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Review of an A-Model for Situational Awareness and reduction of Maternal Mortality rate

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ABSTRACT:Inthisstudy, we reviewed an A-model for Situational Awareness and Reduction of Maternal Mortality rate. The solution to prevent maternal complications is known and preventable by trained health professionals. But in countries like Nigeria where the patient to physician ratio is 1 doctor to 1000 patients, maternal mortality and morbidity rate is high. To fill the gap of highly trained health professionals, Nigeria introduced health extension programs. Task shifting to health extension workers (HEWs) contributed in decreasing mortality and morbidity rate in Nigeria. Knowledge-gap has been one of the major challenges to HEWs. The reasons are trainings are not given in regular manner, there is no midwife, gynaecologists or doctors around for consultation, and all guidelines are paper-based which are easily exposed to damage.The proposed P-model is a unique mobile and desktop innovation for accurate diagnosis and solution to maternal mortality. In addition, the reviewed A-model will adopt deep learning and stochastic modeling techniques.

KEYWORDS:A-Model, Maternal Mortality, Situational Awareness

I. INTRODUCTION

Maternal mortality is defined as a critical health issue which involves the death of an individual due to complications related to pregnancy or child birth. Maternal health is about the health of women starting from preconception up to the postpartum period. Its aim is to give positive experience of motherhood by reducing morbidity and mortality rate of mothers and infants. But attaining this positive experience has been challenged by maternal health complications. Every day 810 women are dying because of preventable pregnancy and childbirth complications, and the 99% of the death reports are from developing countries (WHO, 2019). The major maternal mortality complications are well-known; severe bleeding, infection and pre-eclampsia (WHO, 2019). In Nigeria, most of the causes for maternal mortality are postpartum haemorrhage, sepsis, eclampsia, obstructed labor and unsafe abortion (Desta, 2017). Majority of the causes for maternal mortality are preventable.

The study proposed an A-Model for situation awareness and reduction of maternal mortality in Nigeria using Deep Learning technique. The proposed A-model is a unique mobile and desktop innovation for accurate diagnosis and solution to maternal mortality. In addition, the proposed P-model will adopt deep learning and stochastic modeling techniques. Deep learning is a machine learning technique that teaches computers to do what comes naturally to humans: learn by example. In deep learning, a computer model learns to perform classification tasks directly from images, text, or sound. Stochastic" means being or having a random variable. A stochastic model is a tool for estimating probability distributions of potential outcomes by allowing for random variation in one or more inputs over time.

Lack of enough number of health professionals, weak infrastructure and poor supply chain played a big role in challenging the health sector in developing countries (Bilal, 2011). In Nigeria, the Federal Ministry of Health (FMOH) introduced task shifting program in order to reduce the impact of lack of trained health professionals. The introduction of health extension workers (HEWs) to the health sector filled the gap seen in the number of trained health professionals. The HEWs are engaged in treating specific tasks with short training and fewer qualifications. They are recruited from once community and trained on health education and communication, hygiene and

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environmental sanitation, disease prevention and control, and family health (Desta, 2017). With the help of HEWs, Ethiopia decreased child and maternal mortality rate by large percent in the last 30 years (Berhan, 2014).

Maternal mortality is a dangerous health issue that negatively plagued the health sector of Nigeria. It often results to the death of a pregnant woman due to complications related to pregnancy, underlying conditions worsened by the pregnancy or management of these conditions. This can occur either while she is pregnant or within six weeks of resolution of the pregnancy.

The World Health Organization (WHO), associated the high prevalence of maternal death in Nigeria to inequalities in access to health services as women in resource-poor settings are least likely to receive adequate, timely and affordable health services by skilled personnel compared to their counterparts in more developed countries.

Knowledge-gap due to lack of trained health professionals on maternal mortality has also contributed to the increasing rate of the issue in Nigeria. This is because, the solution to prevent maternal complications are known and preventable by trained health professionals. But in countries like Nigeria where the patient to physician ratio is 1 doctor to 1000 patients, maternal mortality and morbidity rate is high. To fill the gap of highly trained health professionals, Nigeria introduced health extension programs. Task shifting to health extension workers (HEWs) contributed in decreasing mortality and morbidity rate in Ethiopia. Knowledge-gap has been one of the major challenges to HEWs. The reasons are trainings are not given in regular manner, there is no midwife, gynecologists or doctors around for consultation, and all guidelines are paper-based which are easily exposed to damage.

The proposed study intends to address specific maternal mortality issues such as knowledge-gap which occurs as a result of poorly trained health workers and errors in diagnosing maternal mortality in Nigeria.

II. THEORITICALDESCRIPTION

Empirical Review

Haile et al., (2021), proposed MatES: Web-based Forward Chaining Expert System for Maternal Care. They described the design and implementation of a web-based expert system for maternal care. They only targeted the major 10 diseases and complication of maternal health issues seen in Sub-Saharan Africa. Their developed expert system can be accessed through the use of web browsers from computers. Furthermore, they also utilized forward chaining rule-based expert system in order to give suggestions and create a new knowledge from the knowledge-base.

Illah (2013), looked at the causes and risk factors for Maternal Mortality in Rural Tanzania. The aim of his study was to explore levels, causes and risk factors associated with maternal mortality in rural Tanzania. Longitudinal data (2002-2006) from Rufiji HDSS was used where a total of 26 427 women aged 15-49 years were included in the study; 64 died and there were 15 548 live births. Cox proportional hazards regression was used to assess the risk factors associated with maternal deaths.

Reinke (2017), looked at maternal mortality as a millennium development goal (MDG) of the United Nations: a systematic assessment and analysis of available data in threshold countries using Indonesia as example. The author opined that eight global development objectives were defined and the world community aimed to achieve these goals until 2015. In addition to the fight against poverty and starvation, for equalization of nations and individuals the fifth MDG contains the aim to improve the health care of mothers. The maternal mortality has been considered as an important indicator for the health of the population and the economic as well as social development. Based on this prioritization the targeted worldwide reduction of maternal mortality rates was targeted to be reduced by about 75%.

Sonia (2012), looked at maternal mortality as a public health problem. The author opined that maternal mortality is an important indicator which reflects the health status of a community. It can be calculated by maternal mortality ratio (MMR), maternal mortality rate (MMRate), and adult life time risk of maternal death. MMR estimates are based on varieties of methods that include household surveys, sisterhood methods, reproductive-age mortality studies (RAMOS), verbal autopsies and censuses. Main causes of maternal mortality are hemorrhage, infection, unsafe abortion, hypertensive disorder of pregnancy and obstructed labour. Factors of maternal mortality have been conceptualized by three delays model. Estimates of maternal mortality ratio (MMR) trend between 1990 and 2010 (over 20 years period) suggest a global reduction (47%), with a greater reduction in developing countries (47%) including Bangladesh than in developed countries (39%).

Okpako&Asagba (2020), proposed an Improved Framework for Diagnosing Confusable diseases using Neutrosophic based Neural Network. The study presented analysis of the

existing systems and finally present a framework for the diagnosis of confusable disease using Neutrosophic-based Neural Network. However, the system had symptoms issues such as collocation, and also failed to compute similarities and differences between the inputted disease symptoms.

Hayley et al, (2014), looked at the role of healthcare robots for older people at home: a review. The study aimed to identify the areas of need that older people have, and the available solutions. In particular, the robotic solutions are explored and critiqued and areas for future development identified. Furthermore, the authors reviewed several literatures for factors that influence admission to nursing home care, and for technological solutions to these factors. The authors did a good job. But the study could not be implemented with real-life health robotics.

Daniel et al, (2018), presented a study on Agent-based M and S of Individual Family Care decision-making. The authors developed an Agent-based model that enables the simulation of individual decision-making processes. The presented model in the study was based on socio-demographic data to take systemic properties and individual situations into account. Additionally, sociological actor types were used to implement individual preferences and characteristics of care recipients. The authors did a good job. However, a major limitation of their study is that the developed model was deficient in benchmarking and cost benefits analysis.

Stefano et al, (2015), looked at an agent-based architecture for adaptive supervision and control of smart environments. The study described architecture and functionality of a generic agent that is in charge of handling a given environment in an Ambient Intelligence context, ensuring suitable contextualized and personalized support to the user's actions, adaptively to the user's peculiarities and to changes over time, and automated management of the environment itself. Furthermore, the architecture was implemented in a multi-agent system, where different types of agents are endowed with different levels of reasoning and learning capabilities. The authors did a good job. However, the analysis of their adopted methodology showed that they only simulated the implementation, and failed to deploy the work to a real smart environment.

Juan et al, (2010), presented a study on an agent-based architecture for developing activity aware systems for assisting the elderly. The authors proposed an activity-aware computing that allows smart environments to provide continuous activity awareness and opportunistically offer assistance aimed at supporting the elders' current activity. The new paradigm called for novel tools to help developers mirror human activities in the digital domain, and adapt smart environments based on the activities executed by the users. The authors did a good job. However, they were unable to apply the developed system on other software engineering tasks that rely on text analysis using topic models.

Pekka et al, (2017), proposed a study on an In-home Advanced Robotic System to manage Elderly Home-Care Patients' Medication. The study examined the safety profile and usability of an integrated advanced robotic device and telecare system to promote medication adherence for elderly home-care patients. The authors did a good job. However, their developed model failed to proffer solution to identified cases of missed doses that were followed up in real-time.

Achim et al, (2019), looked at the role of a decision support system in back pain diagnosis. The study investigated the concordance of a decision support system and the recommendation of spinal surgeons regarding back pain. Furthermore, eleven (11) patients completed the decision support system in which their illness was diagnosed by a spinal surgeon. The results of the study showed significant medium relation between the DSS and the diagnosis of the medical doctor. However, the drawbacks of the study include:

i) Limited number of patients used in testing the DSS
ii) The system only recommended diagnosed back pain issues to only spinal surgeons
iii) Inconsistencies in symptom check and diagnosis of back pain issues due to the absence of a deep generative model

Mohammed et al, (2011), researched on the design and implementation of fuzzy expert system for back pain diagnosis. The authors produced a Fuzzy Expert System (FES) to diagnosis of back pain disease based on the clinical observation symptoms using fuzzy rules. The clinical observation symptoms which processed by fuzzy expert system may be used fuzzy concepts to describe that symptoms such as (little, medium, high). However, the performance evaluation of their fuzzy-based model showed deficiency in benchmarking, time complexity and cost-benefit analysis

Samy and Rami (2016), looked at lower back pain expert system diagnosis and treatment. The study proposed an expert system that can be used to successfully diagnose low back pain intensity. The suggested systems were found to be

advantageous approach in addition to existing unbiased ones. However, the system was only limited to address the issue of only lower back pain.

Debarpita et al, (2019), looked at a Lattice-Based Fuzzy Medical Expert System for low back pain management. The study proposed an attractive lattice-based knowledge representation scheme for handling imprecision in knowledge, offering a suitable design methodology for a fuzzy knowledge base and a fuzzy inference system. The fuzzy knowledge base is constructed in modular fashion, with each module capturing interrelated medical knowledge about the relevant clinical history, clinical examinations and laboratory investigation results. However, the authors could not carry out an adequate comparative analysis of the Lattice-Based Fuzzy Medical Expert System with other related expert systems in order to evaluate its performance.

Sabreen and Naser (2017), looked at an expert system for diagnosing ankle diseases. The authors developed an expert system that is based on the principle of asking the user gradual questions about the symptoms he feels, leading him to the result of diagnosing the illness, dealing with it quickly, and tips for permanent treatment. These systems may also help both trainee physicians and physiotherapists. However, the performance evaluation of their developed expert system showed that it was only designed to address 3 ankle diseases.

Ekong (2013), looked at a Fuzzy Inference System for Predicting Depression Risk Levels. The study described research results in the development of a fuzzy driven system to determine the depression risk levels of patients. The system is implemented and simulated using MATLAB fuzzy tool box. The result of the system is consistent with an expert specialist's opinion on evaluating the performance of the system. The model lacked measures for long-term future upgrade.

Georgia (2017), looked at Ontology-based Case retrieval in e-Mental Health Intelligent Information System. The study discussed an ontology developed for a case based reasoning system that aims at the support of people facing autism spectrum disorders (ASD). PAVEFS is an intelligent information system designed for the personalized provision of services for the diagnosis and the care of individuals of various ages and types of autism. The authors did a good job but failed to show an in-depth performance evaluation of their developed expert system especially in areas that involves time complexity, benchmarking and cost benefit analysis.

Sumathi and Poorna (2016), researched on Prediction of Mental Health Problems among children using Machine Learning techniques. The study identified eight machine learning techniques and has compared their performances on different measures of accuracy in diagnosing five basic mental health problems. A data set consisting of sixty cases is collected for training and testing the performance of the techniques. Twenty-five attributes have been identified as important for diagnosing the problem from the documents. The authors did a good job but could not implement the discussed issues to a model for more clarification and understanding.

Razzouk (2016), researched on a Decision Support System for the Diagnosis of Schizophrenia Disorders. The work described the development of such a clinical decision support system for the diagnosis of schizophrenia spectrum disorders (SADDESQ). The development of the system was described in four stages: knowledge acquisition, knowledge organization, the development of a computer-assisted model, and the evaluation of the system's performance. The knowledge was extracted from an expert through open interviews. The interviews were aimed at exploring the expert's diagnostic decision-making process for the diagnosis of schizophrenia. The author did a good job. However, performance evaluation of their developed expert system showed that there was deficiency in time complexity and cost benefit analysis.

Santosh et al, (2010), looked at an Expert System for Diagnosis of Human Disease. The authors developed an expert system uses inference rules and plays an important role that will provide certain methods of diagnosis for treatment. According to the study, "detecting diseases at early stage can enable to overcome and treat them appropriately". Identifying the treatment accurately depends on the method that is used in diagnosing the diseases. The authors did a good job. However, performance evaluation of their developed expert system showed that there was deficiency in time complexity and cost benefit analysis.

III. CONCLUSION

Mothers are important constitute of a population and maternal mortality is the culmination of a series of detrimental events in a woman's life. The proposed P-model for maternal care can serve as an assistant for HEWs and practical guideline for medical students.

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