA and Anganwadi workers, play a crucial role in monitoring maternal and neonatal health. However, their efforts are often constrained by manual data handling, lack of real-time insights, and limited technological support. This survey paper reviews recent advancements in the application of artificial intelligences and digital health systems for maternal care, focusing on risk prediction, health monitoring and decision support tools. Existing studies highlights the use of machine learning techniques for identifying high risk pregnancies, tracking vital health parameters, and improving early intervention strategies. Additionally various mobile- based healthcare solutions have been explored to enhance data collection, patient tracking, and communication between healthcare providers and beneficiaries. Despite these developments, several challenges remain, including usability issues, lack of multilingual and voice-enabled interfaces, and difficulties in ensuring continuous care from pregnancy to postnatal stages. This paper identifies these research gaps and discuss the need for an integrated, user-friendly system that supports healthcare workers in real-time monitoring, risk assessment, and follow-up care. The survey further emphasizes the importance of combining AI -driven analytics with features such as voice interaction, automated alerts and immunization tracking to improve healthcare delivery. By analyzing existing approaches and their limitations, this study provides a foundation for developing more efficient and accessible maternal and child health care support.

Keywords:

Maternal Healthcare, Child Health monitoring, Artificial Intelligence in Healthcare, High-Risk Pregnancy Prediction, ASHA worker, Mobile Health, Immunization Tracking, Voice-Based Interfaces

INTRODUCTION

Maternal and child health is a critical component of public healthcare systems, particularly in developing countries where access to quality medical services is often limited. In rural and semi-urban areas, challenges such as shortage of healthcare professionals, lack of awareness, and delayed medical intervention contribute to increased risks during pregnancy and childbirth. Ensuring continuous monitoring and timely care for pregnant women and newborns remains a significant concern.

In India, frontline healthcare workers like ASHA (Accredited Social Health Activist) and Anganwadi worker play an essential role in delivering basic healthcare services at the community level. They are responsible for monitoring maternal health conditions, maintain records, and ensuring immunization and postnatal care. However, their work largely depends on manual data entry and traditional methods, which can lead to errors, inefficiencies, and delays in identifying high-risk cases.

With the rapid advancements of technology, Artificial intelligence (AI) and mobile health (M health) solutions have emerged as promising tools to improve healthcare delivery. Several research studies have explored the use of machine learning algorithms for predicting high-risk pregnancies, monitoring vital health parameters, and assisting in clinical decision-making. Additionally, mobile-based applications have been developed to support data collection, patient tracking, and communication between healthcare providers and patients. Despite these advancements, existing systems often face limitation such as lack of user-friendly interfaces, minimal support local languages, and inadequate integration of maternal and child healthcare services. Many solutions focus only on a specific stage of care and do not provide a complete continuous support system from pregnancy to postnatal monitoring.

This survey paper aims to analyse and review existing research and technological solutions in the field of maternal and child healthcare, with a focus on AI-based decision support systems and mobile health applications. It identifies key methodologies, advantages and limitations of current approaches and highlights the need for an integrated, intelligent and accessible system that can assist healthcare workers in providing efficient and timely care.

LITERATURE REVIEW

1)Mobile-Based EHR Companion for ASHA Workers in Low-Internet Area

This work presents a mobile-based Electronic Health Record (EHR) system aimed at supporting ASHA workers in rural regions where internet connectivity is limited. The application is designed with an offline-first approach, allowing health workers to register beneficiaries, maintain maternal and child health details, monitor immunization schedules, and record home visits without depending on continuous internet access. All the data entered is stored locally on the device and later synchronized with a central server when connectivity is available. The system also provides features such as multilingual support, secure authentication, alert notifications, and reporting dashboards to assist healthcare authorities in effective monitoring.

The system mainly concentrates on digitizing records and managing data efficiently, and does not incorporate advanced AI techniques for predicting high-risk pregnancies or providing intelligent decision support. In addition, it does not include voice-based interaction or real-time health guidance for ASHA workers.

2)The Role of Artificial Intelligence in Enhancing Maternal and Child Health Through Digital Health Initiatives in Resources-Limited Settings

This study focuses on how artificial intelligence and digital health technologies can improve maternal and child healthcare, especially in areas with limited resources. It explains the use of AI in predictive analysis, telemedicine, mobile health applications, wearable devices, and early detection of complications such preeclampsia and preterm birth. Overall, the study shows that these technologies can help in better diagnosis, continuous monitoring, and improved access to healthcare services for both mothers and infants.

However, many of the solutions discussed are still at a theoretical level or in early stages of development and are not widely implemented in real-world healthcare systems.The study also highlights challenges such as poor infrastructure, limited internet access, lack of technical knowledge among healthcare workers, and data privacy issues.

3) Prediction of High-Risk Pregnancy Using Machine Learning Algorithms

This work focuses on predicting high-risk pregnancies using machine learning techniques based on maternal health data. It applies algorithms such Logistic Regression, Decision Tree, Random Forest, SVM, XG Boost, and Multilayer Perceptron (MLP), with MLP giving the best performance. The model uses parameters like age, blood pressure, glucose level, and heart rate to classify risk levels and support early detection of complications.

However, the system mainly focuses on prediction and does not support real-time data collection or practical use field conditions. It also lacks feature like voice input and offline support.

4) ASHA Bot: An LLM-Powered Chatbot for Community Health Workers

This study presents ASHA Bots, an AI-powered chatbot designed to support ASHA workers by answering their healthcare-related questions. The system is integrated with WhatsApp and uses a large language model (LLM) to provide instant responses based on medical knowledge base. It also includes an expert-in-the-loop approach, where unanswered questions are forwarded to ANMs, and the responses are used to improved the system over time. The chatbot supports voice and text input, making it accessible for health workers with different literacy levels.

However, the system mainly focuses on providing informational support and does not include features like patient data collection, risk prediction or continuous monitoring. It also depends on internet connectivity and may face delays when relying on expert responses.

5)ANMOL (Auxiliary Nurse Midwife Online) Mobile Application

ANMOL is a government-based mobile application developed by Ministry of Health and Family Welfare to support Auxiliary Nurse Midwives (ANMs) in delivering maternal and child healthcare services. It enables real-time registration and tracking of beneficiaries such as pregnant women, mothers, and children throughout their healthcare life cycle. The system allows health workers to record antenatal, postnatal, and immunization data, and provides features like dashboards, due lists, and performance reports. It also supports offline data entry and later synchronization with a central server, improving efficiency and reducing manual paperwork.

Although the system is useful mainly focuses on data collection and service tracking, and does not include advanced AI-based risk prediction or intelligence decision support features. It also has limitations in usability, connectivity issues, and lacks voice-based interaction for easier data entry. Compared to the proposed system, which integrates AI-based risk analysis, voice-enabled support, and continuous monitoring for ASHA workers.

6)M-Sakhi Mobile Health Application

M-Sakhi is a mobile-based health application designed to support frontline healthcare workers such as ASHA workers in improving maternal and child healthcare services. It acts as a digital job aid and electronic record system, helping health workers track patient data, provide health education, and improve their skills through content. The application also supports communication with supervisors and assists in identifying health issues, guiding workers to provide better care and timely referrals.

Despite its usefulness, the system mainly focuses on training support an data management and does not include advanced AI-based risk prediction or intelligent decision-support features. It also lacks voice-based input and real-time monitoring capabilities for continuous care.

METHODOLOGY

This survey paper presents Maatri Sakhi, an AI-based maternal and child healthcare companion which is designed to support the ASHA workers. The methodology focuses on analysing the existing research papers and the real-world applications to identify the limitations in current systems. Based on these insights, a structured framework is proposed that integrates AI-based risk prediction, user friendly features for better monitoring, decision making support and continuity of care from registration to delivery.

1. Identification of research gap

The selected studies were systematically analysed based on key parameters including the technologies used, functional capabilities, target users and advantages. Based on comparative study, several critical limitations were identified in the existing systems. These include

- Lack of integrated platforms that cover both maternal and postnatal child care
- Limited support to multilingual and voice-based interaction
- Absence of real time monitoring and automated alert mechanisms and
- Poor usability for the frontline healthcare workers like a ASHA workers.
- Additionally, many systems operate in isolation, leading to fragmented healthcare management and lack of continuity of care.

2. Proposed conceptual framework

To address the identified gaps a conceptual system is proposed that combines AI-based risk prediction with mobile-based healthcare support. The frame work emphasizes real-time monitoring and also tracking of the pregnant women details, voice-enabled interaction, automated alerts to nearby primary health centres (PHC), and continuous care from pregnancy to postnatal stages, ensuring improved efficiency and also accessibility for the frontline healthcare workers.

3. System Architecture

The proposed system is designed as a modular architecture as in Fig 1, where each component performs a specific function. The work flow begins with data collection and proceeds through processing, analysis and output generation.

a) User Module (ASHA worker interface):
- Registration and login
- Entry of maternal health data like blood pressure, weight, symptoms
- Voice based input and output support
- Access to alerts and health reports.
- Offline data entry

b) Data processing Module (Backend):
- Collection and validation of health data
- Preprocessing and handles missing values
- Stored structured data for analysis

c) AI & Analysis Module:
- Risk prediction for high-risk pregnancies
- Feature extraction and classification
- Health status evaluation
- Generates alerts and recommendations

d) Alerts & Notification module:
- Sends real-time alerts for high-risk cases
- ANC visits reminder of the pregnant women
- Missed vaccinations and follow-ups
- Helps ensure timely intervention

e) PHC Dashboard (Doctor /Admin):

- Enables communication between ASHA worker and health centre
- Provides access of patient records to doctors
- Keeps track maternal and child health reports
- Take action/provide advice on emergency alerts

ISSN: 2583-6129
DOI:10.55041/ISJEM07342

- Helps track follow ups and immunization status.

f) Database Module:

- Stores maternal records
- Child health and immunization data
- Maintains history for continuous monitoring

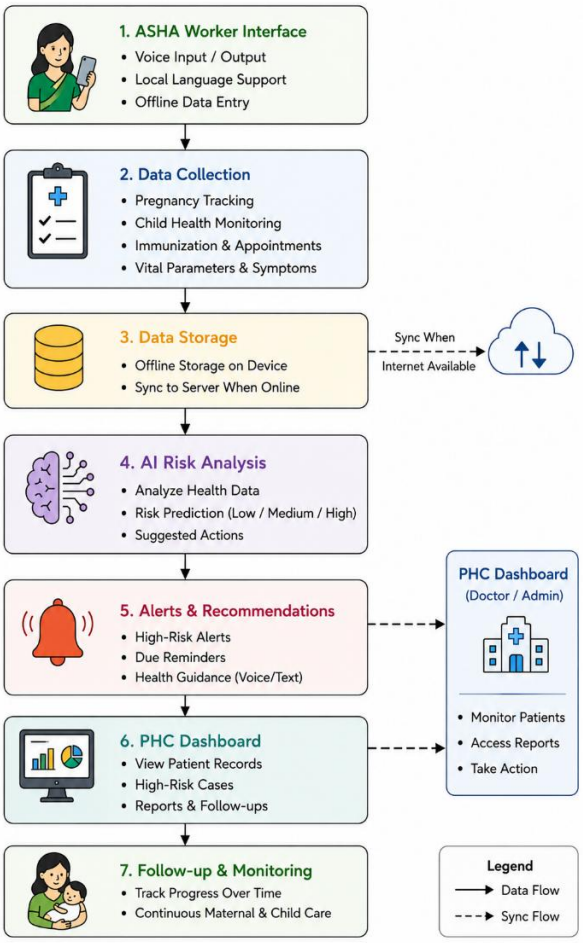

Fig 1: System architecture framework

CONCLUSION

In conclusion, this survey analyzed various maternal health support systems developed to assist ASHA workers. Although existing solutions improve data collection and monitoring, they suffer from limitation such as manual data entry, lack of intelligent decision support, and usability challenges for low digital literacy users. The study identifies a clear research gap in integrating AI-based, user friendly, and voice-enabled systems. To address these limitations, an AI-powered maternal health companion is proposed, which can enhance efficiency, reduces workload, and improve maternal healthcare outcomes, particularly in rural areas.

ACKNOWLEGEMENT

We would like to express our sincere gratitude to Mrs. V Manjula for their valuable guidance, support, and encouragement throughout the preparation of this survey paper. their insights and suggestion greatly helped in improving the quality of the work. we would like to thank our institution for giving us the opportunity to work on this survey paper.

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ISSN: 2583-6129
DOI:10.55041/ISJEM07342