Personalized Real-Time Risk Assessment and Alert System to Mitigate Risks for Mothers with Deteriorating Health

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ABSTRACT
A real-time alert system for pregnant women with worsening health is a digital solution that uses data and analytics to identify potential health risks and send alerts to healthcare providers, family members or the women themselves. This system that processes data and generates alters in real-time, enabling swift action to be taken in response to changing circumstances. The target for this system is to mitigate expectant mothers whose health is deteriorating or at risk of complications. Thus, the goal of this entitled article is to prevent complications and ensure timely medical interventions in worsening mother with deteriorating health condition.

1. Introduction

In this Introduction part before going into brief about this article, we summarize to learn what is a personalized real-time alert system, yes, as we well know it's a system that processes data and generates alerts in real-time, enabling swift action to be taken in response to changing circumstances. In contrast, this article studies about the real-time alert system for pregnant women with worsening health is a digital solution that uses data and analytics to identify potential health risks and send alerts to healthcare providers, family members or the women themselves.

This system that processes data and generates alters in real-time, enabling swift action to be taken in response to changing circumstances. The target for this system is to mitigate expectant mothers whose health is deteriorating or at risk of complications. Thus, the goal of this entitled article is to prevent complications and ensure timely medical interventions in worsening mother with deteriorating health condition.

As, mentioned above the target audience for this digitalized system is expectant mothers whose health is deteriorating or at risk of complications. The system uses data like vital signs, medical history and other health information and analytics to identify potential health risk and predict complications.

The system collects the data from pregnant mothers to detect early warning signs of complications such as: Abnormal Blood Pressure, Foetal Distress, Gestational Diabetes, Preeclampsia etc.,

When a potential health risk is identified, the system sends alerts to healthcare providers (e.g., obstetricians, Midwifes, Nurse, primary care physicians), family members and the pregnant woman herself to prevent or mitigate complications by enabling timely medical interventions such as: Emergency hospitalization, Adjustments to treatment plans and Increased monitoring.

The real time system facilitates prompt action by healthcare providers ensuring that pregnant women receive appropriate care and attention when needed. This real-time alert system aims to improve maternal and foetal health outcomes by leveraging data, analytics and timely interventions.

2. Related Studies

Many published studies and datasets related to pregnancy and healthcare are publicly available, some examples include:

- The National Birth Defects Prevention Study (NBDPS)
- The Pregnancy Risk Assessment Monitoring System (PRAMS)
- The National Health and Nutrition Examination Survey (NHANES)

- The Agency for Healthcare Research and Quality (AHRQ) datasets
- The Centers for Disease Control and Prevention (CDC) datasets

These datasets can be used for research, quality improvement and public health initiatives. There are also many online digitalized "pregnancy dataset" or "Healthcare dataset" publicly available in hospitals and healthcare and research centres. To overcome the related studies, we can see two important assets used in other countries and our country.

2.1 PRAMS- The Pregnancy Risk Assessment Monitoring System:

It is the surveillance system in the United States that collects data on pregnancy and childbirth. It's managed by the Centers for Disease Control and Prevention (CDC) and aims to:

- Monitor pregnancy-related behaviours and experiences
- Identify risk factors for adverse pregnancy outcomes
- Inform public health programs and policy decisions

2.1.1 PRAMS collects data from:

1. Surveys: Sent to a sample of women who have recently given birth (usually within 2-6 months postpartum)
2. Birth certificates: Linked to survey data to provide additional information.

The surveys cover datasets such as:

Prenatal care, health behaviors (e.g., smoking, alcohol use), chronic health conditions (e.g., diabetes, hypertension), Pregnancy complications, Breastfeeding, Infant health and Socioeconomic factors (e.g., education, income)

2.1.2 PRAMS data are used to:

- Track tends and patterns in pregnancy-related behaviors and outcomes
- Identify disparities in healthcare access and outcomes
- Inform development of public health programs and interventions
- Evaluate the effectiveness of existing programs
- Some examples of PRAMS data uses include:
- Monitoring chages in prenatal care utilization
- Identifying risk factors for preterm birth
- Informing breastfeeding promotion initiatives
- Examining disparities in pregnancy outcomes by race/ethnicity

PRAMS data are available online through the CDC website and researchers can access the data for future analysis.

Similarly, India has its own similar system like HMIS (Health Management Information System) to monitor pregnancy and childbirth, some other examples also include:

2.2 MCTS (Mother and Child Tracking System)

A surveillance system that tracks pregnant women and children under five years old to ensure they receive essential health services.

2.3 RCH (Reproductive and Child Health program)

A government initiative that focuses on maternal and child health, including pregnancy care, immunization and family planning.

2.4 NFHS (National Family Health Survey)

A periodic survey that collects data on various health indicators, including pregnancy, childbirth and maternal health.

These systems and programs help track pregnancy-related data in India, but they may not be identical to PRAMS. However, they serve similar purposes such as:

- Monitoring pregnancy outcomes
- Identifying risk factors
- Informing public health programs
- Improving maternal and child health

India's healthcare landscape is diverse and data collection system may vary across states and regions. However, these initiatives demonstrate India's commitment to prioritizing maternal and child health.

3. Experimental Set-Up Alert System for Pregnant Women with Worsening Health

For an alert execution here the real-time alert system is accessed for the pregnant women with worsening chronic conditions, the digital system uses a analytics to identify potential risks and send alert to the registered healthcare providers, to the registered women themselves or to the family members of the registered women. Where here the goal tries to make them prevent from complications and ensure timely medical interventions.

The breakdown of the system starts with data collection, risk assessment, alert generation, alert escalation finally with a response and intervention observations. Here the five steps have been briefly explained.

Data collection: Wearable devices, mobile apps or electronic health records (EHRs) collect vital signs, medical history and other relevant data from pregnant women.

Risk Assessment: Advanced algorithm analyze the data in real-time, identifying potential risks and warning signs such as: abnormal blood pressure, fetal distress, gestational diabetes, preeclampsia etc which are all related to chronic health conditions.

Alert Generation: if the system detects a potential risk, it generates an alert, which can be: through an SMS or mobile notifications, Email alerts, automated phone calls and with an In-app notifications.

Alert Escalation: Depending on the severity of the risk, the system can escalate alerts to: Healthcare providers (doctors, nurses or midwives), family members or emergency contacts or emergency service (ambulance etc.,)

Response and Intervention: Healthcare providers can respond alerts by: contacting the pregnant women for further evaluation, scheduling urgent appointments, providing guidance or advice, initiating emergency interventions (if necessary)

Thus, with the above-mentioned escalation process this real-time alert system enables early detection and swift action, by reducing the risk of complications and improving maternal and fetal health conditions.

3.1 Digitalized flow chart with a simplified representation

Data collection

With the EHRs collect vital sins and medical history, data transmitted to secure serves/cloud storage

Data preprocessing

Data's are cleaned, filtered and formatted for analysis; Machine learning algorithms applied for pattern recognition.

Risk assessment

Advanced algorithms analyze data in real-time, identify potential risks (abnormal blood pressure, fetal distress), risk score assigned on severity

Alert generation

System generates alerts based on risk scores, alerts to women, alerts may include risk level (e.g., low, moderate,

high), recommended actions (e.g., schedule appointment, seek immediate care)

Alert escalation

Severity-based escalation to primary care providers (e.g., physician, obstetrician etc.,), Escalation protocols may vary based on risk level and individual circumstances.

Response and intervention

Healthcare providers respond to alerts to contact pregnant women for evaluation/appointment, provide guidance/advice (e.g., lifestyle changes, medication etc.,), initiate emergency interventions in case of any emergency protocols.

Continuous monitoring

System continues to collect and analyze data, updates risk scores and alerts in real-time.

Feedback Loop

Healthcare providers/ Pregnant women provide feedback on system performance, system refined and updated based on feedback and new research.

Additional steps may include:

- Integration with EHRs and healthcare systems
- Patient engagement and education platforms
- Telemedicine and remote consultation capabilities
- Personalized medicine and genetic data integration
- Continuous quality improvement and system updates.

In contrast, the actual implementation may vary based on specific requirements and cases.

3.2 Outsource of the system

The outsourced data can be extremely useful for healthcare providers/ nurse/ midwives in various ways as explained below:

Early intervention: They can identify potential risks and take proactive measures to prevent complications.

Personalized care: They can tailor their care plans to individual patient's needs on real-time data.

Enhanced patient monitoring: they can closely monitor patients with high-risk scores and provide timely interventions.

Improved communication: They can share relevant data with their circumstances ensuring everyone is informed and in the same page.

Data-driven decision making: They can use data to inform their decisions, reducing reliance on intuition or personal experience.

Streamlined workflows: They can prioritize tasks and allocate resources more efficiently, focusing on high-risk patients.

Patient education: They can educate patients and their families about potential risks and involve them in care planning.

Research and quality improvement: They can contribute to research studies and quality improvement initiatives using aggregated data.

Yes, by leveraging this data, the healthcare providers/ nurse/ midwives can provide more effective, patient-centered care, improving health outcomes with reducing adverse risks.

The real-time alert system for pregnant women with worsening health is a groundbreaking digital solution that leverages data and analytics to identify potential health risks and facilitate timely intervention. By sending alerts to healthcare providers/ nurse/ midwives, family members and the worsen women themselves, this system has

the potential to revolutionize prenatal care and improve maternal and fetal health outcomes.

4. Conclusion

By harnessing the power of technology, we can enhance monitoring and surveillance, enable early detection of complications, facilitate prompt medical attention, empower women to take control of their health, improve communication between healthcare providers and patients. This innovative solution has the potential to save lives, reduce morbidity and improve the quality of care for pregnant women. As we continue to refine and expand this system, we can create a brighter, healthier future for worsening mothers and their babies.

5. Future Enhancement

Personalized real-time risk assessment and alert system to mitigate risks for mothers with deteriorating health can incorporate the alert system with AI-powered predictive analytics, wearable devices and IoT sensors to collect more accurate and real-time data on vital signs and other metrics which utilize machine learning algorithms to analyze data pattern and predict complications, enabling proactive interventions, thus, to generate a personalized care plans based on individual risk factors, medical history and lifestyle. As well to enable remote monitoring and telemedicine capabilities to expand access to healthcare services especially for rural or underserved areas, by providing educational resources and empower patients to take an active role in their care, improving health literacy and self-advocacy.

Ethical Clearance:

Since this article is about awareness programme among/for worsening mothers there is no need for ethical clearance.

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Conflict of Interest: NIL.

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