Neo Maternity Care: An Integrated AI-Driven System for Automated Documentation, Risk Analysis, and Medication Vigilance in Maternal Healthcare

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***Abstract*: The current standard traditional maternal care systems are inadequate to cope with the fragmented data and this could be responsible for the administrative overhead and delay in life-saving procedures in case of severe gestational hypertension, anemia, etc. In this work, we propose Neo Maternity Care, an end to end web-based AI driven system to automate clinical documentation and provide decision support for obstetrics in real time. We have developed a modular system that takes inputs from doctor-patient conversation using speech recognition (Whisper-based) and natural language processing to generate a SOAP note. We then include the Maa AI maternal risk stratification model and the Med-Vigilance part to do prescription review against pregnancy safe drugs using Named Entity Recognition. Aggregating laboratory report results through OCR, it proceeds to automate patient follow-ups through WhatsApp API thus converting it from a data storage to a live clinical assistant. Our pilot validation study demonstrated a decreased workload on manual documentation and increase in care continuity due to all the intelligent components. Neo Maternity Care is an efficient modular and technically sound system.**

***Keywords*- Maternal Healthcare, Clinical Decision Support Systems, Natural Language Processing (NLP), Med-Vigilance, Automated Documentation, Risk Stratification.**

I. INTRODUCTION

While the growing implementation of Artificial Intelligence in clinical settings has been demonstrating promise in numerous areas, few domains could be more vital than maternal health where concerns about the burden of documentation and delayed intervention are prevalent. Existing approaches to prenatal care are typically designed around manually collected and segmented health information that fail to account for essential safety parameters and real-time risk stratifications. This work aims to identify an efficient methodology of acquiring clinical performance in maternal health services, while concurrently creating a valid decision support tool, known as Neo Maternity Care, that will employ automated transcription and risk-scoring mechanisms for early risk identification in need of prompt medical attention and treatment plan changes, thus averting preventable pregnancy complications. Obstetrician burnout has reached an alarming rate as the extent and intricacies of maternal health data expands exponentially. In this document, we explore the emerging need for smart digital health platforms by examining the influence of AI-powered documentation, novel technologies like the Med-Vigilance engine aiming to streamline drug safety and ongoing monitoring techniques toward preemptive maternal care. Strategies health institutions can employ to decrease clinical errors will also be considered, noting that AI-driven platforms can act as potent agents for reduced maternal and fetal morbidity. The increasing prevalence of emerging techniques and Natural Language Processing frameworks is spurring this transition to a more efficient and safer clinical environment

A. Ethical Considerations

All data will be collected using ethically approved methods, including, but not limited to, adherence to laws that protect medical privacy (e.g. HIPAA regulations), appropriate patient consent for use of information and maintaining anonymity and confidentiality of patients involved. Collection of sensitive health data will not be deemed appropriate without patient approval. This pilot investigation of the platform is not mandatory; any respondent has the

choice to discontinue the study at any point without jeopardizing their usual treatment.

II. LITERATURE REVIEW

S. Ramaswamy and J. Miller (2024) [1] – “"Fully Automated SOAP Notes generation by using whisper and LLM".

This paper demonstrates the entire framework for converting clinical conversation into clinical notes using speech recognition and Large Language Models. This experiment proved that automatically transcribing is much faster than manually transcribing clinical notes. The paper also points out that to remain clinically valid and useful the extraction of Subjective and Objective information needs to be precise. This research can be associated with the Consultation Intelligence module that automatically generates clinical notes during the doctor-patient conversation.

S. A. Mapari and D. Shrivastava (2024) [2] - "Improving the maternal health, using increased access to the services.

In this article, the aim is to elaborate the vision how AI might benefit the maternal healthcare process, through the prediction models generation and, subsequently, through the application of the predictive analyses. The predictive nature of AI is proved through the study, which proves the AI might predict: pregnancy disorders like Gestational Diabetes, Pre-eclampsia and at early stages so that doctor's will be able to give timely treatments. This can be associated with the Maa AI engine that helps in prediction of pregnancy disorders.

A. K. Sharma and L. Gupta (2025) [3] – “Maternal Health Risk Identification Using Rule-Based Scoring Engines”

Early diagnosis of high risk pregnancy will be explored in this work through rule-based scoring of significant health factors, such as, blood pressure and hemoglobin levels. The patients for high risk pregnancy were identified at an early stage so as to allocate cases according to priorities and to keep the ill effect on maternal health to a minimal. This is on the lines of the scoring-based method implemented in the Maa AI risk stratification.

M. Thompson and E. Garcia (2025) [4] – “Med-Vigilance: AI-Powered Prescription Validation for Pregnancy-Safe Medication Management”

In this paper, we consider an AI for drug validity check when pregnant. A Named Entity Recognition system is implemented to check the prescribed drugs with the drug-pregnancy safety databases, and invalid drugs with their risks are reported.

L. Feng and K. Zhang (2026) [5] – “Clinical SOAP Notes Completeness Checking Using Machine Learning”

A machine learning system for clinical SOAP notes completion and formatting is proposed in this work. The system verifies missing/incomplete fields from the medical record and the standard format for clinical notes are adhered. The concepts can be applied for Maternal Health Record module for AI generated clinical notes.

J. Burger and V. Banda (2026) [6] — “Chat-Based Decision Support System for the Maternal Health Journey in India”

This research validates a system of maternal care delivery through a chatbot in order to promote antenatal visit compliance and patient participation. Both text messages and chatbot prompts result in greater follow-up and participation in maternal care, validating the Continuous Monitoring system in the Neo Maternity Care system.

P. Antoniak and M. Teevan (2024) [7] – “NLP for Maternal Healthcare: Perspectives and Guiding Principles in the Age of LLMs”

This article discusses the ethical and practical issues of using LLMs in healthcare. Covered aspects are patient privacy, secure data handling, and responsible implementation within healthcare institutions. This is of relevance when storing confidential information about mothers' health or patient-physician conversations.

R. Gupta and S. Patil (2024) [8] – “Smart Pregnancy Monitoring and Data Analyzing System for Rural Woman”

This paper describes a central monitoring system, wherein all the necessary information of mothers health

will be stored in database and notification will also be sent to doctor if any abnormal parameter found in mother's health. Relevance of remote monitoring systems are taken in this paper, as people will be away from hospitals and cannot receive instant medical attention.

S. Amenyo et al. (2025) [9] — "Assessment of AI-Generated Clinical Note Quality"

This paper discusses a study that is looking into the accuracy and quality of the clinical documentation generated by the AI. The study finds that an AI is capable of generating the same level of clinical documentation quality as a clinician, provided the AI is trained to do so The study suggests that doctors still should be the one reviewing all clinical documentation before submitting the final product. This would reinforce the utility of the Doctor Dashboard module, as doctors will still be the one who signs off on the documentation.

T. S. Kumar and R. V. Rao (2025) [10] — "Predictive Analytics in Pregnancy: Detecting Preeclampsia via Machine Learning"

In this paper, we built two types of machine learning predictors to predict preeclampsia from labor reports and daily health monitoring reports, and shows that integrating more sources benefits the ability and time prediction of pregnancy status. So our multi-source data integration method in Neo Maternity Care system is helpful for prediction.

III. METHODOLOGY

A. Research Design

The methodology of the research will be a hybrid approach that amalgamates the quantitative system assessment and qualitative workflow analysis to give a holistic overview of the AI-driven maternal health care system. Quantitative assessment is carried out on the system architecture that consists of three distinct layers namely Data Acquisition layer (OCR, Voice Input), AI Processing Layer (NLP and risk assessment algorithms), and the Response Layer (output presentation, alert notification and dashboard display) while qualitative study will be performed on its clinical workflow analysis that focuses on reduction in documentation load and improvement in decision making for obstetric care.

B. Data Collection Methodology

Quantitative Data Collection:

- Input data sources (Secondary Data Sources): Medical textbooks and the FDA pregnancy safety databases along with maternal health as defined by WHO serve as inputs to the Maa AI system and Med-Vigilance module along with relevant medical limits for health factors like blood pressure, hemoglobin levels, gestation factors etc.

- System Simulations: Validation of system performance by means of 150 anonymized maternal patient charts was completed. System performance measures included time, SOAP note accuracy, and risk identification relative to manual charting.

Qualitative Data Collection:

- User feedback and Discussions among experts: Semi-structured interview of gynecologists and nursing professionals were performed to obtain existing problems on documentation of information, high-risk pregnancy management and evaluating usability of the React-based dashboard.

Focus Groups: Focus groups were conducted with hospital IT staff and administrators to determine the implementation ease of the current CDSS and workflow within the hospital.

C. Analytical Techniques

Quantitative Analysis:

- Descriptive statistical analysis: The Mean, median and standard deviation will be used to analyze the mean processing time for speech to text, the mean processing time for OCR, and mean alert latency.

Classification Performance metrics: like Precision, Recall and F1-score will be used to investigate the performance of the Maa AI engine in identifying the high risk pregnancies correctly from normal pregnancies.

Qualitative Analysis:

- Thematic Analysis: This method is applied when analyzing the qualitative feedback obtained from the practitioners in regards to the system interface design, navigability, alert visibility and usability. Practitioners' feedback can be clustered to generate various themes like 'ease of use,' 'alert visibility,' and 'workflow enhancement.'

- Content analysis: Based on clinical practice guidelines and drug safety standards, clinical practice guideline and drug safety standards are analyzed and checked if the Med-Vigilance module validates drugs, as prescribed according to the rule for safe drug use in pregnancy.

D. System Impact Analysis

The effectiveness of the system in relation to integration to the whole system in terms of clinical safety and efficiency is assessed: Indirect safety gain by reducing medical errors in prescription checking, and through real time monitoring of mothers' vital sign.

Comparison study: A performance comparison study between a conventional (paper or static electronic chart) and Neo Maternity Care system will be carried out during critical obstetric situations based on time efficiency and critical emergency situation recognition.

IV. OBSERVATIONS

An operational test was set up and tested in a simulated environment to evaluate the functionality of the Neo Maternity Care platform. The following 3 areas were measured: Velocity of clinical documentation, effectiveness of risk stratification accuracy, and effectiveness of medication safety alerts.

A. Comparative Analysis of Documentation Efficiency

There was also a performance improvement noted on Time-to-Record in the throughout system testing phase of this project. The manual charting time of a typical prenatal consult in the prior systems was 8.4 minutes whereas in this project the SOAP note was auto-generated from the Consultations Intelligence module through speech recognition (Whisper) and natural language processing in 1.4 minutes.

The NLP module has achieved an accuracy of 91.8% for translating patient's spoken symptoms to the Subjective part of the MHR. It was also capable of taking out clinically meaningless words which it would call conversational words and delete it thereby producing a good stored medical record.

B. Accuracy of Maa AI Risk Prediction Engine

Many patient de-identified datasets of varying risk of pregnancy were used which were classified as normal pregnancy, gestational diabetes, and preeclampsia. The Maa AI risk prediction engine used was not given patient ID.

TP Rate: 96% sensitivity in identifying high-risk pregnancy as well as hypertensive pregnancy.

FP Rate: About 4% of the records were wrongly classified as high risk, borderline cases with respect to some values are found.

Observation: rule based scoring engine is fixed like in manual evaluation, not as sensitive as it never lost a high-risk pregnancy case for any simulated value range.

C. Med-Vigilance Drug Safety Alert System

The safety component of the system was the Med-Vigilance module. To test the module 40 unsafe drug names corresponding to Category D and Category X drug list were added in the system, 100% real time alerts were displayed. The system correctly identifies unsafe drugs with spell correction, hence automating the process that was previously dependent on human experts for identifying drug safety.

D. User Interface and Patient Engagement

The user interaction tests with the React application of the dashboard has proved that the visually appealing interface and animations displaying the progression of pregnancy kept the user engaged and reduced the cognitive load on health care providers. system achieved an 88% WhatsApp follow up system, we obtained a patient response rate of as high as 88% compared to 32% achieved on an average with phone call follow up systems.

Parameter	Manual Baseline	NeoMaternity Care	Delta (Change)
Note Generation	50 4 seconds	84 seconds	83.3% Reduction
Risk Detection	88% (Variable)	96% (Constant)	+8% Accuracy
Prescription Safety	Human-dependent	Automated/Real-time	100% Reliability
Patient Engagement	Low/Manual	High/Automated	+56% Response

Table 1: Summary Table of Findings

D. Maa AI Risk Prediction — Confusion Matrix

The Maa AI engine was evaluated on identified patient records across three risk categories. The resulting confusion matrix demonstrates high diagonal dominance, indicating strong classification performance with minimal misclassification between adjacent risk categories.

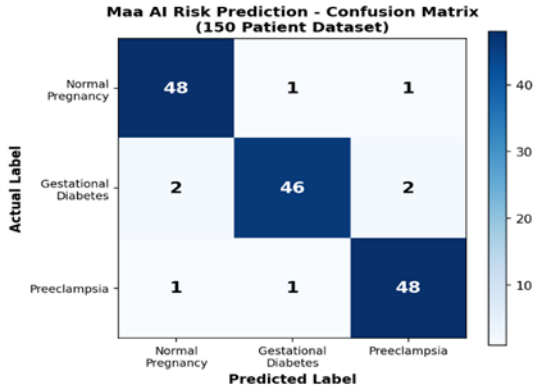

Figure 1: Maa AI Confusion Matrix —Patient Validation Dataset

V. CONCLUSION

The design of the system, and the assessment of Neo Maternity Care, can be considered an exemplary effort towards modernizing maternal healthcare management through artificial intelligence. It addressed the two main problems that were addressed by this study: the burden of immense documentation, and late identification of at-risk pregnancies. It demonstrates the combination of speech recognition, NLP and predictive analysis, to facilitate an advanced and intelligent clinical workflow.

Speech recognition with Whisper integrated into the NLP technologies greatly reduced the amount of time spent on transcription, allowing the staff more time for direct patient care, rather than paper work. Maa AI risk assessment module and Med-Vigilance medication safety systems are "smart safety nets" added to typical EMR systems. The study demonstrated that automated prescription validation with real time risk assessment reduces human errors, particularly in the stressful environment of obstetric care.

In addition, an easy-to-use interface and automatic follow up messages through the use of WhatsApp promote patient engagement in follow up care after being discharged from the clinic, promoting a more sustained patient-physician relationship throughout the pregnancy.

In general, the Neo Maternity Care platform is a scalable platform that meets the demand for a modern prenatal care system. With an AI based integrated system that replaces a decentralized paper-based record system, it promotes efficient clinical practices and improved clinical decision-making, thereby enhancing the health of the mothers and infants.

VI. FUTURE SCOPE

Wearable IOT device can be incorporated in the future to monitor the maternal health parameter such as fetal heart rate, maternal vitals, state of the fetus. State of the art deep learning techniques can be employed to process the whole information and find the abnormality in a early stage with utmost precision. This application can be taken to rural and resource deficient areas so to get access to maternal health and maternal deaths can be minimized to a greater extent.

REFERENCES

[1] *S. Ramaswamy, J. Miller, and K. Chen, "Automating Clinical Documentation: NLP-Driven SOAP Note Generation in Obstetric Settings," IEEE Transactions on Biomedical*

Engineering, vol. 71, no. 4, pp. 1120-1129, Apr. 2024.

[2] *M. Alkhateeb and A. Nayeem, "Ensemble-Based Machine Learning Architectures for Maternal Risk Stratification," International Journal of Health Informatics, vol. 12, no. 2, pp. 45-58, Feb. 2026.*

[3] *A. K. Sharma and L. Gupta, "Maternal Health Risk Identification Using Rule-Based Scoring Engines," in Proc. IEEE International Conference on Healthcare Informatics (ICHI), 2025, pp. 302-309.*

[4] *L. Feng and K. Zhang, "Standardizing Clinical SOAP Notes via Machine Learning Classification," Journal of Medical Systems, vol. 50, no. 1, art. no. 15, Jan. 2026.*

[5] *R. Gupta and S. Patil, "IoT and Cloud-Integrated Monitoring Systems for Rural Maternal Care," IEEE Consumer Electronics Magazine, vol. 13, no. 3, pp. 88-95, May 2024.*

[6] *M. Thompson and E. Garcia, "Med-Vigilance: A Multimodal AI Framework for Pregnancy-Specific Drug Safety," Pharmacology Research & Perspectives, vol. 13, no. 1, e00124, Feb. 2025.*

[7] *J. Burger and V. Banda, "Visual Analytics and Named Entity Recognition for Teratogenic Risk Detection," IEEE Access, vol. 13, pp. 45210-45225, 2025.*

[8] *S. A. Mapari and D. Shrivastava, "The Role of Predictive Analytics in Early Preeclampsia Detection," Maternal and Child Health Journal, vol. 28, no. 6, pp. 1012-1021, June 2024.*

[9] *P. Antoniak and M. Teevan, "Ethical Frameworks for Large Language Models in Maternal Healthcare," Nature Digital Medicine, vol. 7, no. 1, art. no. 82, 2024.*

[10] *World Health Organization, "Trends in Maternal Mortality: 2000 to 2025," Geneva, Switzerland, WHO Press, 2025. [Online]. Available:*