## RESEARCH ARTICLE

## SHOULD STAKEHOLDERS OF MATERNAL AND CHILD HEALTH CONSIDER DIGITAL HEALTH INNOVATIONS TO REDUCE INFANT MORTALITY RATES IN DEVELOPING COUNTRIES? - A WAKE UP CALL NEEDED TO ACHIEVE SDG 3.2.1

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## *Manuscript Info*

## *Abstract*

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This article draws attention to the need to prioritize the national budgets towards health planning and the importance of integrating innovative digital health solutions into thehealthcare systems especially in developing countries. It throws light on the increasing Infant Mortality Rates, especially newborn related deaths. Two countries Nigeria and India were chosen as the representative countries from among the developing countries to describe the Infant mortality rates and the need for digitalization. Examples of digital solutions and their impacts in creating awareness and reducing the infant mortality rates are quoted in this article. Digitalization is considered as easy to use, accessible way to improve health through proper implementation and political commitment of the nations.

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## Introduction:-

Verticalization of information systems poses a challenge to developing countries' health systems, hindering progress towards Universal Health Coverage and the Sustainable Development Goals.[1] Despite digital health innovations being costly, partner-driven and program-specific, low-income and low-middle-income (LMICs) countries like Nigeria and India have not fully integrated them into their health systems. The lack of robust data collection across numerous programming areas and the lack of focus on the poor and hard-to-reach rural areas, where the majority of the population lives, cause weak links across various solutions. In addition, most advanced digital health innovations require internet and electricity, making it much difficult to reach remote areas and poses challenges for the governments to obtain ownership of them. However, the challenges of meeting the SDGs goals and targets can be overcome by LMICs with the best political will and commitment, by investing in human resource capacity for internet communication and technology even for hard-to-reach areas, prioritizing health planning in national budgets and integrating digital health innovations into their national health systems.[2-8]

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Although digital health innovations have made substantial contributions to reducing infant mortality rates in developed nations worldwide, their utilization in addressing child health concerns in emerging or traditional agrarian countries is still in its infancy. While the infant mortality rate for the world in 2021 was 27.334 deaths per 1000 live births, a 2.29% fall from 2020, it was 26.693 deaths per 1000 live births in 2022, a 2.35% decrease from 2021. Despite the presence of advanced digital health technologies in the World Health Organization (WHO) African Region, the probability of a child dying before reaching the age of one is significantly higher (52 per 1000 live births) than in the WHO European Region (7 per 1000 live births). Infant mortality rates have risen in developing countries due to inadequate access to prenatal, perinatal, and postpartum care, as well as limited adoption of available digital health innovations. Consequently, both developing and underdeveloped nations continue to face high infant mortality rates, as stated by the WHO in 2017. [1, 9-11]

Nigeria had in 2022 an infant mortality rate of 56.220 deaths per 1000 live births, a 2.57% decrease from 2021. Nigeria's projected infant mortality rate for the year 2023 is 54.740 deaths per 1,000 live births, a 2.63% decrease from 2022. Similar to other countries, India's infant mortality rate decreased by 3.74% from 2021 to 27.695 deaths per 1000 live births. The anticipated infant mortality rate for the year 2023 is 26.619 deaths per 1,000 live births, a decrease of 3.89% from 2022. [9, 12, 13] Even though the two most populous nations in the world have different infant death rates, the snail's pace trend in mortality rate reductions is similar, which may indicate inefficiency or inadequacy in their intervention strategies. A comprehensive evaluation of the currently implemented measures is required if these two countries and other developing nations are to achieve Sustainable Development Goal 3.2.1, which calls for the elimination of preventable deaths of newborns and children under the age of five by 2030. According to World Health Organisation (WHO) figures, among the top 10 nations with the largest number (thousands) of new-born deaths in 2020, India and Nigeria came in first (425-558 new-born deaths in thousands) and second (199-374 new-born deaths in thousands), respectively. The two targets of SDG 3.2.1 Goal—reducing infant mortality to at least 12 per 1000 live births and reducing under-5 mortality to at least 25 per 1000 live births by 2030—are now far from being met in both nations. The two nations will be much closer to achieving the Sustainable Development Goals by 2030 if they coordinate their current efforts to reduce infant mortality with the digital health innovations currently available and invest in them to make them widely available to rural communities.[14, 15]

Over the past 20 years, some countries have reduced Infant Mortality Rates (IMR) through e-health innovations integrated into their health systems. The UN's 2018 mortality report indicates that IMR has decreased by 51% since 2000. However, high-income nations have lower mortality rates than low-income nations, with 76 and 7 deaths per 1000 live births, respectively.In 2020, infant mortality rates in Nigeria and India were 59 and 27, respectively, per 1,000 live births, with variations among their various regions and geopolitical zones.[16]

Compared to its West African neighbors' such as Benin, Cameroon, Togo, and Ghana, Nigeria has a higher infant mortality rate (IMR), with rates of 57, 48, 44, and 33 deaths per 1000 live births, respectively. Similarly, India has a higher IMR than its neighbor's Bangladesh, Bhutan, and Sri Lanka. Despite a strong economy, India spent only 1.5% of its GDP on healthcare in 2019. Due to high IMR rates, Nigeria and India are among the nations with the highest rates in their respective regions. UNICEF estimates that professional medical care at birth and high-quality postnatal care can prevent 50% of deaths in children under five.[17, 18]

By 2050, Nigeria's population is projected to rise from 200 million to 392 million, making it the fourth most populous country. India's population is expected to reach 1.67 billion, surpassing China's 1.32 billion. As of 2023, India's population is 1.43 billion which has increased by 0.81% from the year of 2022.[19] India and Nigeria have large rural populations with limited access to healthcare facilities. Neither country has adopted effective family planning programs, resulting in a cultural desire for large families and poor health statistics, including high rates of infant and maternal mortality. Lack of political will, government funding, and accessibility to services and products exacerbate the issue. As a result, more children are expected to be born in both countries, leading to a further decline in health outcomes.

It is on this background that we set out to draw the attention of all stakeholders in the health sector of both India and Nigeria to review the current policies in reducing maternal and infant mortality by aligning them with available, effective, and economic friendly digital health innovations that will cut across the span urban and rural regions of the two countries including other developing nations. With projected population growth in both countries, funding and implementation of digital health innovations that can help combat the menace of infant and maternal mortality must be in the forefront in order to avert the impending future gloomy child and maternal health statistics.[20, 21]

**Application of Digital Health Innovations in Reducing Infant Mortality**-
Digital health innovation refers to using digital technology to enhance various functions and processes within the health system, specifically maternal and child health, to promote expansion and effectiveness. Incorporating digital technologies into existing maternal and child health intervention programs has the potential to improve access to and utilization of health services, making them more effective, available, and inexpensive to the public, especially those in remote areas. Currently, mobile apps and websites for digital health innovations in Nigeria and India are developed independently and not included in government intervention programs aimed at lowering child and maternal mortality. However, governments can invest in digital health breakthroughs to accelerate the achievement of the Sustainable Development Goals. These innovations have the potential to reduce infant mortality rates, improve quality of life, and lower healthcare costs.

**Digital Health Innovations – Big Window of Opportunities**-
Digital innovation has created doors of opportunity for becoming a powerful tool for improving mother and child health in Nigeria, India, and other African nations. By enabling better access to healthcare services, removing barriers like distance, a lack of infrastructure, a shortage of healthcare workers, diagnostics, treatment, and monitoring, digital innovations have the potential to reduce maternal and child mortality through its innovative applications. The following are only a few examples of the digital health innovations that can improve mother and child health in Nigeria and India and lower infant mortality:

**Use of Mobile apps and Websites**:-
Mobile apps and websites can be used to improve maternal and child health outcomes in Nigeria and India and other African countries.[23] These platforms can offer access to health information, track pregnancies, monitor immunization regimens, postnatal care, program monitoring for preventing mother-to-child HIV transmission, child development charts, assistance for health education, and modify behaviour. Examples include Babymigo, Omomi, and Safermom from Nigeria and mCare, mMitra&Kilkari mobile based platforms in India.[22, 23] Using a community-led platform with knowledge, tools, and resources from experts, Babymigo lowers maternal and infant mortality in sub-Saharan Africa, starting in Nigeria. In order to improve mother and child health outcomes, the platform empowers, equips, and offers tools and resources to women at all phases of their pregnancies and parenting journeys. Additionally, the Win Senga smartphone app from Uganda aids in foetal heartbeat monitoring, boosting prenatal care at outlying clinics and preventing maternal fatalities. Other mobile phone applications, like immunization monitoring systems, help parents make sure their kids get their shots on time, which helps avoid diseases like polio, tetanus, and influenza that can be prevented by vaccination. Despite the fact that these apps are owned and managed by private persons and non-profit organizations, they require government funding and support in order to be widely used in rural communities and integrated into current mother and child health programmes.[24]

**Use of SMS-based platforms:-**
Mobile health (mHealth) tools—those that use wireless technologies like mobile phones to promote health—offer an alluring way to supplement clinic-based assistance. Women may benefit from advice through short message service (SMS) messaging, sometimes referred to as texting or texting, in between appointments at the clinic. There is evidence that mHealth can be used to educate, remind patients to take their medications and schedule appointments, enhance communication between patients and health care providers (HCWs), and boost self-efficacy, all of which could result in better outcomes. South Africa, Bangladesh, India, Nigeria, and the United States all have MNCH SMS programmes in place.[25-28] Due to the absence of integration of programme efficacy data into some existing intervention programmes for extensive coverage and adequate monitoring, programme efficacy data are currently unavailable in Nigeria, Bangladesh, and India. To make it widely used, accountable, accessible, inexpensive, and efficient, Nigeria and India need to invest more in this technology and incorporate it into current programmes like primary healthcare, the safe motherhood initiative, and others.

**Use Point-of-care diagnostics Innovation:-**
With the goal of improving evidence-based care and lowering infant mortality, this technology can revolutionize diagnosis and treatment in maternal and child health. Mobile hospitals can be equipped with cutting-edge medical equipment and point-of-care diagnostics in an effort to bring diagnosis and treatment to the doorsteps of rural communities. This will aid in the early identification of paediatric illnesses and pregnant difficulties. For instance, pregnant women can screen for high-risk pregnancies such as placental abruption and foetal deformity using portable ultrasound machines, allowing for prompt interventions. In addition, the Hemafuse device is a cutting-edge innovation that can be utilized in an emergency to save the lives of women who are suffering from postpartum

haemorrhage. Additionally, quick tests for HIV, syphilis, and malaria can help prevent the spread of these illnesses from mother to child and guarantee that infected women and newborns receive treatment on time. Infant and maternal mortality will be significantly reduced if this technology is properly included and implemented into the current health system initiatives.[29, 30]

### Use of Wearables:-

Remote monitoring and tracking of mother and child health indicators is now possible thanks to advancements in digital health, which is boosting health outcomes. Pregnant women who want to monitor their health at home and share information with medical professionals so they can take action as soon as feasible can do so with the aid of wearables like foetal heart rate monitors and remote blood pressure monitors. The management of high-risk pregnancies and the observation of premature infants are two areas where this technology is very helpful. For example, the Embrace Nest is a portable, inexpensive incubator designed for premature infants that enables constant remote monitoring of vital signs. Additionally, this innovation brings management and monitoring right up to the patient's door and is easily expandable to difficult-to-reach locations.[31]

### Others tools &Use of Artificial Intelligence:-

The 2022 Reproductive, Maternal, New-Born, Child, and Adolescent Health (RMNCAH) digital scorecard in Zanzibar (Africa) and 2015 Khushi Baby digital Community Health Integrated Platform (CHIP) program in Rajasthan (India) were launched to track maternal and child health's record. A digital scorecard/Khushi baby (CHIP) are used to track and assess key performance indicators (KPIs) that are particular to follow beneficiaries throughout their primary healthcare journey. They can monitor KPIs like immunization rates and rates of maternal and new-born death. Additionally, they can help medical practitioners design targeted treatments to improve mother and new-born healthcare. Drones and other remote sensing technology can be utilized to distribute vaccines and other essential supplies for mother and child health in rural areas with weak infrastructure. The promotion of behavioural change and health education, both of which are essential for enhancing mother and child health outcomes, is also made easier by AI-based technology. Efficiency and standards of medical care are also being improved via eHealth projects, such as electronic health records (EHRs) and health management information systems (HMIS). The electronic storage and retrieval of patient data made possible by EHRs/HMIS reduces errors, increases coordination, and enhances continuity of care. In order to develop policies and make decisions based on the best available research to address maternal and child health issues, it is now possible thanks to the development of health information systems to collect, analyse, and report data.

### The Challenges of Implementing Digital Health in Nigeria and India:-

There are still numerous obstacles preventing the deployment of digital health in Nigeria and India, despite the desire in developed and developing nations to use technology to revolutionise healthcare services. Nigeria and India must evaluate the following challenges before implementing digital health initiatives if they hope to take advantage of the many advantages that digital health has to offer, reduce infant mortality, and achieve sustainable development goals by 2030. The difficulties include, but are not restricted to: incorrect public perceptions of digital health, a lack of infrastructure, an unskilled labour force, declining healthcare quality, corruption, and resistance to change; Typical Methods of Health Care Delivery; Strategic Plan for Health and its Implementation; Epileptic electricity supply, a lack of education and low levels of awareness; Capital issues, a lack of Internet access, a lack of cultural diversity and perception, and a lack of political determination on the part of the government; the purchase of inferior materials and equipment; medical tourism; Political instability, lack of maintenance culture, accessibility issues, and economic instability.

## Conclusion:-

It should be underlined that digital health innovations cannot take the role of an effective healthcare system, even though they can considerably enhance maternal and child health outcomes in Nigeria, India, and other LMICs. In addition, by enhancing access to high-quality healthcare and arming parents with knowledge and resources, digital health technologies and AI-based solutions have the potential to lower infant mortality. Therefore, in order for these digital health innovations to be successful, the current healthcare system must adopt them.

### Author's Contribution:

Mirza Adil Beig, Rajeev Sharma and Manmohan Singhal conceived the idea for the paper, guided the team in developing the structure and content, and reviewed and edited the manuscript. Amos Solomon and Isah Idris Ainavi conducted extensive literature research and drafted the initial manuscript, contributing equally to the writing and

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